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A Comparative Study of the Arithmetic Achievement and Attitude of Fifth Grade Children in the Upper and Lower 25 Per Cent Intelligence Groups Using the S.M.S.G Program of Teaching Arithmetic and the Traditional Methods Used in the Highline School District

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A COMPARATIVE STUDY OF THE ARITHMETIC ACHIEVEMENT AND ATTITUDE OF FIFTH GRADE CHILDREN IN THE UPPER AND LOWER 25 PER CENT INTELLIGENCE GROUPS USING THE S.M.S.G. PROGRAM OF TEACHING ARITHMETIC AND THE TRADITIONAL METHODS USED IN THE HIGHLINE SCHOOL DISTRICT

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CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

In this age of automation and advanced technology, the need for highly trained and skilled technicians has reached beyond the supply. The launching into space of the first earth satellite triggered great demands upon the American education system in an effort to satisfy this need. The curriculum of American schools has experienced a considerable change in these past few years. This is especially true of the science and mathematics programs. According to Wagner:

> The world of today demands a more mathematical knowledge on the part of more people than the world of yesterday, and the world of tomorrow will make still greater demands (12:454).

In an effort to match these demands, educators have been introducing many new materials and techniques designed to improve and strengthen instruction. Groups and committees are very active. The School Mathematics Study Group, Greater Cleveland Mathematics Program, University of Illinois Committee on School Mathematics, Ball State Teachers College Mathematics Program, and the Madison Project are a few of these groups.

The Highline School District was one of several districts in the State of Washington that had been experimenting with the changes that would help elementary school children receive a better knowledge of mathematics. Hannon stated that, "The time is ripe for a reconsideration of arithmetic in the elementary grades." (6:614). With this in mind, nineteen experimental fourth grade classes in the Highline School District started using the School Mathematics Study Group materials at the beginning of the school year of 1962-1963.

This involved 565 youngsters in ten different buildings. The remaining 1,700 fourth graders in the district were taught using traditional methods. In September, 1963, the program was continued on into the fifth grade.

I. THE PROBLEM

Statement of the Problem. It was the purpose of this study to (1) compare the learning of basic arithmetic skills of fifth grade children in the upper and lower 25 per cent intelligence groups using traditional arithmetic textbook materials with the learnings of comparable fifth graders using the School Mathematics Study Group methods and materials; and (2) compare the attitudes toward arithmetic of fifth graders using the traditional arithmetic textbook materials with those of fifth graders using the S.M.S.G. methods and materials. The upper and lower 25 per cent intelligence groups were established to help determine if either program would be more beneficial to a particular group.

This study was based on the hypothesis that: (1) no statistical significant difference would be found in arithmetic achievement between children using S.M.S.G. and children using traditional arithmetic materials, and (2) no statistical significant difference would be found in attitude toward arithmetic between children using S.M.S.G. and children using traditional arithmetic materials.

Importance of the study. Many school systems are taking a critical look at the entire elementary school arithmetic program; re-examining goals, content, and method in relation to children's abilities and needs. Careful and continuous evaluation must be made whenever new methods of instruction are introduced.

Limitation of the study. The *Metropolitan Achievement Test* was the only measuring device available to the writer at the time the study was made. This test was designed primarily to measure proficiency in arithmetic skills taught in a traditional arithmetic program. This was seen as a limitation in this study since it did not appear to be designed to adequately measure the total achievement of the pupils in a modern math program.

II. DEFINITIONS OF TERMS USED

For the purpose of this study the following terms were defined as follows;

Basic arithmetic skills. This refers to the arithmetic skills of computation and problem solving.

Traditional arithmetic materials. This refers to those materials and textbooks used by teachers in the intermediate grades prior to the introduction of the S.M.S.G. materials.

S.M.S.G. materials. This refers to those methods and materials developed by the School Mathematics Study Group used by the teachers and children of the nineteen selected classes.

CHAPTER II

REVIEW OF THE LITERATURE

Much has been written about the recent emergence of modern mathematics in the curriculum of the nation's schools. Zant commented: "Many things are happening in the field of mathematics and mathematics education. From the standpoint of content, mathematics is one of the fastest growing and most radically changing of the sciences (14:594)."

Price, in a report to the National Council of Teachers of Mathematics, stated that: "The changes in mathematics in progress at the present time are so extensive, so far-reaching in their implications, and so profound that they can be described only as a revolution (10:1)."

Yet, as many writers are quick to point out, this revolution is not one of change in the basic concepts of mathematics, but an expansion of the application of these concepts. Mathematics has been described as the only branch of learning in which all of the major theories of 2000 years are still valid, yet never before has there been such a flood of new ideas.

Writers differ on the reasons for this upsurge of interest in mathematics. Some felt that these developments in mathematics have evolved through many years and have come to the public attention because of the publicity caused by the launching of Sputnik and man's race into space. Zant expressed this when he stated:

> By some curious coincident the field of mathematics, though it has expanded continuously over a period of 5,000 years, became a static, almost stagnant, subject in the classrooms of this country. Subject matter for college was crystallized into its present form approximately 60 years ago and has changed little since that time (14:595).

It was generally felt by most that the appearance and importance of modern mathematics today is the result of the need for change coming from a highly technological society. Hipwood commented:

> Mathematics has come emphatically to the foreground in the past two decades as a way of making a living. As 'Queen of the Sciences,' it has stepped out of the college classroom and planted a heavy footprint in industry, business, scientific research, and the home. Vast new employment areas are open in terms of research, statistics, and statistical analysis, computer programming, data processing, and a host of other newly created job opportunities (7:120).

This strong feeling of the importance of mathematics in everyday living has been felt by many, and well stated by Clark:

> The age in which we live is an age of computation, and mathematics, the basis of all science, must keep abreast of the times. If it is to have meaning, it must be developed in relationship to the real needs of the individual; it must provide a genuine foundation in the basic skills.
>
> The national interest in the improvement of instruction in mathematics is phenomenal. Although in all areas of education there is interest in modernizing curriculum, the current activity in mathematics appears to be more exciting, revolutionary, and widespread - and perhaps more needed - than in any other discipline (2:388).

Large sums of money have been made available for the pursuit of public school mathematics improvement projects. Congress, through the National Defense Education Act, has made available funds for consultant services and for materials. Various of the major foundations, the Fund for the Advancement of Education (Ford) and the Carnegie Foundation, have underwritten large-scale projects. The largest single infusion of monies has come from the National Science Foundation. The School Mathematics Study Group has received N.S.F. grants totaling several millions yearly.

