DOCUMENT RESUME

ED 289 704 SE 048 789

AUTHOR Ben-Chaim, David; And Others
TITLE The Aronberg Project: An Intervention Program To Enhance Teacher and Student Performance in Mathematics in Socially Deprived Junior High Schools. Final Report.
INSTITUTION Weizmann Inst. of Science, Rehovot (Israel).
PUB DATE Jul 87
NOTE 247p.; This project was funded by the Lester Aronberg Foundation, United States. Tables with small print may not reproduce well.
PUB TYPE Reports - Evaluative/Feasibility (142) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC10 Plus Postage.
DESCRIPTORS Classrcom Environment; Inservice Teacher Education; *Mathematics Achievement; Mathematics Education; Mathematics Instruction; *Mathematics Teachers; *Remedial Mathematics; Secondary Education; *Secondary School Mathematics; Staff Development; Teacher Attitudes; *Teacher Effectiveness; *Teaching Skills
IDENTIFIERS Mathematics Education Research

ABSTRACT

The Aronberg Project is an attempt to improve the mathematical competence of socially deprived students of small development towns. The main focus of the project is the enhancement of mathematics teacher competency and didactic skills. The purposes of this report are to: (1) describe the various activities of the Aronberg Project; (2) document the instruments used and the data gathered; and (3) report the impact, conclusions, and recommendations of the project. Data accumulated indicate an overall positive change in teacher performance in the classroom, but teacher performance was judged to still need improvement. With respect to student achievement, the results indicate an overall improvement in most of the classes tested. Nevertheless, the achievement at the end of the school year was still unsatisfactory. Recommendations for replication include a minimum commitment of 3 years, principal involvement, teacher commitment and continuous evaluation of teachers and students. (PK)

THE ARONBERG PROJECT

An Intervention Program to Enhance Teacher and Student Performance in Mathematics in Socially Deprived Junior High Schools

David Ben-Chaim, Miriam Carmeli, Maxim Bruckheimer

The Science Teaching Department, The Weizmann Institute of Science, Rehovot, Israel.

Final Report
July 1987

This Project was Funded by
the Lester Aronberg Foundation, U.S A

THE ARONBERG PROJECT

An Intervention Program to Enhance Teacher and Student Performance in Mathematics in Socially Deprived Junior High Schools

David Ben-Chaim, Miriam Carmeli, Maxim Bruckheimer

The Science Teaching Department, The Weizmann Institute of Science, Rehovot, Israel.

Final Report
July 1987

This Project was Funded by
the Lester Aronberg Foundation, U.S.A.

The Project Staff

Director: Dr. David Ben-Chaim

Counsellors: Rachel Bouhadana, Haim Massuri, Ruth Kaplan

Evaluators: Miriam Carmeli, Jeanne Albert

Advisors: Prof. Theodore Eisenberg, Barbara Fresko

Steering Committee: Prof. Maxim Bruckheimer - Head of the Mathematics Group, Dr. David Ben-Chaim, Dr. Alex Friedlander, Rina Hershkowitz, and Dr. Nurit Zehavi.

ACKNOWLEDGEMENTS

We would like to express our gratitude and appreciation to all those who assisted us at the various stages of our work. First of all, we would like to thank the members of the Mathematics Group of the Science Teaching Department at the Weizmann Institute of Science for their ready assistance whenever needed with the planning, operation and evaluation of the project.

Our thanks to the school principals at the four schools in the project, who gave their full support and cooperation to all project activities and, also, to the mathematics teachers and children for their participation and cooperation.

We wish to thank Yetty Varon for statistical advice and help with the data analyses.

Finally, we would like to extend our thanks to the Aronberg Foundation, who by making this project possible, made a positive contribution to mathematics education in Israel.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

I. INTRODUCTION

Mathematics is a key subject in a student's school education, because a certain minimal competency is a prerequisite for so many other studies and professions. It is also one of the more difficult subjects. The junior high school years (grades 7-9) tend to be decisive, because mathematical horizons begin to expand at a quicker rate. Those students who continue to high school are often free to choose between subjects, and in the absence of success in mathematics, they run away from many scientific subjects and those leading to semi-scientific professions for which there are many occupational opportunities.

