AN ANALYSIS OF THE LONGITUDINAL EFFECTS THAT A NONGRADED ELEMENTARY PROGRAM, CONDUCTED IN AN OPEN-SPACE SCHOOL, HAD ON THE COGNITIVE ACHIEVEMENT OF PUPILS

A DISSERTATION

Presented to

the Faculty of the Graduate School

University of Houston

In Partial Fulfillment

of the Requirements for the Degree

DOCTOR OF EDUCATION

by

Charles Kyle Killough

August, 1971

A C K N O W L E D G M E N T S

As is well known in education circles, the writing of a doctoral dissertation is not the exclusive product of one person. The results of the candidate's efforts come from the help, both tangible and intangible, direct and indirect, of many persons. The writer wishes to acknowledge, with gratitude, the contributions which so many individuals have made to this project.

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I dedicate this dissertation to the 1966-67 principal of Matzke Elementary School, Mrs. Kay Killough, and her staff who gave so much of themselves to boys and girls.

C. K. K.

July 1, 1971

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Abstract

This research effort was undertaken to analyze the longitudinal effects that a nongraded elementary school program, conducted in an open-space school, had on the cognitive achievement of pupils.

A review of the literature was undertaken to ascertain the relative statistical or experiential descriptive data available. A longitudinal study of this type is not reported in the literature. Much has been written, however, regarding the philosophical and theoretical basis for nongraded programs that is not supported by evidence.

The research available on how pupils learn supports the philosophy of the nongraded school. The range in intellectual readiness to learn and in most areas of cognitive achievement also dramatically supports this type program. The statistical data available, however, reveals that although pupils in some nongraded programs perform significantly better than do their counterparts in other types of programs the converse is also true. The nongraded school program is still the exception and not the rule.

Only two studies were found regarding the effects that the open-space facility has on pupils. One suggests that no definite conclusions can be made concerning the superiority of either the open-space or traditional facility in producing cognitive gain over a one-year span of time. The second study, an assessment of the organizational climate of an open-space school, suggests that pupils who have had sufficient exposure to the "open" school are in fact more independent, lively, self-reliant, and extroverted than pupils with little exposure.

Pre and posttest achievement data was collected on three hundred randomly selected elementary school pupils over a three-year period. The subjects were equally divided by sex and year in school. One hundred and fifty were enrolled in a nongraded elementary school program, conducted in an open-space facility, and one hundred and fifty in a program other than nongraded conducted in a traditionally designed facility.

A multivariate analysis of variance research design was used to analyze the independent and interactive effects that sex, type of school program, and sex and type of program had on the cognitive achievement gains

of the subjects in arithmetic reasoning, concepts, and computation; reading comprehension; and, vocabulary.

The findings of this study suggest: (1) pupils that remain in a nongraded program for three years will have significantly higher mean achievement gains in most cognitive areas than will pupils in a program other than nongraded, (2) pupils in a nongraded program for three years will achieve at a faster rate for the three-year period in all cognitive areas than will pupils in another type of program, (3) girls in a nongraded program will achieve at a faster rate in arithmetic computation than will boys, (4) boys in a nongraded program will achieve at a faster rate in reading comprehension than will girls, (5) sex and type of school program does not have a significant interactive effect on the cognitive achievement gains of pupils, and (6) pupils that have been in a nongraded elementary program for one year and move into a junior high school program other than nongraded will have significantly higher cognitive mean achievement gains for two years than will those from an elementary program other than nongraded.

The evidence of this study indicates that after pupils remain in a nongraded program, conducted in an

open-space facility, for at least two years that their mean achievement gains will be significantly better during the third year and for the total three-year period than will that of their counterparts in another type of program and facility. They will, moreover, achieve significantly better as they move into a graded junior high school program than will their counterparts.

Additional studies consisting of more independent variables and larger numbers of subjects are recommended. The effects that nongraded programs conducted in open-space schools have on the affective domain of pupils should also receive considerable attention.

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INTRODUCTION

Many attempts have been made over the decades to increase and improve the individualization of learning in elementary and secondary schools. Departmentalization, platooning, dual-progress, team teaching, heterogeneous, homogeneous, and multiage groupings, elimination of grade levels, programmed learning, language laboratories, acceleration and enrichment programs, utilization of various kinds of media materials and equipment, differentiated staffing, and student performance contracting are representative of such efforts. The dilemma persists, however, as to the type of organizational structure that will most efficiently and effectively enhance the individualization of learning.

Defensible schemes of organizational structure have been complicated by shifting perceptions of the purposes of elementary and secondary education, the technological revolution, the knowledge explosion, societal changes, and emergent lore and scientific evidence concerning learners and their learning. A plethora of material

is available reporting theory, practice, and research on the organizational structure of elementary and secondary schools. Vertically, from classroom to classroom, the focus has been upon determining a structure for moving pupils through a time sequence. Horizontally, the search has been for dividing content without losing communication between content areas.

Vertically, the graded type of structure has been the most prevalent since the opening of the Quincy Grammar School in 1848. This structure suggests a relative common sequence of learning tasks. The nongraded organizational structure, introduced in Western Springs, Illinois in 1934, has emerged as an alternative method of vertical organization. It is supported by plausible theories and claims, some research, and suggests a differentiated course of study which permits each pupil to progress at the rate which is normal for him.

Cooper (1967:125) states: "Horizontally the most common alternatives in organizing instruction for pupils are the one-teacher-per-classroom and specialists for each subject. In recent years there has been a revival of interest in various horizontal plans to organize instruction based on student ability, achievement, or

some combination of both. Homogeneous and heterogeneous groups, team teaching, and the dual progress plan are the most popular."

The graded elementary school development of the nineteenth century was a most significant effort. As Goodlad and Anderson (1959:204) state:

> It permitted the convenient classification of unprecedented numbers of pupils pouring into the schools during the second half of the century. It encouraged the division of knowledge into segments to be taught at the various grade levels. Consequently, it simplified the task of preparing needed teachers quickly; teachers were taught what they were themselves to teach in a given grade. Man's zeal for efficiency was challenged and he met the challenge vigorously. Soon an enterprise of gigantic proportions was functioning with amazing efficiency while continuing to expand at an astonishing rate. That so many people agreed so quickly and so generally on distinct learning tasks for each grade level is truly amazing.

Beggs and Buffie (1967:7) suggest that soon after this development, attempts were being made to modify the graded structure. Heavy pupil dropouts and high rates of school failures were viewed by some educators with dismay. They began to speak out against the graded system as one which demanded mass conformity and overlooked the uniqueness of each individual. The graded movement, to them, had given rise to an inhibiting form of regimentation.

The St. Louis, Pueblo, Cambridge, Portland, Batavia, Dalton, and Winnetka Plans of the late nineteenth and early twentieth century were representative of some of the efforts to modify instructional practices within the graded structure. Each made provisions within the curriculum for groups of varying abilities in an attempt to help pupils progress unhampered by uniform grade expectations. Critics of the graded structure, however, contended that such efforts to individualize learning through horizontal organization sought only to modify the arbitrariness of grade standards rather than to eliminate them completely. And, that the uniqueness of each individual was being overlooked because of the emphasis on groups.

The Department of Superintendence of the National Education Association (1925:25) recommended:

> That the general core of subject matter which should prevail throughout the nation for the first six grades be modified in content and time allocation to provide for individual and community differences.

Thirty-five years later, the American Association of School Administrators and the National Education Association (1960:17) jointly endorsed the following statement:

> Many present school practices need re-examination; and the assumptions underlying them and their effects, both good and bad, on the individual pupil, need careful scrutiny. Among these practices may be listed the following: Grade organization, although this plan of grouping children by the 'ladder' concept--changing one whole rung once a year--is almost a universal practice, the need for re-examination of the plan is obvious when it is viewed in the light of individual differences.

Goodlad and Anderson (1959:vi) concluded that the nongraded school organization structure is the best form of organization for challenging learners of the widely varying abilities, attainments, and interests, found in the elementary unit of our educational system.

Dean (1963:1) denounced graded organization as "blind to some of the important factors that govern and influence the instructional side of the elementary school," and spoke in favor of those measures which promote "continuous flexibility and fluidity . . . in nongradedness, multi-gradedness, or some other flexible arrangement. If we believe in and are committed to a doctrine of individual differences--the range of human variability, then our methods of organizing the educational program must operate in support of this conviction."

Beggs (1967:15-16) contends that:

> If one recognizes that all children vary tremendously in past achievement, potential, interest, and socio-economic background, and if one believes what many decades of painstaking study have taught regarding learning theory and child development, then it becomes obvious that graded schools, classrooms, textbooks, expectations, and teachers are all out of step with the goal of individualized teaching. With programs geared to the mythical average student, graded school organization has, for the most part, simply ignored the variety in human capabilities by the very nature of its lock-step pattern and rigidity of structure.

Dufay (1966:29-30) suggests that the nongraded school must and will replace the graded one because the research available on how pupils learn dramatically supports the philosophy of the nongraded school.

The Problem

The purpose of this study was to analyze the longitudinal effects that a nongraded elementary school program, conducted in an open-space facility, had on the academic achievement of pupils.

Need for the Study

The dichotomy between nongraded and graded organizational structures appears to be on the one hand that

of preserving and enhancing the significant differences among students; and, on the other, for patterns that preserve the unity in content, time, and effective utilization of teaching resources.

A review of educational research indicates little statistical or experiential descriptive data to support the nongraded elementary school structure or the open-space concept school. As Garvue (1967:97) states, "The most glaring research weakness relative to making provisions for individual differences is the failure to do longitudinal studies of an adequate number of variables within the framework of a pre-test and post-test design." Moreover, a longitudinal study of this type has not been conducted.

This study, therefore, should provide statistical and experiential descriptive data which will be of value to those concerned with the type of elementary school organizational structure and facility that best facilitates individualized learning.

Limitations of the Study

The major limitations of the study are:

1. The identification of the organizational structure of each of the four elementary schools and the two junior high schools included in the study.

2. The differentiation of the curricular organization of each school.

3. The validity of the standardized achievement tests in appraising pupil achievement relative to the stated goals and objectives of each of the schools.

4. The identification of the criteria utilized in grouping and promoting pupils in the respective schools.

5. The restrictions imposed by the after the fact nature of the study.

6. The focus of the study on the cognitive domain, as measured by standardized tests, with no regard for the affective domain.

Although these limitations will inherently affect the findings of the study they do not impose restrictions that prevent significance.

Hypotheses

Fifteen major research hypotheses are examined in the study. For the sake of consistency, the .05 level of significance was used in all statistical tests. The hypotheses tested were as follows:

H_1 The type of school program has a significant effect on the mean gain achievement in arithmetic reasoning at any of the three-year intervals of the study, and the total three-year period.

H_2 The type of school program has a significant effect on the mean gain achievement in arithmetic concepts at any of the three-year intervals of the study, and the total three-year period.

H_3 The type of school program has a significant effect on the mean gain achievement in arithmetic computation at any of the three-year intervals of the study, and the total three-year period.

H_4 The type of school program has a significant effect on the mean gain achievement in reading comprehension at any of the three-year intervals of the study, and the total three-year period.

H_5 The type of school program has a significant effect on the mean gain achievement in vocabulary at any of the three-year intervals of the study, and the total three-year period.