Mathematics specialists in the universities and colleges became acutely aware of the problems of overhauling their own mathematics curriculum. They have also sensed the need to establish changes down through the high school into the elementary school.

Dawson commented that:

> Literally for the first time on a major scale, university and college mathematicians, other than a few engaged in preparing public school teachers, have shown a willingness to assist in developing curriculum proposals for the public schools (4:16).

Weaver, in a report on recent experimental projects and research, relates that:

> In bringing about an improvement in school mathematics, it might seem that it would be best to start at the beginning, kindergarten, and to work up. However, the procedure taken by the School Mathematics Study Group has been just the opposite of this . . .
>
> Having set the goals the School Mathematics Study Group worked backward. Projects were set up to design courses for grades nine through 12. Other projects were concerned with grades seven and eight.
>
> With the curriculum for grades seven through 12 well established, the Study Group set about planning an elementary program. Realizing the high school mathematics rests on the foundation built in the first six grades, they designed a program in these grades which would allow a substantial strengthening of the program for the higher grades (13:436).

The program developed by the School Mathematics Study Group was not the work of a few but the combined efforts of college and university mathematicians, high school teachers, educational experts with special interests in arithmetic, supervisors, elementary school teachers, psychologists, and representatives of scientific and government organizations having an interest in mathematics. In February, 1959, S.M.S.G. held a conference on elementary school mathematics. In the summer of 1960, an S.M.S.G. writing team, working at Stanford University, produced materials for grades four through six, intended for all pupils.

One of the avowed aims of the elementary school program was to teach children how to think. The ability to take a set of conditions and deduce logical conclusions was an essential skill in our modern society. Arithmetic instruction as an integral part of our total elementary program should make a contribution to the development of deductive reasoning.

The S.M.S.G. material was aimed toward discovering inductively new ideas through exercises that depend on the student's intuition. This is followed by material that again asks the student to be a participant rather than a receiver.

Beberman stated:

> . . . the discovery method develops interest in mathematics, and power in mathematical thinking.

> Because of the student's independence of rote rules and routines, it also develops a versatility in applying mathematics (1:38-39).

Kersh commented, "Guided discovery seems to offer a happy medium between independent discovery and highly directed learning (8:263)."

Though research thus far conducted is far from conclusive, researchers are finding some trends. Dawson noted that, "One insight has been that many pupils can learn more arithmetic sooner than has been the traditional practice (1:17)."

Wagner reported that:

> All information indicates that students using these texts do about as well in the development of mathematical skills, but do better in problem solving than students using conventional texts (12:457).

Not all in the field of mathematics or education are ready to join the avalanche toward modern mathematics. MacLane felt that the reform had been oversold when he asked:

> Why the need for change? Over the years, with no new content school mathematics gradually degenerated because of an exclusive concern for teaching methods. Arithmetic was viewed as a mass of number facts and not as a meaningful structure. Algebra was rote manipulation with no suspicion that there were reasons for the rules. Geometry, with little use of space perception, became a shrinking list of memorized theorems. Occasional voices calling for some modest

reform were ignored. Clear thinking is needed.

> The whole reform is too much centralized. Instead of one School Mathematics Study Group, we should have several smaller ones, lest the future be as rigid as the past. This error is one of Science Foundation policy; it should be corrected at once (9:45).

Spitzer, though he did not join MacLane entirely, did see the need to proceed into new programs with caution when he commented:

> The promoters of the new mathematics state that the elementary school mathematics curriculum must be changed because of the recent advances in the field. Such statements have led some teachers to search the materials for some startlingly new developments.
>
> The results of such searches have been rather disappointing, for while there are new terms such as "set," "union of sets," "operation array", "mathematical sentence," and the like, the terms do not convey to the teacher any great new power or insight. Furthermore, as viewed by these teachers many of these terms are just different names for procedures and materials that have been used for a long time.
>
> It is regrettable that some of the claims for the new mathematics in the elementary schools are unwarranted, for this movement has already made some real contributions to the improvement of instruction in this important curricular area. Among these contributions are (1) the addition of some excellent new content, (2) assistance in creating a climate favorable to change, and (3) the focusing of attention on some very weak features of current, older-type programs (11:44).

Fehr, near the other end of the spectrum, reported:

> Teachers who have used the newer materials are enthusiastic and say they will never return to the

> old. Students enjoy the work and show far more understanding. No one working in the field of either pure or applied mathematics, who carefully examines these materials and compares them with those of 1950 can possibly deny that mathematics has been improved. Though he may disagree with some aspects of the programs, he must admit that a great step forward has been taken. (5:46).

As research in the S.M.S.G. program moves ahead, indications are that certain goals are in sight. Clyde Corle stated:

> Four significant changes have affected elementary school mathematical programs during the past several years. First of all, mathematics for small children is viewed as a combination of several mathematical sciences, each contributing in simple ways to children's competency with numbers. Memorization of meaningless number facts has been replaced by reasoning.
>
> The second change which the new mathematics has brought about is a more careful use of qualitative vocabulary.
>
> The third change advocated by modern mathematics is that of increased emphasis upon understanding the computational operations. Computation has long been a process of following mechanical formulas, one of proceeding step by step in a search for some desirable result, called the answer. The steps are often completely detached from meaning, and the procedures depend almost totally upon memorizing responses.
>
> The fourth change which is supported by the "new mathematics" is that of giving the responsibility of learning back to the children (3:244-245).

CHAPTER III

PROCEDURES USED

At the outset of the adoption of the S.M.S.G. program in the Highline District, it was felt by the district Elementary Curriculum Director, and the elementary Mathematics Committee that accurate measurement procedures be used to evaluate the effectiveness of the program as it progressed.

For the purpose of this study the arithmetic battery of the Metropolitan Achievement Test given to these children in the spring of 1962, and the Lorge-Thorndike verbal and non-verbal D.I.A., administered in the fall of 1962, were used. On the basis of these tests the children selected for the experimental and control groups were matched as closely as possible according to sex, I.Q., and arithmetic achievement.

The sample population for this study consisted of ten boys and ten girls in the upper 25 per cent intelligence group and ten boys and ten girls in the lower 25 per cent intelligence group, selected at random from nineteen classrooms using S.M.S.G. materials. These children were matched with forty comparable boys and girls from classes using traditional arithmetic materials in the Highline School District.

In matching the subjects, a variation of no more than four I.Q. points and two raw score points in arithmetic achievement was allowed. (See Tables XXVI through XXIX in the Appendix).