This problem is particularly widespread in a large section of the Israeli population, which is defined on the basis of socio-economic criteria as socially deprived. Typically, the socially deprived students are marked by under-achievement in junior high school mathematics and hence are not well-represented in the professions which require a high level of proficiency in mathematics and scientific subjects. The problem of low achievement of the socially deprived student does not, of course, start in junior high school. Studies carried out in the past, show clear evidence that the mathematical level of students entering grade 7 drops as the percentage of socially deprived students in the school population increases. The junior high schools, however, have a number of advantages for taking remedial action. Students can be encouraged by a new environment and their greater maturity to make a new start. More importantly, it is assumed that at this level their teachers possess a greater degree of professionalism and subject matter knowledge which should

lead to a higher level of instruction. Unfortunately, this assumption exists in theory only in most socially deprived schools. In reality these schools tend to be characterized by a high proportion of untrained mathematics teachers. These teachers are usually themselves from this population and ill-equipped to deal even with ordinary classes, let alone the socially deprived. There are many small development towns in Israel, where there is not even one teacher who has been trained as a mathematics teacher. For example, at the start of a recent mathematics in-service course which was offered to junior high school teachers, who attended voluntarily and hence could be considered "devoted", the participants could answer only 30% of a questionnaire, which included only elementary questions from the textbooks they were supposed to be teaching. At the end of this 10-day course, the success had risen to 70%, which although a great improvement, is nowhere near sufficient (Fresko & Ben-Chaim, 1984).

Since the teachers are a vital element in solving the achievement problems of the socially deprived students, it is necessary to explore ways by which their competencies can be strengthened. The goal of the Aronberg Project was to do just that, and through the enrichment of teachers' mathematical knowledge and improvement of their didactical skills, the achievement of their pupils was expected to be enhanced.

Purpose and Structure of Report

The purpose of this report is to describe the various activities of the Aronberg Project, to document the instruments used and the data gathered, and to report the impact of the project, the conclusions and the recommendations. This will enable comparison of the Aronberg Project with similar projects run either by the mathematics group at the Weizmann

Institute or elsewhere.

The report is organized into six chapters as follows.

Chapter I defines the problem and gives the purposes of the project and the report.

Chapter II the next chapter, describes the background, the rationale and the operational design of the project.

Chapter III describes the methodological approach, instruments employed, procedures taken and data collection.

Chapter IV presents the project activities and discusses the implementation difficulties.

Chapter V consists of the analysis of the collected data, results and interpretation.

Chapter VI is devoted to a summary, conclusions, implications and recommendations for future projects.

A number of appendices appear which include translations from Hebrew to English of all measures used in the project, and tables reporting achievement and affective test results.

II. THE PROPOSED PROJECT

1. Background to the Project

The Aronberg Project was funded by the Aronberg Foundation based on a proposal submitted by the mathematics group in the Science Teaching Department at the Weizmann Institute of Science. We take the opportunity of thanking the trustees of the Foundation for their initiative and support.

The Science Teaching Department was founded almost 20 years ago, with the purpose of maintaining a long-term curriculum project in mathematics and the sciences within a high level academic environment in these same domains. The work of the mathematics group within the department is devoted to the junior high school mathematics curriculum - the Rehovot Program. This work is based on an underlying philosophy which considers curriculum development and implementation as a continuous long-term interactive activity involving textbook writing, development of materials for non-frontal teaching, implementation, teacher training, research and dissemination of information. In particular, a systematic effort at implementing the materials created in the classroom through a large number of in-service training activities and classroom visits is a main departmental activity. Evaluation and research focussing on learning processes, abilities and disabilities, student and teacher needs, effectiveness of in-service activities and teaching strategies are continuously being used in the process of the evolution and improvement of the activities.

The people involved in the work of the mathematics group today come from differing backgrounds with a great variety of experience in teaching, research and development: mathematics educators work together with creative and experienced teachers, with evaluators and with graduate students. The mathematics educators have the major coordinating, planning and leadership functions. Most of the teachers are heads of mathematics departments in their respective schools, who through the work in the mathematics group, are having an influence beyond the confines of their school system. They usually continue teaching, and work in the group on a part-time basis.