H_6 Sex does have a significant effect on the cognitive mean gain growth in arithmetic reasoning at any of the three-year intervals of the study, and the total three-year period.

H_7 Sex does have a significant effect on the cognitive mean gain growth in arithmetic concepts at any of the three-year intervals of the study, and the total three-year period.

H_8 Sex does have a significant effect on the cognitive mean gain growth in arithmetic computation at any of the three-year intervals of the study, and the total three-year period.

H_9 Sex does have a significant effect on the cognitive mean growth in reading comprehension at any of the three-year intervals of the study, and the total three-year period.

H_{10} Sex does have a significant effect on the cognitive mean gain growth in vocabulary at any of the three-year intervals of the study, and the total three-year period.

H_{11} The interactive effect of sex and school program does not have a significant effect on the cognitive mean gain growth in arithmetic reasoning at any of the three year intervals of the study, and for the total three year period.

H_{12} The interactive effect of sex and school program does not have a significant effect on the cognitive mean gain growth in arithmetic concepts at any of the three year intervals of the study, and for the total three year period.

H_{13} The interactive effect of sex and school program does not have a significant effect on the cognitive mean gain growth in arithmetic computation at any of the three-year intervals of the study, and for the total three-year period.

H_{14} The interactive effect of sex and school program does not have a significant effect on the cognitive mean gain growth in reading comprehension at any of the three-year intervals of the study, and for the total three-year period.

H_{15} The interactive effect of sex and school program does not have a significant effect on the cognitive mean gain growth in vocabulary at any of the three-year intervals of the study, and for the total three-year period.

Definitions of Terms Used

Continuous Progress. The concept that each pupil is permitted to begin school at whatever time seemed best in terms of his self-fulfillment as affected by the school program, and permitted to progress through the school program at a rate commensurate with his unique needs and

abilities rather than tied to the usual end-of-the-year promotion.

Departmentalization. A horizontal form of organization that utilizes specialists for each subject.

Differentiated Staffing. The utilization of personnel of varying skills, knowledge, and abilities in working with pupils to enhance individualized learning.

Dual Progress. Half of the pupil's school day is spent in a vertically graded unit under one teacher, and during the other half of the day the pupil works with special teachers. The self-contained classroom teacher is usually responsible for the cultural imperatives: language arts, social studies, and health and physical education. Specialists are typically responsible for mathematics, science, music, and foreign language, all taught on a nongraded basis.

Graded Elementary Organizational Structure. An organizational structure that is divided into units of equal length, and the work of a grade, a year of progress, and a chronological year in a child's life are seen as comparable for school purposes. Expectations are viewed in a time span.

Horizontal Organization. The organizational techniques used for dividing pupils and teachers into groups for instructional purposes.

Nongraded Elementary Organizational Structure. An organizational structure that is based upon the theory of continuous progress for each student with no regard for time or chronological age. Pupils are permitted vertical progression based upon their individual achievement, ability, interests, and needs.

Platooning. A system of departmentalization or semidepartmentalization wherein students move from room to room for different types of activities.

Self-Contained Classroom. One-teacher-per-classroom with the teacher teaching all subjects.

Semidepartmentalization. A combination of departmentalization and the self-contained classroom. Specialists are used in subjects such as music, remedial reading, and physical education, and the self-contained classroom teacher teaches all other subjects.

Student Performance Contracting. The contracting with industry to guarantee specific pupil achievement within a specified time frame.

Team Teaching. A form of horizontal organization where a team of professional teachers and teacher aides have the instructional responsibilities of a group of students, usually from 60-300; where teaching and learning is organized into large-group instruction, small-group instruction, and individual study; where teachers are deployed for the best utilization of their special abilities; and, where pupils are deployed for learning experiences based upon their individual needs.

Vertical Organization. The classification of pupils in order to provide for their upward progression through the school program. Procedures traditionally used are entry age into school, promotion, nonpromotion, and acceleration.

Organization of the Study

Chapter II, "Review of the Literature," is a review of selected studies regarding individual differences among elementary pupils, vertical organization for elementary pupils, vertical organization for elementary school instruction, and national trends in elementary school organization.

The procedures for conducting the study are described in Chapter III, "Methodology of the Study," and includes the sampling procedures and instrumentation in testing the hypotheses, an account of the measurement of the variables of the study, an account of the data analysis methods, and a description of the pretesting and posttesting methodological details.

A statistical analysis of the results of the study are presented in Chapter IV, "Findings of the Study."

A "Summary and Conclusions" are presented in Chapter V, and an appendix and selected bibliography comprise the last section.

C H A P T E R I I

REVIEW OF THE LITERATURE

A brief summary of selected studies regarding individual intellectual differences among elementary pupils, vertical organization for elementary school instruction, and national trends in elementary school organization is presented in this chapter. Studies regarding individual differences other than intellectual ones and the various horizontal organizations are not reviewed since this study relates only to the effects that vertical organization for instruction has on the academic achievement of pupils.

Goodlad and Anderson (1959 and 1963:1-28) analyzed data from classes randomly selected in grades one through five in four American schools and midterm data in reading achievement from the eighth-grade classes of two elementary schools in a large city. From this data they generalized:

1. Children enter the first grade with a range of from three to four years in their readiness to profit from a "graded minimum essentials" concept of schooling.

2. This initial spread in abilities increases over the years so that it is approximately double this amount by the time children approach the end of the elementary school.

3. The achievement range among pupils begins to approximate the range in intellectual readiness to learn soon after first-grade children are exposed to reasonable normal school instruction.

4. Differing abilities, interests, and opportunities among children cause the range in certain specific attainments to surpass the range in general achievement.

5. Individual children's achievement patterns differ markedly from learning area to learning area.

6. By the time children reach the intermediate elementary grades, the range in intellectual readiness to learn and in most areas of achievement is as great as or greater than the number designating the grade level.

Cutts and Moseley (1960:2-3) surveyed a class of twenty-nine sixth-grade pupils. They found a range of more than three and a half years in chronological age, 104 pounds in weight, 14 inches in height, 62 points in IQ, and 8 years 4 months in mental age. Their achievement, as measured by the Iowa Every-Pupil Tests of Basic Skills, ranged from 4.3 to 9.9 in grade average, from 4.4 to 9.5 in reading, and from 3.5 to 11.4 in spelling. They also found wide ranges of differences within ability grouped classes from five fifth-grade classes with the twenty-six

pupils in the top class having a range on the battery median of the Stanford Achievement Test of 7.5 to 11.1. The data reinforced the authors' feelings that even though differences are so great and so varied that the problem of organizing instruction to provide for individual differences may seem almost insoluble, the opposite extreme, regimentation, is obviously absurd.

The intellectual talents, artistic and motor skills, and psychophysical characteristics of twenty-seven fifth-grade pupils were studied by Thomas and Thomas (1965:3-30). In verbal abilities the pupils ranged from grade 3 through grade 8. In quantitative ability, they ranged from grade 4 through grade 9. Reading abilities ranged from grade 3 through grade 12, and the spread of talent in mathematics, social science, science and writing encompassed between seven and nine grade levels. They also found that individual pupils did not rank the same in all areas of intellectual talents.

In artistic talent they found that pupils exhibited different preferences for subject matter and differed in the degree to which their drawings portrayed nature realistically. A third area of difference was color-scheme preference, a fourth was preference of media

(crayons, colored pencils, clay), and a fifth was formality or informality of design structure. The pupils varied in singing skill, in ability to recognize recorded musical selections, and in their preferences for kinds of music.

Significant psychophysical differences were also found among the pupils in sight, hearing, speech, and physical handicaps.

Beggs and Buffie (1967:24-25) present data that reinforces the thesis that pupils vary significantly in terms of potential and achievement. They contend that it is not unusual to find pupils in a typical first-grade class whose mental age spans a range of four years, or whose IQ scores vary as much as 60 points. Moreover, they collected data on a typical fourth-grade class as well as three fourth-grade classes in three different schools, and a nongraded primary school in Bloomington, Indiana. The typical fourth-grade class had an academic achievement range of 2.9 to 8.7 in reading, 2.7 to 7.9 in language, and 2.8 to 4.9 in arithmetic. IQ data from the three fourth-grade classes ranged from 91 to 122 in one class, 96 to 145 in another, and 70 to 129 in the third. Reading test results of 166 pupils in the nongraded primary, consisting of six, seven, and eight year olds, ranged from readiness to 8.5 grade level.

McNemar's (1942:97) quantitative data also indicates that the ranges of mental ages at various educational levels are significant. According to him, mental ages in the first grade are distributed according to the normal curve; the middle 96 percent of the pupils have mental ages between four and eight years, and the variability among sixth-grade pupils is double that among first-grade pupils; teachers of the sixth grade have pupils whose mental ages may be as low as eight and as high as sixteen years.

Cook (1941:65) came to similar conclusions about within-grade variability in achievement for various school subjects. He found that the spread for the middle 96 percent of first-grade pupils is between three and four years, and it is greater in the upper than in the lower grades of the elementary school. Teachers, he found, in grades 4, 5, and 6 may expect to find in their classes practically the whole range of achievement of elementary-school pupils.

Dufay (1966:17-18) contends that although experience and intuition tell u s that children are indeed in the no-two-are-alike category, American education had been based firmly on the determination that school children

ought to be alike. He further suggests that the creative powers of children continue to be encapsulated by production-line techniques of instruction; and, developing personalities are still humiliated and deformed by unreasonable, impossible demands.

Vertical Organization for Instruction

Promotion vs. Nonpromotion

One of the most common aspects of variability relating to education, individual rate of progress, has been handled by accelerating the gifted, promoting the normal learners, and failing those who have not made grade expectations. In recent years increasing numbers of educators have questioned the practice of promotion based on rigid grade norms.

Goodlad (1954:301-328), in summarizing major studies published regarding promotion practices, found that nonpromoted pupils tend to continue to make poor progress, that they are often doing less well than slow learners who were promoted, and that the failures often have social problems. Otto (1951:128-129), on the basis of his research, felt that nonpromotion policies were at

least partly outmoded and stated that such policies might even serve to lower academic standards. Shane (1962:42-45) suggested that retardation should be a last resort, that causation as well as the mere fact of poor progress needed to be considered, and that academic progress in any one given year was an insufficient basis on which to retard a pupil.

Cook and Clymer (1962:206) contended that research had not supported the hypothesis that nonpromoted students achieve better results than would have been possible had they been promoted. Moreover, they indicate that there is evidence that nonpromotion produces negative attitudes toward self and school which result in harmful long-range effects on school achievement.

Robert Sears (1942:235-238) showed that failure produced a decrease in interest and effort, a sharp increase in daydreaming, a reduction in social responsiveness, and an increase of nonadjustive behavior. Pauline Sears (1940:498-536) found that pupils with a history of success in learning approached new learning activities with confidence and with a realistic view of their own capabilities. Those with histories of failure tended to be unrealistic about their capabilities to master new tasks

and either greatly overestimated or greatly underestimated their capabilities for learning.

Cartwright (1932:73-86) and Gebhard (1948:371-388) found that success and failure influence the attractiveness of learning tasks. Success served to change previously neutral tasks into attractive ones where failure tended to make the tasks unattractive.

Arthur's (1936:203-205) study of sixty first-grade students who were retained in the first grade indicates that the retention of the pupils did not significantly alter their achievement gains. Studies by Klene and Branson (1952:150-155) and Saunders (1941:77) also support the thesis that nonpromotion does not enhance achievement.