The Lorge-Thorndike intelligence test was used to determine the upper and lower 25 per cent groups based on Highline School District norms.

A different form of the Metropolitan Achievement series was given to the children in February, 1964, when they were fifth graders. A comparative analysis was made of these test scores.

Statistical methods involved in the analysis included finding the standard deviation from the mean scores, (see Table XXX in the Appendix), and the application of a t-test to determine any significance in the difference between the mean scores. Statistical significance was determined at the one per cent level of confidence.

In May, 1963, and again in May, 1964, an Arithmetic Attitudinal test was given to all of the children. Scores for more than 70 per cent of the study sample were available to the writer. (See Tables XXXI and XXXII in the Appendix). A comparative analysis was made of this information using the same statistical procedures as for arithmetic achievements.

Using the data found in Tables XXVI through XXIX in the Appendix, a test for correlation was administered to determine the relationship between measured intelligence scores and measured arithmetic achievement.

CHAPTER IV

FINDINGS AND INTERPRETATION OF DATA

This chapter presented the findings from a comparative analysis of post-test scores of the subjects on the Metropolitan Achievement and Arithmetic Attitudinal tests.

<u>Arithmetic Computation - Upper 25 Per Cent</u>. The data contained in Table I presents a comparison of mean scores in arithmetic computation of experimental and control groups in the upper 25 per cent intelligence group.

TABLE I

MEAN COMPARISON FOR ARITHMETIC COMPUTATION: UPPER 25 PER CENT EXPERIMENTAL AND CONTROL GROUPS

Group	N	Obtained Means	σm	σDm	Obtained t	Required t
Experimental	20	22.90	5.56	1.90	1.42	2.72
Control	20	25.60	6.40			

As indicated in Table I, it may be seen that the control group excelled the experimental group in their mean score for computation, although the difference between the means was 2.70. This difference was not found to be statistically significant at the one per cent level of confidence.

<u>Arithmetic Problem Solving - Upper 25 Per Cent</u>. Table II presents the comparison of mean scores for problem solving of the experimental and control groups in the upper 25 per cent intelligence group.

TABLE II

MEAN COMPARISON FOR ARITHMETIC PROBLEM SOLVING: UPPER 25 PER CENT EXPERIMENTAL AND CONTROL GROUPS

Group	N	Obtained Means	σm	σDm	Obtained t	Required t
Experimental	20	28.20	6.20	1.93	.88	2.72
Control	20	29.90	6.04			

As shown in Table II, it is evident that the control group excelled the experimental group in problem solving ability. However, the difference between the mean scores for the two groups was smaller for problem solving than it was for computation. The difference between the mean scores for problem-solving, 1.70, was not found to be statistically significant.

<u>Arithmetic Computation - Lower 25 Per Cent</u>. A comparison of mean scores in arithmetic computation is presented in Table III on page 18 for the experimental and control groups in the lower 25 per cent intelligence group.

TABLE III

MEAN COMPARISON FOR ARITHMETIC COMPUTATION: LOWER 25 PER CENT EXPERIMENTAL AND CONTROL GROUPS

Group	N	Obtained Means	σm	σDm	Obtained t	Required t
Experimental	20	13.00	4.29	1.39	3.13	2.72*
Control	20	17.35	3.79			

*Statistically significant at the .01 level of confidence

Table III indicates that the control group excelled the experimental group in arithmetic computation. The difference between the mean scores was found to be 4.35, which was significant statistically at the one per cent level of confidence.

Arithmetic Problem-Solving - Lower 25 Per Cent. A comparison of mean scores for arithmetic problem-solving ability of the lower 25 per cent intelligence group is presented in Table IV.

TABLE IV

MEAN COMPARISON FOR ARITHMETIC PROBLEM-SOLVING LOWER 25 PER CENT EXPERIMENTAL AND CONTROL GROUPS

Group	N	Obtained Means	σm	σDm	Obtained t	Required t
Experimental	20	15.35	3.90	2.19	1.30	2.72
Control	20	18.20	5.34			

In Table IV, as shown above, it may be seen that the control group excelled the experimental group in problem solving ability. The difference between the mean scores of 2.85, was not found to be statistically significant.

Arithmetic Computation - Girls, Upper 25 Per Cent. Table V presents a comparison of mean scores in computation of all girls in the upper 25 per cent intelligence group.

TABLE V

MEAN COMPARISON FOR ARITHMETIC COMPUTATION: GIRLS IN THE UPPER 25 PER CENT EXPERIMENTAL AND CONTROL GROUPS

Group	N	Obtained Means	σm	σDm	Obtained t	Required t
Experimental	10	23.30	5.18	2.14	2.90	2.88*
Control	10	28.50	4.36			

*Statistically significant at the .01 level of confidence

In Table V it may be noted that girls in the control group excelled girls working in the experimental group in computation. The difference of 6.30 between the mean scores for computation was found to be statistically significant.

Arithmetic Problem-Solving - Girls, Upper 25 Per Cent. Table VI illustrates the comparison of mean scores in problem-solving ability of all girls in the upper 25 per cent intelligence group.

TABLE VI

MEAN COMPARISON FOR ARITHMETIC PROBLEM-SOLVING: GIRLS IN THE UPPER 25 PER CENT EXPERIMENTAL AND CONTROL GROUPS

Group	N	Obtained Means	σm	σDm	Obtained t	Required t
Experimental	10	24.90	6.24	2.69	2.68	2.88
Control	10	32.10	5.78			

As indicated in Table VI, girls in the control group excelled girls in the experimental group in problem-solving. The difference between the mean scores for control and experimental groups in problem-solving ability of 7.20 was not found to be significant statistically. This was true even though as the reader will note, in a comparison of Tables V and VI, that with girls in the upper 25 per cent group, the differences between the mean scores was greater for problem-solving ability than it was for computation.

<u>Arithmetic Computation, Boys - Upper 25 Per Cent.</u>

The data contained in Table VII illustrates a comparison of the mean scores in computation of all boys in the upper 25 per cent intelligence group.

TABLE VII

MEAN COMPARISON FOR ARITHMETIC COMPUTATION: BOYS IN THE UPPER 25 PER CENT EXPERIMENTAL AND CONTROL GROUPS

Group	N	Obtained Means	σm	σDm	Obtained t	Required t
Experimental	10	23.70	5.94	2.83	.35	2.88
Control	10	22.70	6.72			

Table VII indicates that boys in the experimental group excelled boys working in the control group in computation. Although the difference between the means was found to be 1.00, this difference was not found to be statistically significant.