The junior high schools (grades 7-9) in Israel are comprehensive and compulsory. In mathematics classes, students are streamed at the beginning of grade 7 within each school, with some degree of mobility between the two to three streams maintained throughout the three years. Each stream works at a different level of difficulty, with appropriate textbooks and other materials.

Because of the particular composition of Israeli society and because the schools are comprehensive, the mathematics group has to deal with a very heterogeneous population of students and teachers. (The Rehovot Program is being taught in the majority of the Israeli junior high schools.) The student population includes a variety of groups with different social backgrounds; about one third of the population has been defined by the Ministry of Education as "socially deprived", according to socio-cultural criteria. e.g. the number of children in the family and the country of origin. With regard to the teachers in the junior high schools, some are university graduates, possibly with a mathematics major. But they do not

always easily adapt to changes in the curriculum or in teaching methods. In addition, there is another large group of teachers which is more problematic. These teachers were elementary teachers in the past and were trained accordingly in teacher's colleges, often as general teachers. Some of them have not been appropriately trained in mathematics and in surveys we have found that many know less than half of the material they are supposed to teach. Their understanding of mathematics tends to be superficial, and they are often unable to see the curriculum topics in a wider perspective. This group of teachers is typically found in many development towns where most of the population is defined as socially deprived.

The accumulated experience of the mathematics group from previous projects reveals a serious lack of achievement in mathematics in the socially deprived student population (for example, see Hershkowitz, 1979a) as well as a shortage of competent mathematics teachers (Hershkowitz & Israeli, 1981). Some of the special difficulties of the socially deprived students have been identified and some remedial materials to overcome these difficulties have been designed. An experiment on a limited sample has shown that a careful use of remedial materials and proper support for the teachers, can enhance student achievement in mathematics.

A large scale project, similar to the Aronberg Project, was started in the academic year beginning September 1985. The mathematics group was invited by the Department of Education of Tel-Aviv Municipality, to begin a project of achievement enhancement in mathematics in two large socially deprived junior high schools in Tel-Aviv. This project which is now completing its second school year involves about 55 mathematics classes and

25 teachers. The curriculum materials, the students and their teachers, and the interactions between them in the real environment of the school, are all given attention in this project, which will run for at least another year.

The initiation of the Aronberg Project, described below, should be viewed as an outcome of the various activities and projects conducted by the mathematics group, and especially of the Tel-Aviv project.

2. The Rationale

The Aronberg Project is aimed at the socially deprived student population of small development towns. Based on the accumulative experience of the mathematics group and reports in the professional literature, it was decided to cope with the problem by a comprehensive approach, which also takes into account most of the components involved in the instruction of mathematics. Any long term intervention program which focuses on the teacher should provide both individual and group teacher guidance mainly within the schools, should assist with adaptation of the curriculum, and should evaluate affective and cognitive student behavior for feedback and follow-up purposes.

The main focus of the intervention program had to be the mathematics teacher, under the assumption that lasting change can only be accomplished in this way. If we remember the number of children a teacher is responsible for each year, and the number of years of the teacher's working life, we considered efforts to enhance teacher competency and didactical skills to be a tremendous investment, which could potentially enhance the achievement of thousands of children.

Accepting the opinion, so aptly expressed by Lee Shulman (1979), that "changes in curriculum and instruction must be mediated through the minds, motives and activities of teacher", the major aim of this intervention was to alter teacher behavior in the classrooms. Planned change involves the learning of new concepts and ideas, new attitudes and values, and new patterns of behavior and skills. According to one model of teacher change (Schein, 1972), there are three stages:

(1) Unfreezing - creatio of awareness and motivation to change.

(2) Changing - development of new beliefs, attitudes, values and behavior patterns on the basis of new information and cognitive redefinitions.

(3) Refreezing - integration of new beliefs, attitudes, values, and behavior patterns both in the personalities of participants and in the culture of the system.