In summarizing research conducted before 1954, focused on promotion-versus-retention in elementary schools, Otto (1954:201) stated:

> It is now evident that practically all the notions previously held about the value of nonpromotion or the motivating value of the threat of failure have been exploded. Out of a group of repeaters, about 20 percent will show no change, and about 40 percent will actually do worse. If doubtful cases are divided into two groups appropriately matched on essential items, and one group is promoted and the other group is held back to repeat the grade, several studies have shown that the achievement of the group

> held back is not significant. If the objective of the school is to promote the optimum development of pupils, nonpromotion is not the way to get it.

Wrightstone (1957:5) also summarized research on this same topic by stating:

> Nonpromotion affects the personality of the pupil unfavorably. Clinical studies of children who have failed show that there is a loss of self-confidence. Self-respect is undermined. The feeling of security, so necessary to mental health, is usually weakened and feelings of inferiority are increased.

Graded vs. Nongraded Organization

In 1958 Goodlad (1960:221) wrote, "Nongrading is supported by some plausible sounding claims and theories rather than by research." In 1959, with Anderson (1959:3) he wrote in regard to the comparative achievement of pupils in graded and nongraded schools, "there is no evidence to suggest anything. We have little more than inadequate first-hand impressions to go on."

Ingram (1960:76-80) reported that the reading achievement of 68 pupils who had completed three years in a nongraded primary cycle was significantly superior to that of 337 pupils who had completed third grade in a graded school.

Zerby (1961:33) reports that the reading, arithmetic, and spelling achievement of primary pupils in a nongraded school program were significantly superior to those of pupils in a graded primary.

Provus (1960:391-398) studied the effects of nongrading in arithmetic on fourth-, fifth-, and sixth-grade students. Pupils were allowed to proceed through the arithmetic sequence at their own rate of progress. His study yielded data significantly favoring the nongraded approach with the superior students profiting most from nongrading.

Hart (1962:130-133) compared the arithmetic achievement of 50 third-grade pupils who had been taught arithmetic in a nongraded program with the achievement of 50 third-grade pupils who had been taught in a graded program. He matched the groups on the basis of sex, age, IQ, and socioeconomic status. His findings indicate a significant superiority in arithmetic achievement for the nongraded pupils.

Morgan and Stucker (1960:69-73) compared the reading achievement of matched groups of 180 fifth- and 226 sixth-grade pupils assigned to self-contained and ability-grouped reading classes. At the end of one year

the fifth-grade classes grouped for reading on the basis of ability were superior in reading achievement to the self-contained classes at the .01 level of confidence. At the sixth-grade level the ability groups were superior to the self-contained groups at the .05 level of confidence.

Skapski (1960:41-45) undertook a study to determine whether second- and third-grade pupils who were involved in a nongraded reading program achieved better than pupils in a graded program and whether in such a program achievement in reading was superior to achievement in other academic areas. She found pupils in the nongraded program were significantly superior in reading to a matched group of pupils in a graded program, and that the reading achievement of the nongraded group was significantly superior to the arithmetic and spelling achievement.

Carbone (1961:82-88) compared the achievement of 122 intermediate grade pupils, grades 4, 5, and 6, who had been taught in a nongraded primary program with 122 intermediate grade pupils who had been taught in a graded primary program. The groups were matched on the basis of sex and age, and the influence of mental ability

was held constant by means of analysis of covariance. The pupils from the graded primary classrooms were found to be significantly superior in achievement in all areas: vocabulary, reading comprehension, language, work study skills, and arithmetic, to the pupils from the nongraded primary classrooms. Moreover, in four of five mental-health factors there was no significant difference in the adjustment of the graded and nongraded pupils. However, in social participation the graded pupils scored significantly higher, .01 level of confidence, than the nongraded pupils.

The achievement of graded pupils was compared by Halliwell (1963:59-64) with that of nongraded pupils who had been in a nongraded reading and spelling program for one year. Nongraded pupils who would have been in the first grade scored significantly higher than graded first grade pupils in word knowledge and reading comprehension. Nongraded pupils of third grade level scored significantly higher than regular third graders in spelling. Nongraded pupils also produced higher results in arithmetic on the second and third grade levels, even

though arithmetic had not been ungraded in the experimental situation.

A study conducted by Aigner (1962:43-46) in the Bellevue School District, Bellevue, Washington, and reported as "A Second Report of Bellevue's Continuous Growth Program," reports that the nongraded program did not affect significantly greater achievement in the elementary grades, kindergarten through sixth, when compared with the graded program. Intent of the study was to compare the difference in mean scores in reading between pupils in the continuous growth program and those in graded classrooms. Only one of seven t-tests was significant at the 5 percent level.

A report by Kennedy and Say (1971:1-4) states that no definite conclusions can be made concerning the superiority of either an open area or closed area school environment in producing cognitive gains over a one-year span of time.

Buffie (1962) compared the mental health and academic achievement of 117 elementary school pupils in graded programs and 117 in nongraded programs. He selected eight public elementary schools, four from each of two midwestern school systems, for the study. Each

was matched with a counterpart on the basis of socioeconomic level, school enrollment, average class size (at third-year level only), and training and experience of its teachers. He found that pupils attending schools under the rationale of the nongraded primary plan do better academically than do their counterparts in the graded primary and that the nongraded pupils are better adjusted than their graded counterparts, particularly in the area of social adjustment.

Carbonari (1970:1-24) concluded that pupils who have had sufficient exposure to the "open" school are in fact more independent, lively, self-reliant, and extroverted than pupils with little exposure to this system. Further, he indicated that based upon the results of a study of the teachers of the "open" school that the differential effects shown in the pupils were probably not due to teachers so exceptional that they would override any system and cause these same results under any conditions, i.e., open, traditional, or other systems.

"Both the descriptive and empirical research indicate very strongly," state Beggs and Buffie (1967: 51), "that youngsters in nongraded programs perform significantly better in all measures of school achievement

than do their counterparts in randomly assigned or paired regular graded classrooms."

National Trends in Elementary Organization

The majority of elementary schools in this country continue to use the graded type of vertical organization structure. As Anderson (1959:46) stated in 1955:

> Although I should like very much to regale you with accounts of numerous successful examples of the ungraded primary school, the distressing truth is that the movement is very young and has accelerated at the pace of the tortoise (more) than the hare.

A 1957 survey by Goodlad and Anderson (1958: 642-643) reported that 44 of 180 communities contacted operated one or more nongraded elementary schools. A 1960 survey by the same authors revealed that 89 communities had nongraded schools and 550 others were believed to be utilizing the concept.

Dean (1960:13) reported that in 1958 and 1959 18 percent of the elementary schools of the nation were using the nongraded primary unit plan.

A 1961 survey by the Research Division of the National Education Association (1961:7) indicated that

about 6.3 percent of all urban school districts were using an ungraded primary block plan either for the entire system or on an experimental basis in a few schools. In 1966 the Division (1969:119) reported that about 11 percent of the school districts of the nation were utilizing the nongraded structure in one or more elementary grades.

As Knezevich (1969:407) concludes, "In the 1960's more was being written about nongraded organizational patterns than was being practiced."

Summary

Descriptive and empirical research is available that indicates that pupils in nongraded elementary programs perform significantly better in academic achievement than do their counterparts in randomly assigned or paired regular graded classrooms. Much has been written, however, regarding the philosophical and theoretical basis for nongraded structures that is not supported by evidence. Such enthusiasm cannot sustain a change in organizational structure. Research on open-space schools is practically nonexistent.

The nongraded type of elementary school organization is the exception and not the rule. Provisions

for individual pupil differences are being attempted primarily by horizontal organizations and not through vertical organization.

C H A P T E R I I I

METHODOLOGY OF THE STUDY

The methodology of analyzing the longitudinal effects that a nongraded elementary school program, conducted in an open-space facility, had on the cognitive gains of pupils is described in this chapter.

Sampling Procedures

Two component groups of subjects were used in the data gathering aspect of the study and may be described briefly as follows:

> Experimental group. One hundred and fifty pupils enrolled in or graduated from a nongraded, open-space elementary school.
>
> Control group. One hundred and fifty pupils enrolled in or graduated from an elementary school program other than a nongraded one.

Subjects were randomly selected from four elementary schools, grades one through five of the same school system. The populations of the schools were considered to be matched for the purposes of this study since the attendance area of each was similar in population, geographic location, socioeconomic structure, and ethnic distribution.

As shown in Tables 1, 2, 3, and 4 each group consisted of fifteen boys and fifteen girls enrolled in each of the five elementary grades during the 1966-67 school year. The experimental group was randomly selected from one elementary school which operated a nongraded program in an open-space facility. Five boys and five girls were randomly selected from each of the five grade levels in each of the three elementary schools which operated a program other than nongraded in a traditionally designed facility.

Testing Instruments and Sequence

The standardized testing instruments and the testing sequence used in the study are shown in Table 5.

All subjects were administered an intelligence quotient test during the fall of 1966-67. The Otis Quick Scoring Mental Ability Test was used with first and second graders. Third and fourth graders were administered the Primary Mental Abilities Test, and the Sequential Tests of Education Progress were administered to fifth graders.

The Science Research Associates Achievement Series, Multilevel Edition, was used as the standardized

TABLE 1

GIRLS' EXPERIMENTAL GROUP

Years in School	School Year			
	1966-67	1967-68	1968-69	1969-70
1	N=15[a]			
2	N=15[b]	N=15[a]		
3	N=15[c]	N=15[b]	N=15[a]	
4	N=15[d]	N=15[c]	N=15[b]	N=15[a]
5	N=15[e]	N=15[d]	N=15[c]	N=15[b]
6		N=15[e]	N=15[d]	N=15[c]
7			N=15[e]	N=15[d]
8				N=15[e]

TABLE 2

BOYS' EXPERIMENTAL GROUP

Years in School	School Year			
	1966-67	1967-68	1968-69	1969-70
1	N=15[a]			
2	N=15[b]	N=15[a]		
3	N=15[c]	N=15[b]	N=15[a]	
4	N=15[d]	N=15[c]	N=15[b]	N=15[a]
5	N=15[e]	N=15[d]	N=15[c]	N=15[b]
6		N=15[e]	N=15[d]	N=15[c]
7			N=15[e]	N=15[d]
8				N=15[e]

TABLE 3

GIRLS' CONTROL GROUP

Years in School	School Year			
	1966-67	1967-68	1968-69	1969-70
1	N=15[a]			
2	N=15[b]	N=15[a]		
3	N=15[c]	N=15[b]	N=15[a]	
4	N=15[d]	N=15[c]	N=15[b]	N=15[a]
5	N=15[e]	N=15[d]	N=15[c]	N=15[b]
6		N=15[e]	N=15[d]	N=15[c]
7			N=15[e]	N=15[d]
8				N=15[e]

TABLE 4

BOYS' CONTROL GROUP

Years in School	School Year			
	1966-67	1967-68	1968-69	1969-70
1	N=15[a]			
2	N=15[b]	N=15[a]		
3	N=15[c]	N=15[b]	N=15[a]	
4	N=15[d]	N=15[c]	N=15[b]	N=15[a]
5	N=15[e]	N=15[d]	N=15[c]	N=15[b]
6		N=15[e]	N=15[d]	N=15[c]
7			N=15[e]	N=15[d]
8				N=15[e]

TABLE 5

TESTING INSTRUMENTS AND SEQUENCE

Grade in School in 1966-67	Instruments and Sequence
1	Otis Quick Scoring Mental Ability - September, 1966 Science Research Associates Achievement Series, Multilevel Edition Grade 1 - April, 1967 Grade 2 - April, 1968 Grade 3 - April, 1969
2	Otis Quick Scoring Mental Ability - September, 1966 Science Research Associates Achievement Series, Multilevel Edition Grade 2 - September, 1966 Grade 2 - April, 1967 Grade 3 - April, 1968 Grade 4 - April, 1969
3	Primary Mental Abilities - October, 1966 Science Research Associates Achievement Series, Multilevel Edition Grade 3 - September, 1966 Grade 3 - April, 1967 Grade 4 - April, 1968 Grade 5 - April, 1969
4	Primary Mental Abilities - October, 1966 Science Research Associates Achievement Series, Multilevel Edition Grade 4 - September, 1966 Grade 4 - May, 1967 Grade 5 - April, 1968 Grade 6 - November, 1969
5	Sequential Tests of Education Progress - November, 1966 Science Research Associates Achievement Series, Multilevel Edition Grade 5 - September, 1966 Grade 5 - May, 1967 Grade 6 - April, 1968 Grade 7 - April, 1969

testing instrument. Pretests were administered in September of 1966 to the second, third, fourth, and fifth grade subjects. Posttests, using different forms of the instrument, were subsequently administered in April of each of the three succeeding years of the study: 1967, 1968, and 1969.