Problem-Solving - Boys - Upper 25 Per Cent. Table VIII presents a mean comparison of problem-solving ability of boys in the upper 25 per cent intelligence group.

TABLE VIII

MEAN COMPARISON FOR ARITHMETIC PROBLEM-SOLVING: BOYS IN THE UPPER 25 PER CENT EXPERIMENTAL AND CONTROL GROUPS

Group	N	Obtained Means	σm	σDm	Obtained t	Required t
Experimental	10	31.40	4.01	2.10	1.76	2.88
Control	10	27.70	5.46			

As shown in Table VIII, boys in the experimental group excelled boys in the control group in problem-solving ability. The difference between the mean scores was 3.70, and was not found to be statistically significant.

Computation, Girls - Lower 25 Per Cent. The data presented in Table IX shows a comparison of mean scores in computation of all girls in the lower 25 per cent intelligence group.

TABLE IX

MEAN COMPARISON FOR ARITHMETIC COMPUTATION: GIRLS IN THE LOWER 25 PER CENT, EXPERIMENTAL AND CONTROL GROUPS

Group	N	Obtained Means	σm	σDm	Obtained t	Required t
Experimental	10	13.70	6.08	2.09	1.34	2.88
Control	10	16.50	2.97			

As indicated in Table IX, the girls in the control group excelled girls in the experimental group in computation. The difference between the mean scores was 2.80. No statistical significant difference was found.

Problem-Solving, Girls - Lower 25 Per Cent. A comparison of mean scores in problem-solving ability of girls in the lower 25 per cent intelligence group is presented in Table X.

TABLE X

MEAN COMPARISON FOR ARITHMETIC PROBLEM-SOLVING: GIRLS IN THE LOWER 25 PER CENT, EXPERIMENTAL AND CONTROL GROUPS

Group	N	Obtained Means	σm	σDm	Obtained t	Required t
Experimental	10	15.70	4.82			
				2.21	.90	2.88
Control	10	17.70	5.10			

It may be noted in Table X that the girls in the control group excelled girls in the experimental group in problem-solving ability. Even though the difference between the means was 2.00 in favor of the control group, it was not found to be statistically significant.

<u>Computation, Boys - Lower 25 Per Cent</u>. Table XI, located on page 23, presents a comparison of mean scores in computation of boys in the lower 25 per cent intelligence group.

TABLE XI

MEAN COMPARISON FOR ARITHMETIC COMPUTATION: BOYS IN THE LOWER 25 PER CENT EXPERIMENTAL AND CONTROL GROUPS

Group	N	Obtained Means	σm	σDm	Obtained t	Required t
Experimental	10	12.50	3.56			
				1.76	3.24	2.88*
Control	10	18.20	4.30			

*Statistically significant at the .01 level of confidence

Table XI, located on page 23, shows that boys in the control group excelled boys in the experimental group in computation. Table XI also reveals that the difference of the mean score of 5.70 was found to be statistically significant.

Problem-Solving, Boys - Lower 25 Per Cent. A comparison of mean scores for problem-solving ability of boys in the lower 25 per cent intelligence group is presented in Table XII.

TABLE XII

MEAN COMPARISON FOR ARITHMETIC PROBLEM-SOLVING: BOYS IN THE LOWER 25 PER CENT, EXPERIMENTAL AND CONTROL GROUPS

Group	N	Obtained Means	σm	σDm	Obtained t	Required t
Experimental	10	15.00	2.64	1.93	1.92	2.88
Control	10	18.70	5.51			

As shown in Table XII the control group surpassed the experimental group in problem-solving ability. The difference between the mean was 3.70, which was not found to be statistically significant.

Arithmetic Attitude, Upper 25 Per Cent, 1963. The data contained in Table XIII, located on page 25, presents a comparison of mean scores in arithmetic attitude in 1963 of boys and girls in the experimental and control groups for the upper 25 per cent intelligence group.

TABLE XIII

MEAN COMPARISON FOR ARITHMETIC ATTITUDE: UPPER 25 PER CENT EXPERIMENTAL AND CONTROL GROUP MAY, 1963

Group	N	Mean	σ m	σ Dm	Obtained t	Required t
Experimental	19	52.13	3.65			
				1.48	2.78	2.76*
Control	12	56.25	4.21			

*Statistically significant at the .01 level of confidence

As indicated in Table XIII the control group surpassed the experimental group in their mean score for arithmetic attitude. The difference between the means was found to be 4.12, which was significant statistically at the one per cent level of confidence.

Arithmetic Attitude, Upper 25 Per Cent - 1964. Table XIV presents a mean comparison of the 1964 arithmetic attitude of experimental and control groups in the upper 25 per cent intelligence bracket.

TABLE XIV

MEAN COMPARISON FOR ARITHMETIC ATTITUDE: UPPER 25 PER CENT EXPERIMENTAL AND CONTROL GROUPS, MAY, 1964

Group	N	Mean	σ m	σ Dm	Obtained t	Required t
Experimental	18	56.16	3.90			
				1.62	1.44	2.76
Control	12	53.83	4.63			

Table XIV shows that the experimental group excelled the control group in arithmetic attitude. While the difference between these means, 2.33, favors the experimental group the difference is not statistically significant.

Arithmetic Attitude, 1963 - Lower 25 Per Cent. A comparison of mean scores for arithmetic attitude of the lower 25 per cent intelligence group is presented in Table XV.

TABLE XV

MEAN COMPARISON FOR ARITHMETIC ATTITUDE: LOWER 25 PER CENT EXPERIMENTAL AND CONTROL GROUPS, MAY, 1963

1962-63 Group	N	Mean	σm	σDm	Obtained t	Required t
Experimental	14	66.65	3.33			
					6.50	2.76*
Control	16	59.50	2.61	1.10		

*Statistically significant at the .01 level of confidence

As indicated in Table XV it may be seen that the experimental group excelled the control group in their mean score for arithmetic attitude. The difference between the mean scores was found to be 7.15, which was statistically significant.

Arithmetic Attitude, 1964 - Lower 25 Per Cent.

The data presented in Table XVI shows a comparison of mean scores in arithmetic attitude of the experimental and control group in the lower 25 per cent intelligence bracket.