A similar model is introduced by Friedlander, Bruckheimer & Albert (1987).

The teachers in the Aronberg program were expected to pass through these phases in becoming better teachers. First, their consciousness would be raised as to the need for change and as to the various alternatives available. Next, through their motivation to change and under the sympathetic guidance of the counsellor they would become more willing to try new ways. Finally, they would actually try out new strategies and gradually learn to put them to use effectively in the classroom.

Consequently the process of change requires a long period of time and considerable effort. In agreement with this statement, several studies and in particular the Rand study (Mclaughlin & March, 1979) suggest a number of assumptions to guide the design and implementation of staff development activities.

1. In the process of implementation of an innovation, teachers and administrators need to "reinvent the wheel" each time. This helps teachers and administrators understand and adjust the innovation to their needs.
2. Professional learning is a long-term, non-linear process. Innovation could take several years to be completely implemented.
3. The process of adoption of an innovation helps define the program-improvement goals for teachers, administrators and project staff. It is important that professional learning be related to on-going classroom activities.
4. Professional learning is critically influenced by organizational factors in the school site and in the district.

In addition, Richard Skemp (1985,1986) pointed out that in-service education of teachers has tended to fail as a long-term remedy, essentially because the focus has been on individual teachers in artificial contexts, who find it difficult to apply what they learn in schools where the old ways are dominant. It has been suggested that in-service programs must deal with teachers in their own environment in order to be really effective.

Thus the intervention program of the Aronberg Project was intended to operate mainly within the school sites, involving <u>all</u> the mathematics teachers, with the continuous assistance of counsellors, who observe lessons, discuss instructional topics and offer advice along the way. Studies on the impact of training (Burnett-Strother, 1983) have shown that, unless "counselling" is incorporated, little transfer of knowledge takes place. Good and Brophy (1974) demonstrated the power of intensive observation and feedback in assisting teachers to alter their attending

behavior. Counselling has been conceived in the professional literature (e.g. Showers, 1983) as a combination of elements, including support and encouragement for teachers as they attempted new strategies in their classrooms, provision of technical feedback on the fidelity of their trials to the models being attempted, and assistance in finding appropriate uses for the new teaching strategies.

Finally, it should be emphasized that there is no "magic formula" for an effective inservice program. Following a meta-analysis of 91 studies on in-service teacher education, Wade (1985) concludes that "many factors are involved in determining the effectiveness of any given in-service activity, context issues - such as understanding the school climate; principal support; adequate resources, including time and an understanding of the needs - should not be underestimated. Nor should process issues such as governance and teacher investment be overlooked".

3. The Operational Design of the Project

In the original proposal submitted to the Lester Aronberg Foundation on September 1985 it was suggested that:

* The target population of the project would be the students and the teachers in junior-high schools in three development towns.
* The project staff would advise the teachers in the planning of class instruction and student evaluation, and would work with them in their classrooms.
* The project staff would work with the teachers in special workshops designed to enhance mathematical knowledge and didactical strategies.
* Promising teachers from the target schools would be identified and specially trained in order to gradually take over a leading role in their

schools with support from the project staff.

* The project activities and impact on the teachers and the students would be assessed by evaluation instruments according to a structured design.
* A steering committee composed of senior members of the mathematics group would be responsible for the overall planning and on-going direction of the project.

Following the preparatory stage of the project, the specific operational design was planned. The operational model developed for the intervention program is depicted in Figure 1.