Test Data Conversion

Grade equivalent achievement test scores were converted into units of measurement of equal size known as Growth Scale Values. Tables from Evaluating Educational Growth (1967:45-51) were used to convert the scores.

These values provide a way of expressing elementary and secondary school test results in the same units. This was necessary in tracing the progress of the subjects over a three-year period. The Growth Scale Scores, moreover, made it possible to compare rates of growth because within each scale throughout the range the units of measurement are the same size. Statistically they were easier to use since they are based on a normal distribution of scores; and, additionally, they provided a meaningful baseline for this long-term study since the

meaning of the values does not change each time the test is restandardized.

Statistical Procedures

Factorial analysis of variance was used to analyze the independent and interactive effects that specific variables had on the cognitive achievement of pupils. Sex, treatment, or the type of school program, and sex and treatment were used as the independent variables in the study. Five dependent variables were used: arithmetic reasoning, arithmetic concepts, arithmetic computation, reading comprehension, and vocabulary.

Mean gain achievement scores for each year and for the total three years of the study were determined by the use of covariates and criteria. As shown in Table 6 the intelligence quotient was a covariate for each dependent variable. The criterion for each gain the first year was the succeeding year's gain. Intelligence quotient and gain scores were used as covariates for the gains in years 2, 3, and 4. Intelligence quotient was used as the covariate and the fourth-year gain as the criterion in determining the overall gain in each dependent variable.

TABLE 6

COVARIATES AND CRITERIA

Dependent Variables	Covariate(s)	Criteria
First year arithmetic reasoning	IQ	2nd year
Second year arithmetic reasoning	IQ and 2nd year	3rd year
Third year arithmetic reasoning	IQ and 3rd year	4th year
Fourth year arithmetic reasoning	IQ and 4th year	5th year
Overall arithmetic reasoning	IQ	4th year
First year arithmetic concepts	IQ	2nd year
Second year arithmetic concepts	IQ and 2nd year	3rd year
Third year arithmetic concepts	IQ and 3rd year	4th year
Fourth year arithmetic concepts	IQ and 4th year	5th year
Overall arithmetic concepts	IQ	4th year
First year arithmetic computation	IQ	2nd year
Second year arithmetic computation	IQ and 2nd year	3rd year
Third year arithmetic computation	IQ and 3rd year	4th year
Fourth year arithmetic computation	IQ and 4th year	5th year
Overall arithmetic computation	IQ	4th year
First year reading comprehension	IQ	2nd year
Second year reading comprehension	IQ and 2nd year	3rd year
Third year reading comprehension	IQ and 3rd year	4th year
Fourth year reading comprehension	IQ and 4th year	5th year
Overall reading comprehension	IQ	4th year
First year vocabulary	IQ	2nd year
Second year vocabulary	IQ and 2nd year	3rd year
Third year vocabulary	IQ and 3rd year	4th year
Fourth year vocabulary	IQ and 4th year	5th year
Overall vocabulary	IQ	4th year
First year composite	IQ	2nd year
Second year composite	IQ and 2nd year	3rd year
Third year composite	IQ and 3rd year	4th year
Fourth year composite	IQ and 4th year	5th year
Overall composite	IQ	4th year

Treatment of Data

Data for the study were screened for consistency, then punched into tabulating cards and verified. Statistical procedures were carried out through the use of the computer at Southern Methodist University, Dallas, Texas. Results were spot checked to verify the accuracy of machine computation.

Analysis of Data

Forty factorial analyses of variance summaries were generated from the data and are included in the appendix. The probability levels from each summary are presented in table form in Chapter IV relative to each of the independent and dependent variables for each year of the study. Mean gain achievement scores on each dependent variable are also presented in table form.

Summary

Factorial analysis of variance was used as the research design of this study to analyze the longitudinal effects that a nongraded elementary school program,

conducted in an open space facility, had on the cognitive gains of pupils.

Intelligence scores were controlled and the independent and interactive effects that sex, type of school program, and sex and type of program had on the achievement of pupils are analyzed in Chapter IV.

C H A P T E R I V

FINDINGS OF THE STUDY

An analysis of the longitudinal effects that a nongraded elementary school program, conducted in an open-space school, had on the cognitive gains of pupils is presented in this chapter. The independent and interactive effects that sex, school program, and sex and school program had on each of the five dependent variables studied: arithmetic reasoning, concepts, and computation; reading comprehension, and vocabulary, are analyzed.

Forty factorial analyses of variance summaries were generated in the data collection process and are included in the appendix. The probability levels from all the summaries, however, are presented in this chapter in table form for 1966-67 grade one subjects and 1966-67 gradestwo through five subjects.

Net gain achievement scores are presented in table form for each of the three years of the study. The data included in these were calculated from the differences in mean gain growth scale values on each group of subjects for each of the three years of the study and for the total three year net gain by groups.

Subjects

The number of subjects in both the experimental and control group, upon whom the findings are based, are shown in Tables 7 and 8. Because of the incomplete data for the total three-year period the total number of subjects studied was 267. Of this number 70 were boys and 62 were girls from the nongraded school, and 68 boys and 67 girls from a program other than nongraded.

Hypotheses

The following fifteen research hypotheses were tested and accepted at the .05 level:

H_1 The type of school program has a significant effect on the mean gain achievement in arithmetic reasoning at any of the three-year intervals of the study, and the total three-year period.

H_2 The type of school program has a significant effect on the mean gain achievement in arithmetic concepts at any of the three-year intervals of the study, and the total three-year period.

H_3 The type of school program has a significant effect on the mean gain achievement in arithmetic computation at any of the three-year intervals of the study, and the total three-year period.

H_4 The type of school program has a significant effect on the mean gain achievement in reading comprehension at any of the three-year intervals of the study, and the total three-year period.

TABLE 7

EXPERIMENTAL SUBJECTS

Grade in 1966-67	N = 70 Boys	N = 62 Girls
1	15	14
2	13	12
3	13	11
4	15	14
5	14	11

TABLE 8

CONTROL SUBJECTS

Grade in 1966-67	N = 68 Boys	N = 67 Girls
1	14	15
2	15	14
3	12	15
4	14	13
5	13	10

H_5 The type of school program has a significant effect on the mean gain achievement in vocabulary at any of the three-year intervals of the study, and the total three-year period.

H_6 Sex does have a significant effect on the cognitive mean gain growth in arithmetic reasoning at any of the three-year intervals of the study, and the total three-year period.

H_7 Sex does have a significant effect on the cognitive mean gain growth in arithmetic concepts at any of the three-year intervals of the study, and the total three-year period.

H_8 Sex does have a significant effect on the cognitive mean gain growth in arithmetic computation at any of the three-year intervals of the study, and the total three-year period.

H_9 Sex does have a significant effect on the cognitive mean growth in reading comprehension at any of the three-year intervals of the study, and the total three-year period.

H_{10} Sex does have a significant effect on the cognitive mean gain growth in vocabulary at any of the three-year intervals of the study, and the total three-year period.

H_{11} The interactive effect of sex and school program does not have a significant effect on the cognitive mean gain growth in arithmetic reasoning at any of the three-year intervals of the study, and for the total three-year period.

H_{12} The interactive effect of sex and school program does not have a significant effect on the cognitive mean gain growth in arithmetic concepts at any of the three-year intervals of the study, and for the total three-year period.

H_{13} The interactive effect of sex and school program does not have a significant effect on the cognitive mean gain growth in arithmetic computation

at any of the three-year intervals of the study, and for the total three-year period.

H_{14} The interactive effect of sex and school program does not have a significant effect on the cognitive mean gain growth in reading comprehension at any of the three-year intervals of the study, and for the total three-year period.

H_{15} The interactive effect of sex and school program does not have a significant effect on the cognitive mean gain growth in vocabulary at any of the three-year intervals of the study, and for the total three-year period.

Analysis of 1966-67 Grade One Data

Presented in Table 9 are the probability levels of the independent and interactive effects that sex, school program, and sex and school program had on the dependent variables of the 1966-67 grade one subjects.

Sex had no significant effects during any year of the study or for the total three-year period. Because they were not administered pretests, the year 1 columns represent the findings at the end of the first grade. Year 2 and 3 data represent the achievement gains of the subjects in the second and third grade. The total 3 years data reflect the net three-year achievement gains of the subjects.

The type of school program was significant at the .005 and .001 levels during year 3 and for the total

TABLE 9

PROBABILITY LEVELS OF THE INDEPENDENT AND INTERACTIVE EFFECTS ON 1966-67 GRADE ONE SUBJECTS

Dependent Variables	Year 1	Year 2	Year 3	Total 3 Years
Sex				
Arithmetic Reasoning	.892	.884	.129	.185
Arithmetic Concepts	.523	.123	.222	.500
Arithmetic Computation	.600	.895	.936	.933
Reading Comprehension	.446	.201	.177	.677
Vocabulary	.971	.731	.117	.128
School Program				
Arithmetic Reasoning	.117	.316	.005	.001
Arithmetic Concepts	.005	.297	.276	.300
Arithmetic Computation	.303	.624	.003	.002
Reading Comprehension	.257	.271	.007	.060
Vocabulary	.145	.891	.046	.039
Sex and School Program				
Arithmetic Reasoning	.462	.157	.738	.493
Arithmetic Concepts	.323	.046	.268	.859
Arithmetic Computation	.122	.272	.228	.172
Reading Comprehension	.274	.964	.848	.805
Vocabulary	.024	.630	.384	.357

three-year period in arithmetic reasoning. It was also significant at the .005 level during year 1 in arithmetic concepts. Significant levels of .003 and .002 during year 3 and for the total 3 years existed in arithmetic computation, and .046 and .039 levels for the same periods in vocabulary. Program was also significant at the .007 level in reading comprehension in year 3. Sex and school program had significant interactive effects at the .046 and .024 level in year 2 in arithmetic concepts and year 1 in vocabulary. These significant differences favored the nongraded elementary school program.