TABLE XVI

MEAN COMPARISON FOR ARITHMETIC ATTITUDE: LOWER 25 PER CENT EXPERIMENTAL AND CONTROL GROUP, MAY, 1964

Group	N	Mean	σm	σDm	Obtained t	Required t
Experimental	15	60.34	2.94		3.48	2.75*
Control	17	64.06	3.13	1.07		

*Statistically significant at the .01 level of confidence

As shown in Table XVI the control group surpassed the experimental group in arithmetic attitude. The difference of 3.72 between the mean scores was found to be statistically significant.

By a comparison of mean scores in Tables XIII and XIV the reader will note that the experimental group in the upper 25 per cent bracket increased in measured arithmetic attitude from 1963 to 1964. During this same period the control group decreased in measured arithmetic attitude. By also comparing the mean scores shown in Tables XV and XVI, of children in the lower 25 per cent intelligence group, the control group increased in measured arithmetic attitude from 1963 to 1964, while the experimental group decreased during this same period.

It may further be noted that all of the mean scores of the lower 25 per cent intelligence group exceeded the mean scores of the upper 25 per cent group for both years.

Arithmetic Attitude Experimental Group - Upper and Lower 25 Per Cent. Tables XVII presents a comparison of mean scores in arithmetic attitude of the experimental group in the upper and lower 25 per cent intelligence brackets.

TABLE XVII

MEAN COMPARISON FOR ARITHMETIC ATTITUDE: UPPER AND LOWER 25 PER CENT EXPERIMENTAL GROUPS, MAY,1963

Group	N	Mean	σm	σDm	Obtained t	Required t
Exp. Upper	19	52.13	3.65			
				1.22	11.90	2.75*
Exp. Lower	14	66.65	3.33			

*Statistically significant at the .01 level of confidence

Table XVII indicates that the experimental group in the lower 25 per cent intelligence bracket excelled, in their mean scores, the experimental group in the upper 25 per cent in arithmetic attitude for the test administered in 1963. The table also reveals that the difference of the mean scores of 14.52 is found to be statistically significant.

Arithmetic Attitude of the Experimental Group in the Upper and Lower 25 Per Cent in 1964. Table XVIII illustrates the comparison of the mean scores in arithmetic attitude of the experimental group in the upper and lower 25 per cent intelligence groups.

TABLE XVIII

MEAN COMPARISON FOR ARITHMETIC ATTITUDE: UPPER AND LOWER 25 PER CENT EXPERIMENTAL GROUPS, MAY, 1964

Group	N	Mean	σ m	σ Dm	Obtained t	Required t
Exp. Upper	18	56.16	3.90			
				1.19	3.51	2.75*
Exp. Lower	15	60-34	2.94			

*Statistically significant at the .01 level of confidence

As indicated in Table XVIII the experimental group in the lower 25 per cent group again excelled the experimental in the upper 25 per cent group. The difference between the mean scores was found to be 4.18, which was statistically significant. In a comparison of Tables XVII and XVIII it may be noted that the difference in the means for the 1963 test (14.52) is greater than the difference between the mean scores for 1964, (4.18)

Arithmetic Attitude of Control Group in the Upper and Lower 25 Per Cent, 1963. Table XIX presents a comparison of mean scores in the arithmetic attitude test of the control group in the upper and lower 25 per cent intelligence bracket administered in 1963.

TABLE XIX

MEAN COMPARISON FOR ARITHMETIC ATTITUDE: UPPER AND LOWER 25 PER CENT CONTROL GROUPS, MAY, 1963

Group	N	Mean	σm	σDm	Obtained t	Required t
Cont. Upper	12	56.25	4.21	1.37	2.37	2.78
Cont. Lower	16	59.50	2.61			

Table XIX indicates that the lower 25 per cent intelligence group excelled the control group in the upper 25 per cent. The difference between the means of 2.25, was not found to be statistically significant.

<u>Arithmetic Attitude of Control Group in the Upper and Lower 25 Per Cent, 1964</u>. Table XX illustrates a comparison of the mean scores in arithmetic attitude of the control group in the upper and lower 25 per cent intelligence group.

TABLE XX

MEAN COMPARISON FOR ARITHMETIC ATTITUDE: UPPER AND LOWER 25 PER CENT CONTROL GROUPS, MAY, 1964

Group	N	Mean	σm	σDm	Obtained t	Required t
Cont. Upper	12	53.83	4.63	1.53	6.69	2.77*
Cont. Lower	17	64.06	3.13			

*Statistically significant at the .01 level of confidence

As shown in Table XX the control group in the lower 25 per cent group excelled the control group in the upper 25 per cent. The difference between the mean scores was found to be 10.23, which was significant statistically.

Arithmetic Attitude for Upper 25 Per Cent Experimental Group in Years 1963 and 1964. Table XXI presents a comparison of the mean scores in arithmetic attitude of the upper 25 per cent experimental group for the years 1963 and 1964.

TABLE XXI

MEAN COMPARISON FOR ARITHMETIC ATTITUDE: UPPER 25 PER CENT, EXPERIMENTAL GROUP, MAY, 1963 AND MAY, 1964

Year	N	Obtained Means	σm	σDm	Obtained t	Required t
May 63	19	52.13	3.65			
				1.24	3.25	2.72*
May 64	18	56.16	3.90			

*Statistically significant at the .01 level of confidence

Table XXI illustrates that for the upper 25 per cent experimental group the mean score for the second year, 1964, exceeded the score for the first year, 1963. The difference of 4.03 between the mean scores was found to be statistically significant.

Arithmetic Attitude - Lower 25 Per Cent Experimental Group in Years 1962-1963 and 1963-1964. A comparison of the mean scores in arithmetic attitude of the lower 25 per cent experimental group for the 1963 and 1964 tests is presented in Table XXII.

TABLE XXII

MEAN COMPARISON FOR ARITHMETIC ATTITUDE: LOWER 25 PER CENT, EXPERIMENTAL GROUP, MAY 1963 AND MAY 1964

Year	N	Obtained Means	σ_m	σ_{Dm}	Obtained t	Required t
May 1963	14	66.65	3.33			
				1.20	5.26	2.77*
May 1964	15	60.34	2.94			

*Statistically significant at the .01 level of confidence

As indicated in Table XXII the lower 25 per cent experimental group scored higher in 1963 than they did in 1964 in arithmetic attitude. The difference of the mean scores for the two tests was 6.31, which was statistically significant.

It may be noted in a comparison of table XXI and XXII that during the period of time covered by the tests, the upper 25 per cent intelligence group increased their mean score in arithmetic attitude while the lower 25 per cent intelligence group scored lower the second year. It should also be noted, however, that the 1964 mean for the control group remained higher than the 1964 mean for the experimental group.