The mean gain achievement in arithmetic reasoning for 1966-67 grade one subjects is shown in Table 10. The variances between the scores of the experimental and control subjects in year 3 and for the total 3 years suggests that boys and girls in a nongraded program achieve higher mean gains in arithmetic reasoning than do those from a program other than nongraded after they have been in the nongraded program three years. The rate of mean gains between year 2 and 3 for each group also suggests that pupils in the nongraded program progress more rapidly than do those in other types of programs.

The mean gain achievement scores in arithmetic concepts, Table 11, indicate that the control girls' and

TABLE 10

MEAN GAIN ACHIEVEMENT OF 1966-67

GRADE ONE SUBJECTS IN ARITHMETIC REASONING

Subjects	Year 2	Year 3	Total 3 Years
Experimental Girls	22.78	133.20	155.98
Control Girls	41.74	95.40	137.14
Experimental Boys	43.53	109.33	152.86
Control Boys	25.93	66.78	93.71

TABLE 11

MEAN GAIN ACHIEVEMENT OF 1966-67

GRADE ONE SUBJECTS IN ARITHMETIC CONCEPTS

Subjects	Year 2	Year 3	Total 3 Years
Experimental Girls	21.00	99.36	120.36
Control Girls	61.33	61.87	123.20
Experimental Boys	14.60	93.26	107.86
Control Boys	34.42	108.08	142.50

boys' scores were larger each of the three years and for the total three years than were the scores of the experimental subjects; however, the experimental girls' scores were larger in year 3 than were those for the control girls. The largest variance in gain scores was between the scores in year 2. These data show that the control group had higher gain scores in arithmetic concepts at the end of the first year than did the experimental group. However, the experimental groups' rate of gain from year 2 to year 3 and year 2 to total 3 years exceeded that of the control groups.

The .046 level of interaction between sex and program and arithmetic concepts during year 2 (Table 9) was caused by the large variance between the mean gains of the control girls and the other subjects. This suggests that girls in a program other than nongraded achieve significantly more in arithmetic concepts than do boys in that same type program or than do girls and boys in a nongraded program. An analysis of the gain scores in year 3 and for the total 3 years indicates, however, that this assumption is not valid when viewed over a period of three years.

Gain achievement scores in arithmetic computation shown in Table 12 show that both girls and boys in

TABLE 12

MEAN GAIN ACHIEVEMENT OF 1966-67

GRADE ONE SUBJECTS IN ARITHMETIC COMPUTATION

Subjects	Year 2	Year 3	Total 3 Years
Experimental Girls	47.78	83.79	131.57
Control Girls	67.60	60.60	128.20
Experimental Boys	71.00	93.67	164.67
Control Boys	53.42	49.93	103.35

a nongraded program achieved significantly better than did pupils in another type of program, .003 and .002 probability levels (Table 9), during the third year and for the total three years of the study. As indicated the mean gain score of the experimental girls in year 2 was smaller than that of the control girls. However, this variance was reversed in year 3 and for the total three years. Experimental boys' score in year 2 was larger, however, than that of the control boys and remained so in year 3 and for the total three years. This indicates that although both girls and boys achieve more in a nongraded program than do those in another type of program that perhaps the nongraded program is more beneficial in arithmetic computation achievement for girls than it is for boys.

Reading comprehension gain achievement scores, Table 13, indicate that girls and boys in a nongraded program achieve significantly better during the third year in the program than do pupils in another program (Table 9--.007 level of probability). The mean gain scores in year 2 were smaller for the experimental subjects than for the control. This trend was reversed, however, in year 3 and for the total three years. The mean changes

TABLE 13

MEAN GAIN ACHIEVEMENT OF 1966-67

GRADE ONE SUBJECTS IN READING COMPREHENSION

Subjects	Year 2	Year 3	Total 3 Years
Experimental Girls	33.22	69.92	103.14
Control Girls	60.33	30.47	90.80
Experimental Boys	35.30	85.73	121.03
Control Boys	45.15	52.21	97.36

of the experimental boys suggest that boys in a nongraded program achieve better in reading comprehension than do girls in the same program or than do girls and boys in a program other than nongraded. The relatively small mean gain of the control girls between year two and three and for the total three years suggests the possibility that girls' achievement is more restricted than are boys' in a program other than nongraded.

As shown in Table 14, the mean gain score in vocabulary of the experimental girls was less than the control girls in year 2. This gain was reversed, however, during year 3, and the total three-year gain for both groups was approximately equal. The scores of the experimental boys were higher than those of the control boys in year 2, 3, and the total three-year period. Such a trend indicates that girls in a nongraded program achieve at a faster rate in vocabulary than do boys in a nongraded program or girls and boys in a program other than nongraded. Girls and boys achieve better in a nongraded program in vocabulary during the third year and for the total three years than do girls and boys in another type program.

As shown in Table 15, the .024 level of significance (Table 9) during year 1 between sex and program

TABLE 14

MEAN GAIN ACHIEVEMENT OF 1966-67

GRADE ONE SUBJECTS IN VOCABULARY

Subjects	Year 2	Year 3	Total 3 Years
Experimental Girls	43.64	56.93	100.57
Control Girls	69.80	34.60	104.40
Experimental Boys	65.47	62.50	127.97
Control Boys	45.50	54.43	99.93

TABLE 15

MEAN ACHIEVEMENT VOCABULARY SCORES OF

1966-67 GRADE ONE SUBJECTS

Subjects	Year 1	Year 2	Year 3
Experimental Girls	168.00	211.64	268.57
Control Girls	133.60	203.40	238.06
Experimental Boys	141.86	207.33	269.80
Control Boys	156.21	211.71	266.14

and vocabulary indicates that girls in a nongraded program do significantly better than do boys in a nongraded program or than do girls and boys in a program other than nongraded. Sex, however, did not continue to have an interactive effect during the second or third year which suggests that over a two- and three-year period sex does not have a significant effect on vocabulary achievement.

Analysis of 1966-67 Grades Two through Five Scores

The analysis of data of the subjects in grades two through five in 1966-67 is conducted separately on each of the five dependent variables studied.

Arithmetic Reasoning

The probability levels of the interactive effects that the three independent variables had on arithmetic reasoning are shown in Table 16. Sex of the subjects had a significant interactive effect of .055 during the third year of the study. Treatment, type of school program, was significant at the .045 and .010 levels during the first year and for the total three years. Sex and treatment had no significant interactive effects during any period of the study.

TABLE 16

PROBABILITY LEVELS GRADES 2 THROUGH 5

ARITHMETIC REASONING

Variables	Pre-Post Test	Year 2	Year 3	Total 3 Years
Sex	.487	.180	.055	.487
Treatment	.048	.694	.123	.010
Sex and Treatment	.832	.147	.917	.468

As indicated in Table 17, the girls from grades 3, 4, and 5 in 1966-67 had higher gain scores in arithmetic reasoning during year 3 of the study than did the boys. They did not, however, have the same variance in the pre- and posttest year, year 2, or for the total three years. It can be concluded, therefore, that although girls may score significantly higher than boys during any one year that they will not over a period of more than one year.

The pupils from the nongraded program, grades 3 and 5 in 1966-67, had higher gain scores during the pre- and posttest year than did the control subjects. Subjects in grades 2 and 4 were approximately equal. These trends also existed for the total three years of the study. The variances between the gain score differences of the 1966-67 grades 3 and 5 subjects increased from the pre-posttest year to the total three years, particularly the fifth graders. This suggests that as pupils move from a nongraded elementary program into a junior high school that is not nongraded that the variance between the gain score differences of their achievement and the achievement of pupils from another type program will become larger in the nongraded pupils' favor. This trend is also present in the total three-year data in the other three grades.

TABLE 17

MEAN GAIN ACHIEVEMENT SCORES IN ARITHMETIC

REASONING GRADES 2 THROUGH 5

Grade in 1966-67	Group	Pre-Post Test Year 1		Year 2		Year 3		Total 3 Years	
		Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
2	Control	104.27	67.64	61.66	107.48	62.20	17.9	128.03	93.14
	Experimental	57.31	96.42	79.00	84.58	34.07	32.09	170.38	113.09
3	Control	18.91	76.47	85.84	38.8	23.90	109.00	128.66	224.73
	Experimental	110.31	84.09	31.69	112.37	84.00	50.27	236.00	246.73
4	Control	56.57	108.31	62.00	48.31	44.86	23.23	163.43	129.85
	Experimental	95.06	75.64	23.40	42.07	34.14	105.71	152.60	153.42
5	Control	35.00	31.30	6.31	56.10	52.54	89.4	93.85	76.8
	Experimental	39.79	60.36	45.85	49.18	59.65	46.55	145.29	156.09

Arithmetic Concepts

The probability levels of the effects that the independent variables had on arithmetic concepts are listed in Table 18. Sex of the subjects was significant at the .019, .031, .046, and .008 levels for years 1, 2, and 3 and for the total three-year period respectively. Treatment and sex and treatment were not significant during any year or for the total three years of the study.

Boys tended to have higher mean achievement gains during each of the three years of the study and for the total three years than did the girls, as shown in Table 19. During the second and third years of the study, however, girls from the fourth and fifth grade classes of 1966-67 had higher gains than did the boys. This suggests that boys achieve higher gain scores in arithmetic concepts than do girls.

The experimental subjects from grades 2, 3, and 5 in 1966-67 had higher total gain scores the first year and for the total three years than did the control subjects.

Arithmetic Computation

As shown in Table 20 there were four significant interactive effects between the independent variables

TABLE 18

PROBABILITY LEVELS GRADES 2 THROUGH 5

ARITHMETIC CONCEPTS

Independent Variables	Pre-Post Test	Year 2	Year 3	Total 3 Years
Sex	.019	.031	.046	.008
Treatment	.832	.869	.081	.159
Sex and Treatment	.629	.926	.755	.791

TABLE 19

MEAN GAIN ACHIEVEMENT SCORES IN ARITHMETIC

CONCEPTS GRADES 2 THROUGH 5

Grade in 1966-67	Group	Pre-Post Test Year 1		Year 2		Year 3		Total 3 Years	
		Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
2	Control	59.92	92.50	46.80	48.93	81.06	36.36	240.13	77.79
	Experimental	112.27	95.83	70.24	26.67	43.07	28.67	179.23	151.17
3	Control	55.50	62.93	42.16	33.27	45.08	60.80	142.75	157.00
	Experimental	95.23	71.28	22.54	8.82	68.45	69.81	186.23	149.91
4	Control	24.45	31.54	59.28	77.00	54.22	85.08	137.93	164.54
	Experimental	25.33	-10.92	54.20	66.35	56.07	74.29	145.60	129.72
5	Control	52.69	44.60	31.62	40.30	40.23	24.60	124.54	109.50
	Experimental	100.50	55.18	35.50	72.46	76.00	59.63	176.00	187.27

TABLE 20

PROBABILITY LEVELS GRADES 2 THROUGH 5

ARITHMETIC COMPUTATION

Independent Variables	Pre-Post Test	Year 2	Year 3	Total 3 Years
Sex	.371	.958	.398	.325
Treatment	.389	.013	.003	.006
Sex and Treatment	.029	.514	.716	.719

and arithmetic computation. Sex had no significant effect. Treatment was significant at the .013, .003, and .006 levels at year 2, year 3, and for the total three-year period. Sex and treatment was significant at the .029 level at year 1.

The mean gain achievement scores in arithmetic computation, Table 21, show that the control subjects had the highest gain scores during the second year of the study. However, during year 3 and the total three-year period the experimental subjects had higher gains, which suggests that pupils in or from a nongraded program have significantly better arithmetic computation achievement after they have been in the program more than one year than do pupils from a program other than nongraded.

Reading Comprehension

Three significant relationships between the independent variables and reading comprehension gain scores are reflected in Table 22. Sex had a significant effect at the .005 and .001 level during year 3 and for the total three-year study. An .018 significance level also occurred in the third year between the treatment variable

TABLE 21

MEAN GAIN ACHIEVEMENT SCORES IN ARITHMETIC

COMPUTATION GRADES 2 THROUGH 5

Grade in 1966-67	Group	Pre-Post Test Year 1		Year 2		Year 3		Total 3 Years	
		Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
2	Control	81.53	63.50	43.00	90.79	28.67	-10.86	153.20	143.43
	Experimental	49.93	73.83	70.69	42.09	4.6	12.41	125.23	128.33
3	Control	55.16	38.26	59.74	47.00	32.00	76.60	147.00	161.86
	Experimental	74.62	87.18	70.46	51.82	40.82	58.18	186.00	197.18
4	Control	21.86	32.15	78.36	90.46	28.40	18.08	128.72	158.69
	Experimental	48.87	47.64	23.86	19.07	93.94	87.00	166.67	143.71
5	Control	56.54	8.1	55.23	77.9	13.62	13.30	125.39	99.30
	Experimental	36.14	41.46	52.72	72.36	77.07	59.55	165.93	172.37

TABLE 22

PROBABILITY LEVELS GRADES 2 THROUGH 5

READING COMPREHENSION

Independent Variables	Pre-Post Test	Year 2	Year 3	Total 3 Years
Sex	.153	.325	.005	.001
Treatment	.185	.207	.018	.056
Sex and Treatment	.189	.614	.896	.586

and reading comprehension. There was no significant interaction between sex and treatment and the dependent variable.

The mean gain achievement scores in reading comprehension, Table 23, indicate that during the third year of the study and for the total three years that boys made higher gain scores than did girls. It also shows that during the third year and for the total three years the experimental subjects had higher gains than did the control subjects. This suggests, also, that pupils in or from a nongraded program have more significant achievement gains in reading comprehension than do those in or from a program other than nongradedness.

Reading Vocabulary

Five significant relationships between the independent variables and reading vocabulary are shown in Table 24. Sex had significant effects during year 1, year 3, and for the total three years. Treatment was significant in year 3 as well as in the total three years. Sex and treatment had no significant effects on reading vocabulary.

TABLE 23

MEAN GAIN ACHIEVEMENT SCORES IN READING

COMPREHENSION GRADES 2 THROUGH 5

Grade in 1966-67	Group	Pre-Post Test Year 1		Year 2		Year 3		Total 3 Years	
		Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
2	Control	90.67	68.21	43.53	53.22	10.93	34.58	145.13	86.85
	Experimental	47.00	67.17	28.47	18.42	33.69	45.50	110.16	94.25
3	Control	13.92	29.33	42.33	39.93	4.34	42.87	60.59	112.13
	Experimental	68.54	36.64	27.30	56.27	49.85	10.45	140.69	103.36
4	Control	35.69	19.54	5.93	22.00	37.07	31.39	78.71	72.93
	Experimental	50.60	37.50	24.86	12.46	34.34	27.36	109.80	77.50
5	Control	27.84	25.60	31.85	16.20	6.46	20.00	76.15	61.80
	Experimental	16.42	32.36	15.43	20.55	27.79	3.90	59.64	56.81

TABLE 24

PROBABILITY LEVELS GRADES 2 THROUGH 5

VOCABULARY

Independent Variables	Pre-Post Test	Year 2	Year 3	Total 3 Years
Sex	.039	.845	.003	.003
Treatment	.662	.708	.029	.054
Sex and Treatment	.164	.291	.471	.107

An analysis of the mean gain scores in reading vocabulary, Table 25, shows that boys from grades three and four had larger gain scores during the pre- and post-test than did girls. Girls, however, from grades two and five had larger scores than did the boys. In year 3, boys from grades two, four, and five had larger gain scores than did girls. For the total three-year period boys from grades one, three, and five also had larger gain scores. Therefore, it is assumed that boys generally have higher gain achievement in vocabulary than do girls.

The experimental subjects had higher gains during the third year and for the total three-year period than did the control subjects.

Analysis of these scores suggests that pupils in or from a nongraded program have significantly higher achievement gains in vocabulary after at least two years than do pupils from a program other than nongradedness.

Summary of Findings

Factorial analysis of variance was used to determine the longitudinal effects that a nongraded elementary school program, conducted in an open-space facility,

TABLE 25

MEAN GAIN SCORES IN READING VOCABULARY

Grades 1966-67	Group	Pre-Post Test Year 1		Year 2		Year 3		Total 3 Years	
		Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
2	Control	100.67	87.14	22.80	52.29	16.4	-23.5	139.87	105.86
	Experimental	48.39	71.42	34.77	6.33	48.30	27.84	131.46	105.59
3	Control	35.58	23.13	28.84	32.20	29.70	57.54	93.17	112.87
	Experimental	81.39	37.09	25.23	57.82	33.15	28.55	139.77	123.46
4	Control	41.29	28.23	26.86	29.54	42.78	25.92	110.93	83.69
	Experimental	47.54	23.86	20.53	26.79	46.07	26.50	114.14	77.15
5	Control	20.47	32.20	29.00	22.70	30.23	10.60	79.70	65.50
	Experimental	26.93	22.18	22.00	25.09	34.78	20.82	83.71	68.09

had on the cognitive gain of pupils. Presented in Tables 26 and 27 are summaries of the significant probability levels found in this study.

As shown in Table 26 sex had no significant effect on the cognitive achievement of pupils in grade 1 in 1966-67 during any of the three years of the study or for the total three-year period. Treatment, or school program, had no significant effect in the first year of the study. Significant probability levels were present, however, relative to the second and third year of the study in all treatment and dependent variable cells with the exception of arithmetic concepts. The summary data for the total three years of the study also reflect significant levels between treatment and the dependent variables of arithmetic reasoning and computation and vocabulary. The independent variables of sex and treatment were significant only in year 1 arithmetic concepts.

The type of school program had no significant effect on the achievement gains of pupils from the 1966-67 first grade the first year of the study. However, after the first graders had been in the nongraded program two years they achieved significantly better in four of the five variables studied than did the control group from

TABLE 26

SUMMARY OF SIGNIFICANT FINDINGS

1966-67 GRADE 1

Dependent Variables	Year 1	Year 2	Year 3	Total 3 Years
Sex				
Arithmetic Reasoning	x	x	x	x
Arithmetic Concepts	x	x	x	x
Arithmetic Computation	x	x	x	x
Reading Comprehension	x	x	x	x
Vocabulary	x	x	x	x
Treatment				
Arithmetic Reasoning	x	.005	.005	.001
Arithmetic Concepts	x	x	x	x
Arithmetic Computation	x	.003	.002	.002
Reading Comprehension	x	.007	x	x
Vocabulary	x	.046	.039	.039
Sex and Treatment				
Arithmetic Reasoning	x	x	x	x
Arithmetic Concepts	.046	x	x	x
Arithmetic Computation	x	x	x	x
Reading Comprehension	x	x	x	x
Vocabulary	x	x	x	x

the program other than nongraded. After being in the nongraded program for three years, they did significantly better in three of the five variables as they also did for the total three-year period.

As reflected in Table 27, sex had significant effects on four of the five dependent variables in grades two through five: arithmetic concepts in years 1, 2, 3, and total three years; arithmetic reasoning in year 3; vocabulary in years 1, 3, and total three years; and reading comprehension in year 3 and the total three years.

Treatment, or type of school program, was significant in year 1 arithmetic reasoning; year 2 arithmetic computation; year 3 arithmetic computation, reading comprehension, and vocabulary; and for the total three years with all dependent variables except arithmetic concepts. Pupils, therefore, who remain in a nongraded program for two years will achieve significantly better during the third year than will those not in a nongraded program.

Sex and treatment had a significant interactive effect only on arithmetic computation during the first year of the study. Therefore, although significant as

TABLE 27

SUMMARY OF SIGNIFICANT FINDINGS

GRADES 2 THROUGH 5, 1966-67

Dependent Variables	Year 1	Year 2	Year 3	Total 3 Years
Sex				
Arithmetic Reasoning	x	.031	.055	x
Arithmetic Concepts	.019	x	.046	.008
Arithmetic Computation	x	x	x	x
Reading Comprehension	x	x	.005	.001
Vocabulary	.039	x	.003	.003
Treatment				
Arithmetic Reasoning	.048	x	x	.010
Arithmetic Concepts	x	x	x	x
Arithmetic Computation	x	.013	.003	.006
Reading Comprehension	x	x	.018	.056
Vocabulary	x	x	.029	.054
Sex and Treatment				
Arithmetic Reasoning	x	x	x	x
Arithmetic Concepts	x	x	x	x
Arithmetic Computation	.029	x	x	x
Reading Comprehension	x	x	x	x
Vocabulary	x	x	x	x

independent variables, both sex and treatment have no significant effects on the cognitive learning of pupils.

Chapter V includes the summary, conclusions, recommendations, and implications of this study.

C H A P T E R V

SUMMARY, CONCLUSIONS, RECOMMENDATIONS, AND IMPLICATIONS

Summary

Educators have espoused for years the philosophy of individual learning and have made efforts to implement this concept in elementary and secondary schools. The accomplishment of this objective, however, has not been attained and the dilemma persists as to the type of organizational structure, instructional design, and facilities and materials that will most effectively enhance the individualization of learning.

The graded type of organizational structure has been the most prevalent since the Quincy Grammar School. The philosophy and instructional design of this type of organization suggest a relative common sequence of learning tasks for all pupils and within the same timeframe. Team teaching, heterogeneous and homogenous grouping, and dual progress have been the most popular efforts undertaken to organize instruction based on student ability and achievement. They have succeeded, however, only in modifying the

arbitrariness of grade standards rather than eliminating them completely. Thus, the uniqueness of each individual has been overlooked because of the emphasis on groups.

Empirical evidence indicates very specifically the wide variability that exists in pupils' abilities, talents, achievements, and needs. And, although evidence is also available that indicates that nongraded programs are superior to other programs in making provisions for these differences the majority of schools continue the graded type of vertical organization.

Open--space schools are becoming more commonplace in American education. There are, however, relatively no evidence and few studies that indicate the effects that such facilities have on the learning of pupils.

This three-year study was undertaken, therefore, to add to the existing empirical evidence relative to nongraded elementary school programs and open--space facilities. An analysis was made of the longitudinal effects that a nongraded elementary school program, conducted in an open-space facility, had on the cognitive achievement of pupils. The experimental group of subjects consisted of 70 boys and 62 girls enrolled in or graduated from a nongraded elementary school program which was conducted in an open-space

school. The control group consisted of 68 boys and 67 girls enrolled in or graduated from an elementary school program other than nongraded conducted in a traditionally designed facility. All subjects were randomly selected from four elementary schools of the same school system and each was administered pretests at the beginning of the study and posttests each of the three years of the study.