Arithmetic Attitude - Upper 25 Per Cent Control Group in May 1963 and 1964. Table XXIII presents a comparison of mean scores in arithmetic attitude of the upper 25 per cent control group for the two years 1963 and 1964.

TABLE XXIII

MEAN COMPARISON FOR ARITHMETIC ATTITUDE: UPPER 25 PER CENT, CONTROL GROUP, MAY, 1963 AND MAY, 1964

Year	N	Obtained Means	σm	σDm	Obtained t	Required t
May 1963	12	56.25	4.21			
				1.80	1.34	2.82
May 1964	12	53.83	4.63			

Table XXIII indicates that the mean score for the upper 25 per cent control group decreased in 1964 when the test was given for the second time. However, the difference between these means, of 2.42, was not found to be statistically significant at the 1 per cent level of confidence.

Arithmetic Attitude - Lower 25 Per Cent Control Group 1962-63 and 1963-64. The data presented in Table XXIV shows a comparison of mean scores in arithmetic attitude of the lower 25 per cent control group for the school years 1962-63 and 1963-64.

TABLE XXIV

MEAN COMPARISON FOR ARITHMETIC ATTITUDE: LOWER 25 PER CENT CONTROL GROUP, MAY 1963 AND MAY 1964

Year	N	Obtained Means	σm	σDm	Obtained t	Required t
May 1963	16	59.50	2.61			
				1.01	5.37	2.75*
May 1964	17	64.06	3.13			

*Statistically significant at the .01 level of confidence

As shown in Table XXIV the mean score for arithmetic attitude increased in 1963-64 over the mean score for the year previous. The difference of 4.56 between the mean score was found to be statistically significant.

In a comparison of the mean scores in Tables XXIII and XXIV the lower intelligence control group showed an increase in its arithmetic attitude mean score while the upper intelligence control group showed a decrease. This is a reversal of the trend indicated in a comparison of Tables XXI and XXII and discussed on pages 31 and 32.

Correlations of Arithmetic Achievement and Intelligence. Table XXV presents correlations of measured arithmetic achievement in computation and problem-solving and measured intelligence for the upper and lower 25 per cent groups.

TABLE XXV

CORRELATIONS OF ARITHMETIC ACHIEVEMENT AND INTELLIGENCE

Group	N		Obt.r.	Req.r.
Upper 25%	20	Exp. Computation	.12*	.561
Upper 25%	20	Control Computation	.36**	.561
Upper 25%	20	Exp. Problem-Solving	.11*	.561
Upper 25%	20	Control Problem-solving	.09*	.561
Lower 25%	20	Exp. Computation	.35**	.561
Lower 25%	20	Control Computation	.47**	.561
Lower 25%	20	Exp. Problem-Solving	.30**	.561
Lower 25%	20	Control Problem-Solving	-.01*	.561

As shown in Table XXV no statistically significant correlations of measured arithmetic achievement and measured intelligence were indicated. The single asterisk (*) denotes indifferent or negligible relationship. The double asterisk (**) denoted low correlation; present but slight.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

It was the intent of this study to ascertain the difference in arithmetic achievement and attitude between an experimental group using S.M.S.G. materials and a control group using traditional arithmetic materials.

In developing this study children from nineteen classrooms using S.M.S.G. materials were closely matched on the basis of sex, arithmetic achievement in computation and problem-solving ability, and intelligence; verbal and non-verbal, with comparable children using traditional arithmetic materials. The subjects for the study were selected only from the upper 25 per cent and lower 25 per cent intelligence brackets as established by Highline School District norms.

The findings of this study were based on the results of the arithmetic battery of the Metropolitan Achievement Test given approximately a year and a half after the introduction of the S.M.S.G. program. Results of the Arithmetic Attitudinal tests administered near the end of the first and second year of the program were also compared. An analysis was made of the difference between the mean scores for the various tests. The t-test was applied to determine statistical significance at the one per cent level of confidence.

Data obtained from the study appears to justify the following summarization dealing with arithmetic achievement and attitude toward arithmetic of fifth grade children in the Highline School District.

Arithmetic Achievement. A comparison of mean scores for arithmetic achievement revealed that: the only difference in mean scores showing statistical significance was in the area of computation and in favor of the control groups. The control groups showing significant achievement included: girls in the upper 25 per cent, boys in the lower 25 per cent, and the group of boys and girls in the lower 25 per cent intelligence bracket.

The only experimental group to exceed the control group in mean scores was the boys in the upper 25 per cent. They exceeded the control group in both computation and problem-solving though the difference was not found to be statistically significant.

Arithmetic Attitude. A comparison of mean scores in arithmetic attitude indicated that: Boys and girls in the upper 25 per cent experimental group increased in measured arithmetic attitude from 1963 to 1964 while the control group decreased in measured arithmetic attitude.

Boys and girls in the lower 25 per cent experimental group decreased in measured arithmetic attitude from 1963 to 1964 while the control group increased in measured arithmetic attitude.

The difference of the mean scores for the upper and lower 25 per cent experimental groups decreased from 1963 to 1964.

The difference of the mean scores for the upper and lower 25 per cent control groups increased from 1963 to 1964.

The lower 25 per cent experimental group showed a decrease in measured arithmetic attitude while the upper 25 per cent experimental group showed an increase from 1963 to 1964.

The lower 25 per cent control group showed an increase in measured arithmetic attitude while the upper 25 per cent control group showed a decrease from 1963 to 1964.

Both the lower 25 per cent intelligence experimental and control groups scored higher than the upper 25 per cent groups in the results of both attitudinal tests.

Correlation of Arithmetic Achievement and Intelligence. Correlations of measured arithmetic achievement and measured intelligence showed that: There was no statistically significant correlation between measured arithmetic achievement and intelligence. Furthermore, it was revealed that all of the correlations were low to negligible in interpretation.

II. CONCLUSIONS

This study was based on the hypothesis that: (1) no statistical significant difference would be found in arithmetic achievement between children using S.M.S.G. and children using traditional arithmetic materials, and (2) no statistical significant difference would be found in attitude toward arithmetic between children using S.M.S.G. and children using traditional arithmetic materials.