Factorial analysis of variance was used to analyze the independent and interactive effects that sex, type of school program, and sex and type of school program had on the dependent variables of arithmetic reasoning, concepts, and computation; reading comprehension; and vocabulary. Significant effects were found which indicated that after at least two years in the nongraded elementary school program, conducted in an open-space school, pupils had significantly better achievement gains in most cognitive areas than did their counterparts in another type of program and facility. These significant effects, moreover, were also found during the third year and for the total three-year period of the study.

Conclusions

On the basis of this study a number of conclusions were drawn:

1. Pupils that began the first year of school in the nongraded program, after three years in the program, had significantly higher mean achievement gains in arithmetic reasoning and computation than did boys and girls in a program other than nongraded. Their three-year net gain achievement was also significantly better.

2. Pupils that began the first year of school in the nongraded program did, after the second year, achieve at a faster rate in arithmetic concepts than did pupils in another type of program.

3. Girls that began the first year of school in the nongraded program achieved at a faster mean rate in arithmetic computation than did boys in the nongraded program or boys or girls in another type of program.

4. Pupils that began the first year of school in the nongraded program did, after three years in the program, achieve significantly better mean gains in reading comprehension and vocabulary than did pupils in the program other than nongraded. Their three-year net mean gain achievement was also significantly better.

5. Boys that began the first year of school in the nongraded program achieved at a faster mean rate in reading comprehension than did girls in the nongraded program or boys and girls in the program other than nongraded.

6. After two years in a program other than nongraded girls achieved at a slower mean rate in reading comprehension than did boys in that type of program or boys and girls in the nongraded program.

7. Although girls had significantly higher mean gains in arithmetic reasoning than boys during any one year this difference did not continue over the three-year period.

8. After pupils had been in the nongraded elementary program for one or more years and moved to a junior high school program other than nongraded their mean gain achievement was significantly higher in the junior high school after two years than was that of pupils from an elementary program other than nongraded.

9. Pupils that began their second, third, fourth, or fifth year of school in the nongraded program did, after three years, have significantly higher mean gains in arithmetic reasoning and computation, reading comprehension, and vocabulary than did boys and girls that began in a program other than nongraded.

10. Boys did have significantly higher mean achievement gains in arithmetic concepts, reading comprehension, and vocabulary over a three-year period than did girls.

11. Pupils that began their second, third, fourth, or fifth year of school in the nongraded program achieved at a higher mean achievement rate, after three years, in arithmetic concepts than did pupils from a program other than nongraded.

12. Sex and type of school program did not have a significant interactive effect on the cognitive achievement gains of pupils.

The implementation of a nongraded elementary school program demands much more than a label. Providing for and meeting the individual needs of pupils is difficult and complex and demands strenuous efforts and sincere commitments

on the part of those who attempt to do so. The empirical evidence available justifies the merits of a nongraded program, and those educators that are sincerely committed to providing for individual differences should, without hesitation, adopt and implement the concept.

Space flexibility of the open-space school encourages and permits more different kinds of learning experiences than does a traditional building. It should be designed, however, only after much deliberation as to the types of learning activities that are to be conducted. As with any facility the specifications must be congruent with the objectives of the educational program and not the reverse. One of the major advantages of the open-space facility is the fact that the openness tends to stimulate the best teaching possible on the part of teachers.

Recommendations

Based on the findings of this study and the conclusions drawn, the recommendations listed below are made for further study.

1. In order to test and improve the statistical probabilities of this study, it is recommended that a larger sample be selected for at least a three-year study.

2. On the basis of either the data collected in this study or data collected on a larger sample individual pupil's achievement gains should be traced in an attempt to ascertain the effects on individuals rather than groups.

3. Additional studies of this type should ascertain the degree of changes in the affective behavior of pupils in or from a nongraded program and an open-space school.

4. Teacher behavior, organizational climate of the school, and the learning patterns and styles of pupils should be included as independent variables in future studies regarding nongraded programs and open-space schools.

5. Testing instruments should be designed and standardized that have more validity for the objectives of nongraded programs, and used in future studies of this type.

6. Longitudinal studies should be conducted which focus specifically on the effects that an open-space facility has on teachers and pupils.

After the decision has been made by a school district to implement a nongraded program, or to design an open-space school, the following recommendations should be considered:

1. The concept of a nongraded program or an open-space facility must be of developmental evolution and not imposed on pupils, teachers, administrators, or parents. Do not adopt either concept as the latest fad in education without total commitment to the principles underlying either.

2. Involve local teacher training institutions in all phases of the program. Too often public

schools overlook the significant benefits to education that can be derived from the resources of these institutions.

3. Select only those teachers and administrators who have a zealous desire to undertake the implementation of the concepts. Attempt to discriminate, however, between commitment and fadism.

4. Select, initially, only one school in the district, regardless of the size of the district, as the pilot school. Involve the total staff of that school and nurture and support it for at least two years before replicating in other schools.

5. Insure that evaluation and replication processes are defined before initiating the concept. Evaluation must consist of much more than standardized achievement test scores, and the replication design must prevent a decade's lag in implementation.

6. Commit additional financial support to the pilot school for at least the first two years, specifically in the area of consultation services and materials.

7. Design a training program for the nonprofessional personnel of the pilot school. Part of this training must include the philosophy, concept, and operation of the program, and basic concepts regarding how to work effectively with pupils.

8. Select and begin the training of the pilot school staff before implementing the concept. This training must be continuous and cannot be the kind normally conducted as in-service training. The success of implementation will depend on the ability of staff members to internalize the concepts presented during this training and to actually demonstrate the concepts in practice. To insure a continual developmental process, however, teams must be formed and permitted to function both as teams and as individuals within the team. This affords a team approach and also permits individuals to develop their own style of implementation.

Training activities should be organized around such topics as:

a. The concepts of a nongraded program.
b. Diagnostic and prescription techniques.
c. Evaluation of pupils.
d. Techniques and materials for individualizing learning.
e. Learning theorems.
f. Interpersonal relationships.
g. Instructional design that permits individualized learning.
h. The role of teachers as directors of learning.
i. Effective utilization of space to enhance learning.
j. Concept of team teaching.
k. Differentiated staffing.
l. Decision making.
m. Skills of management.
n. Concept of learning resource center.
o. Teacher self-analysis.
p. The role of technology.
q. Reporting to parents.

It is also highly recommended that experienced consultants from outside the district be utilized in this training.

9. Insure that the pilot school staff has the flexibility to deviate from such traditional policies as: report cards, district-wide curriculum, district-wide in-service training, chronological age grouping of pupils, labeling of pupils (special education, slow learners, average, and gifted), pupil-teacher ratio, and the amount and the kind of instructional materials that can be used. In other words, the pilot school staff must have the authority to break from many of the traditional administrative policies if they are to successfully implement these concepts.

10. Assign curriculum writers and research design support personnel to the pilot school for the purpose of supporting the staff.

11. Plan and conduct awareness seminars and conferences in the pilot school for the purpose of familiarizing district-wide staff members, parents, and Board of Education members with the program.

12. Do not dissipate the energies of the staff of the pilot school with unnecessary reporting, visitation schedules, and traditional administrativa.

13. The facility specifications must be congruent with the objectives of the educational program. If an open-space school is planned insure that the architectural specifications are based on the program specifications and not the reverse. If traditional buildings are used consideration should be given to renovation that can more easily facilitate the program specifications.

The aforementioned recommendations will not assure significant educational results. They are intended, however, only as guidelines and suggestions for those interested in implementing a nongraded elementary school program in an open-space facility.

Implications

The empirical evidence of this study suggests that a nongraded elementary school program, conducted in an open-space facility, is significantly better than a program other than nongradedness for the cognitive achievement of pupils. It is not valid, however, for educators

to expect such results on the mere basis of a change to a nongraded organizational structure in an open-space school. Such a change requires tireless efforts and can not be imitated easily and precisely by following specific steps.

Teachers and administrators must be committed to the nongraded and open-space school concept, understand it, and plan carefully for its implementation and promotion. The superintendent and his staff, the Board of Education, and the community must also understand the concept and be kept thoroughly informed. Success, however, will depend upon the degree of cooperation, enthusiasm, and understanding of teachers and administrators.

There is no evidence to suggest that any school district could not or would not profit by the suggested recommendations. It would be beneficial, however, if the studies and recommendations were carried out in several school districts which would permit the long-range effects of a careful development of a nongraded program in an open-space facility and concomitant activities to be felt in virtually every subsystem of the respective school districts.

Such an undertaking is theoretically feasible and is in need of systematic development and implementation in several school districts. If this were undertaken,

many personnel in several school systems would be involved which could lead to a system-wide accountability of teachers and administrators.

The evidence of this study reinforces the concept of nongradedness. It should be used, however, only as a basis in realizing the principle of an individualized program that permits each pupil the opportunity of progressing at his own rate of learning based on his own unique needs, learning style, and ability. It should not and must not be used as the basis to elect or reject the nongraded program or any other type of program, or the open--space facility.

A P P E N D I X

FACTORIAL ANALYSES OF VARIANCE SUMMARIES

A P P E N D I X

The forty summary tables of the analysis of variance generated from the data are included herein. Intelligence was used as a covariate and "regression" used to indicate this in each summary. Therefore, in all summaries "regression" has a probability of less than .001. "Treatment" in each summary refers to the type of school program, graded or nongraded.

1966-67 GRADE 1 SUMMARIES

Source	SS	df	MS	f	P less than
	First Year Arithmetic Reasoning				
Within Cells	119292.720	53	2250.806		
Regression	102832.906	1	102832.906	45.687	.001
Sex	41.605	1	41.605	.018	.892
Treatment	5723.809	1	5723.809	2.543	.117
Sex and Treatment	1236.225	1	1236.225	.549	.462
	Second Year Arithmetic Reasoning				
Within Cells	58796.985	52	1130.711		
Regression	106127.745	2	53063.872	46.930	.001
Sex	24.332	1	24.332	.022	.884
Treatment	1158.061	1	1158.061	1.024	.316
Sex and Treatment	2333.981	1	2333.981	2.064	.157
	Third Year Arithmetic Reasoning				
Within Cells	175796.000	52	3380.692		
Regression	207711.450	2	103855.725	30.720	.001
Sex	8039.047	1	8039.047	2.378	.129
Treatment	29062.567	1	29062.567	8.597	.005
Sex and Treatment	382.090	1	383.090	.113	.738
	Overall Arithmetic Reasoning				
Within Cells	228324.270	53	4308.005		
Regression	155183.180	2	155183.180	36.022	.001
Sex	7763.391	1	7763.391	1.802	.185
Treatment	53080.895	1	53080.895	12.321	.001
Sex and Treatment	2048.379	1	2048.379		
	First Year Arithmetic Concepts				
Within Cells	85446.191	53	1612.192		
Regression	29733.867	2	29733.867	18.443	.001
Sex	666 852	1	666.852	.414	.523
Treatment	13594.155	1	13594.155	8.432	.005
Sex and Treatment	1604.373	1	1604.373	.995	.323
	Second Year Arithmetic Concepts				
Within Cells	52700.543	52	1013.472		
Regression	37375.072	2	18687.536	18.439	.001
Sex	2491.185	1	2491.185	2.458	.123
Treatment	1122.524	1	1122.524	1.108	.297
Sex and Treatment	4227.560	1	4227.560	4.171	.046

1966-67 GRADE 1 SUMMARIES (cont.)

Source	SS	df	MS	f	P less than
		Third Year Arithmetic Concepts			
Within Cells	161854.800	52	3112.592		
Regression	156096.960	2	78048.477	25.075	.001
Sex	4746.637	1	4746.637	1.525	.222
Treatment	3770.867	1	3770.867	1.211	.276
Sex and Treatment	3903.531	1	3903.539	1.254	.268
		Overall Arithmetic Concepts			
Within Cella	191849.570	53	3619.803		
Regression	126102.188	1	126102.188	34.837	.001
Sex	1670.813	1	1670.813	.462	.500
Treatment	3961.387	1	3961.387	1.094	.300
Sex and Treatment	114.535	1	114.535	.032	.859
		First Year Arithmetic Computation			
Within Cells	43019.532	53	811.689		
Regression	43416.332	1	43416.332	53.489	.001
Sex	225.717	1	225.717	.278	.600
Treatment	877.454	1	877.454	1.081	.303
Sex and Treatment	2000.813	1	2000.813	2.465	.122
		Second Year Arithmetic Computation			
Within Cells	43457.749	52	835.726		
Regression	26456.299	2	13228.150	15.828	.001
Sex	14.778	1	14.778	.018	.895
Treatment	202.979	1	202.979	.243	.624
Sex and Treatment	1028.398	1	1028.398	1.231	.272
		Third Year Arithmetic Computation			
Within Cells	105180.012	52	2022.693		
Regression	32745.159	2	16372.579	8.094	.001
Sex	13.090	1	13.090	.006	.936
Treatment	19755.485	1	19755.485	9.767	.003
Sex and Treatment	3005.250	1	3005.250	1.486	.228
		Overall Arithmetic Computation			
Within Cells	110348.313	53	2082.044		
Regression	27576.859	1	27576.859	13.245	.001
Sex	15.012	1	15.012	.007	.933
Treatment	21941.908	1	21941.908	10.549	.002
Sex and Treatment	3984.898	1	3984.898	1.914	.172
		First Year Reading Comprehension			
Within Cells	59825.059	53	1128.775		
Regression	52471.425	1	52471.425	46.485	.001
Sex	665.485	1	665.485	.590	.446
Treatment	1483.296	1	1483.296	1.314	.257
Sex and Treatment	1379.395	1	1379.395	1.222	.274

1966-67 GRADE 1 SUMMARIES (cont.)

Source	SS	df	MS	f	P less than
		Second Year Reading Comprehension			
Within Cells	72566.736	52	1395.514		
Regression	42144.055	2	21072.028	15.100	.001
Sex	2335.702	1	2335.702	1.674	.201
Treatment	1730.298	1	1730.298	1.240	.271
Sex and Treatment	2.914	1	2.914	.002	.964
		Third Year Reading Comprehension			
Within Cells	122296.670	52	2351.859		
Regression	115241.238	2	57620.619	24.500	.001
Sex	4401.555	1	4401.555	1.872	.177
Treatment	18545.658	1	18545.658	7.886	.007
Sex and Treatment	87.736	1	87.736	.037	.848
		Overall Reading Comprehension			
Within Cells	171888.460	53	3243.179		
Regression	65649.444	1	65649.444	20.242	.001
Sex	568.422	1	568.422	.175	.677
Treatment	11964.348	1	11964.348	3.689	.060
Sex and Treatment	199.014	1	199.014	.061	.805
		First Year Vocabulary			
Within Cells	69414.616	53	1309.710		
Regression	26653.074	1	26653.074	20.350	.001
Sex	1.728	1	1.728	.001	.971
Treatment	2859.606	1	2859.606	2.183	.145
Sex and Treatment	7056.592	1	7056.592	5.388	.024
		Second Year Vocabulary			
Within Cells	77929.600	42	1498.646		
Regression	51213.399	2	25606.700	17.087	.001
Sex	179.686	1	179.686	.120	.731
Treatment	27.653	1	27.653	.018	.892
Sex and Treatment	351.890	1	351.890	.235	.630
		Third Year Vocabulary			
Within Cells	67070.102	52	1289.810		
Regression	80132.370	2	40066.185	31.064	.001
Sex	3278.844	1	3278.844	2.542	.117
Treatment	5389.621	1	5389.621	4.179	.046
Sex and Treatment	994.385	1	994.385	.771	.384
		Overall Vocabulary			
Within Cells	90563.817	53	1708.751		
Regression	56638.655	1	56638.655	33.146	.001
Sex	4089.402	1	4089.402	2.393	.128
Treatment	7620.092	1	7620.092	4.459	.039
Sex and Treatment	1477.813	1	1477.813	.865	.357

1966-67 GRADES TWO THROUGH FIVE SUMMARIES

Source	SS	df	MS	f	P less than
		First Year Arithmetic Reasoning			
Within Cells	761646.230	191	3987.66		
Regression	645768.180	2	322884.090	80.970	.001
Sex	1932.234	1	1932.234	.485	.487
Treatment	15783.891	1	15783.891	3.958	.048
Sex and Treatment	180.156	1	180.156	.045	.832
		Second Year Arithmetic Reasoning			
Within Cells	619549.320	191	3243.714		
Regression	694030.430	2	347015.220	106.981	.001
Sex	5886.766	1	5886.766	1.815	.180
Treatment	502.359	1	502.359	.155	.694
Sex and Treatment	6865.484	1	6865.484	2.117	.147
		Third Year Arithmetic Reasoning			
Within Cells	1047184.410	191	5482.641		
Regression	1505624.400	2	752812.190	137.308	.001
Sex	20516.094	1	20516.094	3.742	.055
Treatment	13165.500	1	13165.500	2.401	.123
Sex and Treatment	60.375	1	60.375	.011	.917
		Overall Arithmetic Reasoning			
Within Cells	1308755.00	191	6852.120		
Regression	1244053.80	2	622026.920	90.779	.001
Sex	3330.250	1	3330.250	.486	.487
Treatment	45930.938	1	45930.938	6.703	.010
Sex and Treatment	3630.781	1	3630.781	.530	.468
		First Year Arithmetic Concepts			
Within Cells	611149.970	191	3199.738		
Regression	499264.550	2	249632.280	78.016	.001
Sex	17859.625	1	17859.625	5.582	.019
Treatment	144.500	1	144.500	.045	.832
Sex and Treatment	750.969	1	750.969	.235	.629
		Second Year Arithmetic Concepts			
Within Cells	501141.400	191	2623.777		
Regression	487635.400	2	253817.700	92.926	.001
Sex	12439.914	1	12439.914	4.741	.031
Treatment	71.766	1	71.766	.027	.869
Sex and Treatment	22.781	1	22.781	.009	.926

Source	SS	df	MS	f	P less than
		Third Year Arithmetic Concepts			
Within Cells	1011331.440	191	5294.929		
Regression	1383894.700	2	691947.330	130.681	.001
Sex	21264.063	1	21264.063	4.016	.046
Treatment	16249.344	1	16249.344	3.069	.081
Sex and Treatment	516.938	1	516.938	.098	.755
		Total Concepts			
Within Cells	1186635.900	191	6212.753		
Regression	1208590.200	2	604295.100	97.267	.001
Sex	44339.438	1	44339.438	7.137	.008
Treatment	12397.781	1	12397.781	1.996	.156
Sex and Treatment	436.469	1	436.469	.070	.791
		First Year Arithmetic Computation			
Within Cells	424209.470	191	2220.992		
Regression	200306.150	2	100153.071	45.094	.001
Sex	1788.695	1	1788.695	.805	.371
Treatment	1656.367	1	1656.367	.746	.389
Sex and Treatment	10738.391	1	10738.391	4.835	.029
		Second Year Arithmetic Computation			
Within Cells	484478.810	191	2536.538		
Regression	196381.030	2	98190.510	38.710	.001
Sex	7.086	1	7.086	.003	.958
Treatment	15960.969	1	15960.969	6.292	.013
Sex and Treatment	1086.586	1	1086.586	.428	.514
		Third Year Arithmetic Computation			
Within Cells	843015.750	191	4413.695		
Regression	747597.550	2	343498.780	84.691	.001
Sex	3165.656	1	3165.656	.717	.398
Treatment	38836.047	1	38836.047	8.799	.003
Sex and Treatment	586.062	1	586.062	.133	.716
		Overall Arithmetic Computation			
Within Cells	851569.160	191	4458.435		
Regression	739052.150	2	369526.080	82.882	.001
Sex	4348.281	1	4348.281	.975	.325
Treatment	34810.297	1	34810.297	7.808	.006
Sex and Treatment	578.516	1	578.516	.130	.719
		First Year Reading Comprehension			
Within Cells	330937.680	191	1732.658		
Regression	284871.000	2	142435.500	82.206	.001
Sex	3568.773	1	3568.773	2.060	.153
Treatment	3060.797	1	3060.797	1.767	.185
Sex and Treatment	3008.703	1	3008.703	1.736	.189

Source	SS	df	MS	f	P less than
		Second Year Reading Comprehension			
Within Cells	347624.320	191	1820.023		
Regression	205932.330	2	102966.166	56.574	.001
Sex	1771.180	1	1771.180	.973	.325
Treatment	2918.711	1	2918.711	1.604	.207
Sex and Treatment	465.430	1	465.430	.256	.614
		Third Year Reading Comprehension			
Within Cells	403387.670	191	2111.977		
Regression	351717.200	2	175858.590	83.267	.001
Sex	16852.164	1	16852.164	7.979	.005
Treatment	12008.914	1	12008.914	5.686	.018
Sex and Treatment	35.969	1	35.969	.017	.896
		Overall Reading Comprehension			
Within Cells	506485.800	192	2637.947		
Regression	248619.050	1	248619.050	94.247	.001
Sex	28407.352	1	28407.352	10.769	.001
Treatment	9730.992	1	9730.992	3.689	.054
Sex and Treatment	783.750	1	783.750	.297	.586
		First Year Reading Vocabulary			
Within Cells	296984.610	191	1554.893		
Regression	223047.790	2	111523.892	71.724	.001
Sex	6704.484	1	6704.484	4.312	.039
Treatment	298.656	1	298.656	.192	.662
Sex and Treatment	3034.559	1	3034.559	1.952	.164
		Second Year Reading Vocabulary			
Within Cells	343936.430	191	1800.714		
Regression	207413.990	2	103706.996	57.592	.001
Sex	69.461	1	69.461	.039	.845
Treatment	253.531	1	253.531	.141	.708
Sex and Treatment	2022.383	1	2022.383	1.123	.291
		Third Year Reading Vocabulary			
Within Cells	402118.620	191	2105.333		
Regression	427173.790	2	213586.900	101.450	.001
Sex	19474.696	1	19474.696	9.250	.003
Treatment	10127.562	1	10127.562	4.810	.029
Sex and Treatment	1097.891	1	1097.891	.521	.471
		Total Reading Vocabulary			
Within Cells	499833.960	191	2603.302		
Regression	329458.450	1	329458.450	126.554	.001
Sex	23277.375	1	23277.375	8.941	.003
Treatment	9821.766	1	9821.766	3.773	.054
Sex and Treatment	6845.883	1	6845.883	2.630	.107

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