In view of the information gathered, the hypothesis as stated for arithmetic achievement was retained. Only three of the twelve t-tests employed were statistically significant. It was found that girls in the upper 25 per cent, boys in the lower 25 per cent, and girls and boys in the lower 25 per cent intelligence group achieved in computation to a statistically significant degree using traditional arithmetic materials. This may be due in part to the measuring device used, the Metropolitan Achievement Test, which was designed primarily to measure achievement using traditional arithmetic content and skills. Also to be considered is the reliance of the S.M.S.G. materials upon arithmetical terminology in which children in the lower 25 per cent intelligence bracket may be weak. This weakness would be indicated more readily in problem-solving than in computation.

The lack of statistically significant difference between scores attained by the experimental and control groups may be due also to the lag in the presentation, by the S.M.S.G. program, of basic arithmetic processes which are extensively assessed in the Metropolitan test. These basic concepts are introduced later in the S.M.S.G. program than they are in the traditional.

Based on the analysis of the data, that part of the hypothesis concerned with the attitude of children toward arithmetic was rejected. Investigation revealed that the S.M.S.G. program generated a more positive attitude toward arithmetic in the upper 25 per cent intelligence group. On the other hand the traditional program produced a more positive attitude in the lower 25 per cent intelligence groups. Though this conclusion is not born out statistically in all aspects of the study, those areas not showing statistical significance do show a trend which supports this interpretation.

This might lead to the conclusion that the inductive discovery approach incorporated in the S.M.S.G. program provides a more invigorating challenge to the children in the upper intelligence bracket, whereas, the security provided by rote memorization and drill so much a part of traditional arithmetic might appeal more readily to children in the lower intelligence brackets.

Furthermore, there appears to be a definite relationship between the attitude indicated and the correlations between arithmetic achievement and measured intelligence. The low correlation between achievement and intelligence may generate the feeling on the part of the low intelligence group that achievement in arithmetic is possible or within their grasp. This, in turn, may be highly conducive to the positive attitude indicated by the measured attitude score of the subjects in the lower intelligence group.

III. RECOMMENDATIONS

On the basis of the evidence presented as a result of this study, the following recommendations appear appropriate:

1. Further research should be conducted similar to

this study, over a longer period of time, and perhaps, involving a similar sample. Tests, more comprehensive and based on the desired goals of today's elementary arithmetic program, should be used as a measure of achievement in this future study.

2. For the lower intelligence group children, a greater degree of teacher demonstration and pupil participation is desirable. Tracking or grouping might be a means of providing a modified program involving modern math techniques and terminology.

3. The administration of the Highline School District should encourage the continued use and expansion of the S.M.S.G. program within the district.

4. The administration of the Highline School District should maintain an in-service training program to assure teacher proficiency in teaching basic arithmetic skills using modern mathematics techniques.

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APPENDIX

TABLE XXVI

ARITHMETIC ACHIEVEMENT AND INTELLIGENCE SCORES FOR GIRLS IN THE UPPER 25 PER CENT EXPERIMENTAL AND CONTROL GROUPS

	Metropolitan Achievement Test Arithmetic Battery				Lorge-Thorndike D.I.Q.		
	Pre-Test		Post-Test				
	Comp.	Prob. Solve	Comp.	Prob. Solve	Verbal	Non-verb.	Ave.
GUX 1	22	22	18	25	130	126	128
GUC 1	22	22	35	33	132	128	130
GUX 2	30	28	34	37	131	125	128
GUC 2	30	27	33	42	126	127	127
GUX 3	24	20	22	26	130	125	128
GUC 3	25	21	28	31	134	126	130
GUX 4	17	21	16	30	124	123	124
GUC 4	17	21	26	37	127	127	127
GUX 5	20	19	25	36	125	113	119
GUC 5	20	19	38	31	124	119	122
GUX 6	20	16	24	22	113	126	120
GUC 6	20	15	25	21	113	122	118
GUX 7	24	18	19	18	121	115	118
GUC 7	23	18	23	28	121	115	118
GUX 8	23	16	22	22	119	119	119
GUC 8	22	17	24	29	121	123	122
GUX 9	22	16	16	19	115	119	117
GUC 9	22	16	36	39	112	119	116
GUX 10	19	15	23	22	118	113	116
GUC 10	19	14	27	32	122	112	117

X Signifies experimental subjects
C Signifies control subjects

TABLE XXVII

ARITHMETIC ACHIEVEMENT AND INTELLIGENCE SCORES
FOR BOYS IN THE UPPER 25 PER CENT
EXPERIMENTAL AND CONTROL GROUPS

	Metropolitan Achievement Test Arithmetic Battery				Lorge-Thorndike D.I.Q.		
	Pre-Test		Post-Test				
	Comp.	Prob. Solve	Comp.	Prob. Solve	Verbal	Non-verb.	Ave.
BUX 1	15	20	21	30	111	119	115
BUC 1	15	22	15	28	111	119	115
BUX 2	21	17	26	33	111	120	116
BUC 2	21	15	23	20	110	119	115
BUX 3	33	30	25	34	118	125	122
BUC 3	33	32	27	31	115	123	119
BUX 4	24	13	25	32	115	118	117
BUC 4	23	14	29	28	111	119	115
BUX 5	19	20	32	36	121	115	118
BUC 5	18	19	22	25	123	115	119
BUX 6	17	15	19	25	121	110	116
BUC 6	18	16	11	22	119	112	116
BUX 7	22	24	24	31	122	117	120
BUC 7	21	24	29	29	124	118	121
BUX 8	25	27	35	37	133	117	125
BUC 8	25	26	31	40	131	118	125
BUX 9	22	21	18	32	118	127	123
BUC 9	22	21	14	23	121	129	125
BUX 10	19	19	22	24	125	129	127
BUC 10	19	19	28	30	128	126	127

X Signifies experimental subjects
C Signifies control subjects

TABLE XXVIII

ARITHMETIC ACHIEVEMENT AND INTELLIGENCE SCORES FOR GIRLS IN THE LOWER 25 PER CENT EXPERIMENTAL AND CONTROL GROUPS

	Metropolitan Achievement Test Arithmetic Battery				Lorge-Thorndike D.I.Q.		
	Pre-Test		Post-Test				
	Comp.	Prob. Solve	Comp.	Prob. Solve	Verbal	Non-verb.	Ave.
GLX 1	12	5	14	18	95	95	95
GLC 1	12	6	14	13	97	90	94
GLX 2	9	8	9	13	93	92	93
GLC 2	11	8	23	27	95	93	94
GLX 3	14	8	16	19	95	90	93
GLC 3	14	6	16	15	95	89	92
GLX 4	12	3	21	23	86	95	91
GLC 4	11	3	13	18	87	100	94
GLX 5	10	5	10	12	88	94	91
GLC 5	9	4	19	8	88	97	93
GLX 6	21	16	22	24	90	88	89
GLC 6	21	14	18	19	93	91	92
GLX 7	12	6	18	10	85	95	90
GLC 7	12	6	18	19	87	89	88
GLX 8	17	9	12	13	87	82	85
GLC 8	17	8	16	15	88	82	85
GLX 9	12	7	1	10	87	75	81
GLC 9	12	6	15	23	85	79	82
GLX 10	11	8	13	15	74	85	80
GLC 10	11	9	13	23	79	79	79

X Signifies experimental subjects
C Signifies control subjects

TABLE XXIX

ARITHMETIC ACHIEVEMENT AND INTELLIGENCE SCORES FOR BOYS IN THE LOWER 25 PER CENT EXPERIMENTAL AND CONTROL GROUPS

	Metropolitan Achievement Test Arithmetic Battery				Lorge-Thorndike D.I.Q.		
	Pre-Test		Post-Test				
	Comp.	Prob. Solve.	Comp.	Prob. Solve	Verbal	Non-Verb.	Ave.
BLX 1	10	7	17	16	89	100	95
BLC 1	9	7	24	31	87	101	94
BLX 2	20	15	15	18	97	89	93
BLC 2	20	15	22	18	97	92	95
BLX 3	16	13	16	17	88	95	92
BLC 3	16	14	17	18	86	91	89
BLX 4	13	4	7	11	90	90	90
BLC 4	13	4	20	13	90	96	93
BLX 5	15	7	13	12	87	91	89
BLC 5	14	7	16	25	89	90	90
BLX 6	13	4	8	16	85	94	90
BLC 6	13	5	23	16	81	94	88
BLX 7	12	7	8	12	90	82	86
BLC 7	11	7	10	14	88	82	85
BLX 8	11	7	13	13	83	86	85
BLC 8	11	6	15	20	86	86	86
BLX 9	13	7	13	19	86	88	87
BLC 9	13	7	14	11	81	86	83
BLX 10	13	12	15	16	82	82	82
BLC 10	13	12	21	21	81	88	85

X Signifies experimental subjects
C Signifies control subjects

TABLE XXX

ARITHMETIC ACHIEVEMENT PRE-TEST
AND POST-TEST SCORES WITH
STANDARD DEVIATION
FOR POST-TEST

UPPER 25% GIRLS Group	Area	MEAN SCORES Pre-Test	Post-Test	σ m
Experimental	Computation	22.10	22.30	5.18
Control	Computation	22.00	28.50	4.36
Experimental	Problem-solving	19.10	24.90	6.24
Control	Problem-solving	19.00	32.10	5.78
UPPER 25% BOYS				
Experimental	Computation	21.70	23.70	5.94
Control	Computation	21.50	22.70	6.72
Experimental	Problem-solving	20.50	31.40	4.01
Control	Problem-solving	20.90	27.70	5.46
LOWER 25% GIRLS				
Experimental	Computation	13.00	13.70	6.08
Control	Computation	13.00	16.50	2.97
Experimental	Problem-solving	7.50	15.70	4.82
Control	Problem-solving	7.00	17.70	5.10
LOWER 25% BOYS				
Experimental	Computation	8.60	12.50	3.56
Control	Computation	8.40	18.20	4.30
Experimental	Problem-solving	8.30	15.00	2.64
Control	Problem-solving	8.40	18.70	5.51

TABLE XXXI

RAW SCORES FOR ARITHMETIC ATTITUDINAL TEST ADMINISTERED TO GIRLS AND BOYS IN THE UPPER 25 PER CENT EXPERIMENTAL AND CONTROL GROUPS IN MAY 1963 AND 1964

Experimental			Control		
	May '63	May '64		May '63	May '64
GUX 1	55	60	GUC 1	63	--
GUX 2	40	31	GUC 2	--	--
GUX 3	66	66	GUC 3	--	--
GUX 4	--	60	GUC 4	39	60
GUX 5	63	60	GUC 5	60	60
GUX 6	57	64	GUC 6	60	60
GUX 7	46	66	GUC 7	--	--
GUX 8	60	24	GUC 8	71	63
GUX 9	33	71	GUC 9	37	63
GUX 10	53	63	GUC 10	--	--
BUX 1	24	49	BUC 1	61	48
BUX 2	71	63	BUC 2	--	--
BUX 3	63	75	BUC 3	--	--
BUX 4	63	--	BUC 4	41	53
BUX 5	22	--	BUC 5	61	39
BUX 6	48	37	BUC 6	71	35
BUX 7	35	46	BUC 7	--	63
BUX 8	66	71	BUC 8	71	53
BUX 9	60	33	BUC 9	40	50
BUX 10	63	71	BUC 10	--	--
Mean	52.13	56.16		56.25	53.83
S. D.	3.65	3.90		4.21	4.63
N	19	18		12	12

TABLE XXXII

RAW SCORES FOR ARITHMETIC ATTITUDINAL TEST ADMINISTERED TO GIRLS AND BOYS IN THE LOWER 25 PER CENT EXPERIMENTAL AND CONTROL GROUPS IN MAY 1963 AND 1964

Experimental			Control		
	May '63	May '64		May '63	May '64
GLX 1	82	69	GLC 1	51	78
GLX 2	82	78	GLC 2	70	--
GLX 3	51	61	GLC 3	62	67
GLX 4	62	69	GLC 4	--	56
GLX 5	--	31	GLC 5	68	70
GLX 6	--	--	GLC 6	--	--
GLX 7	72	68	GLC 7	63	56
GLX 8	86	--	GLC 8	--	81
GLX 9	57	71	GLC 9	55	75
GLX 10	55	46	GLC 10	76	77
BLX 1	73	70	BLC 1	52	70
BLX 2	65	50	BLC 2	53	24
BLX 3	--	--	BLC 3	46	38
BLX 4	44	54	BLC 4	67	--
BLX 5	--	--	BLC 5	81	80
BLX 6	--	28	BLC 6	64	67
BLX 7	35	65	BLC 7	63	73
BLX 8	--	--	BLC 8	25	52
BLX 9	64	70	BLC 9	--	56
BLX 10	93	72	BLC 10	53	61
Mean	66.65	60.34		59.50	64.06
S.D.	3.33	2.94		2.61	3.13
N.	14	15		16	17