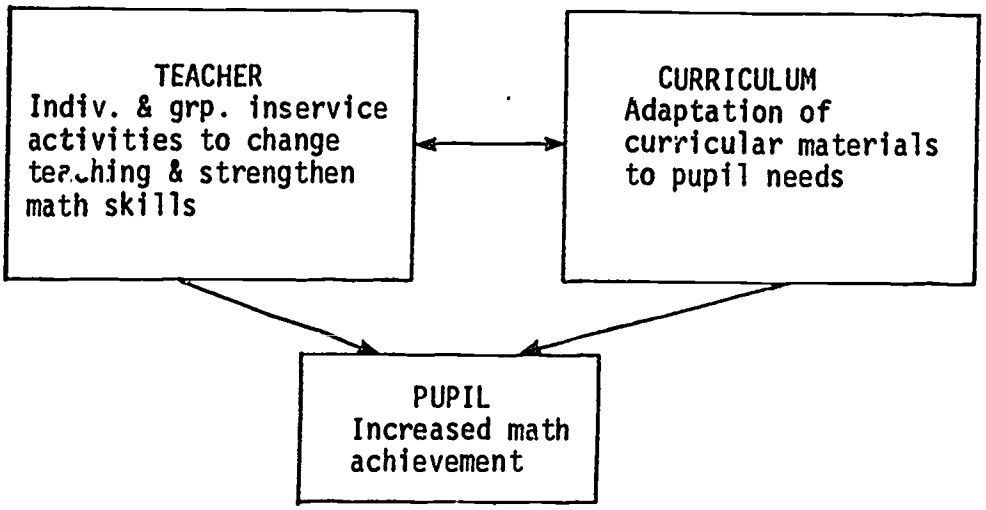


Figure 1: The Operational Model of the Intervention Program

It was planned that most of the activities of the project that were aimed at the teachers and at curriculum adaptation were to be coordinated within each of the school sites by a counsellor who was also a member of the project staff. The workshop course for enhancing both mathematical and didactical competencies, was to be led by project staff and additional members of the mathematics group and held in the Weizmann Institute for all the teachers in the project.

The in-school activities were to include: (1) regular in-class observation by the counsellor followed by constructive discussion with the teacher; (2) demonstration lessons given either by the counsellor or one of the teachers, followed by group discussion; (3) advice to the teachers regarding topics to be taught, pacing of instruction and appropriate textbooks to be used; (4) provision of tools for dealing with lack of student prerequisite knowledge.

III. METHODOLOGY

Following the approval of the proposal for the Aronberg Project, the Steering Committee, composed of senior members of the mathematics group, started meeting weekly in order to get the project underway. A project director and project staff were appointed, and the following principle decisions were taken:

* To approach development towns and schools which have a majority of socially deprived students, where the Rehovot mathematics program is taught, and which are within a reasonable radius of the Weizmann Institute.
* To provide the mathematics teachers in the schools with comprehensive in-school guidance.
* To conduct a course of workshops for the teachers at the Weizmann Institute.
* To follow-up the project's effect on teachers and students through on-going evaluation.

1. Participating Schools

Nine schools which fit the criteria set by the Steering Committee were identified as possible participants. Contact was made first with local authorities, then with the school principals and finally with the mathematics teachers. Four schools, which expressed the greatest interest in the project were chosen. The administation authorities and the mathematics teachers in these schools were willing to adapt themselves to the project demands. The schools in the project were comprehensive junior high schools, located in the development towns which will be denoted by HR,

MKR, MKG, and AY.

Information was collected concerning school size, organizational structure, streaming of students, teachers' educational and professional experience, as well as available equipment, such as computers and audio-visual aids.

Table 1 presents information on the schools in the project: number of mathematics teachers, partition into ability levels, and size of the student population.

In Table 1, as well as throughout this report, the highest ability level will be referred to as "A", the middle level as "B" and the lowest as "C". It should be pointed out that each school determines its own criteria for partitioning the students into levels, which depend on the overall level and the number of students in each grade in the particular school. Hence, Level A students, for example, in one school may not be equivalent to Level A students in another school.

Table 1: Distribution of Schools, Teachers and Ability Groups by Grade

School	No. of Teachers	No. of ability groups by grade									No. of Students
		7th Grade			8th Grade			9th Grade			
		A	B	C	A	B	C	A	B	C	
HR	5	-	2	3	1	2	2	1	1	2	224
MKR	4	1	1	1	1	1	1	1	1	1	172
MKG	6	1	1	2	1	1	2	1	1	2	291
AY	5	1	2	1	1	2	2	1	2	2	273
Total	20	3	6	7	4	6	7	4	5	7	960

With regard to the 20 teachers who were teaching mathematics in these schools, most of them lacked the appropriate formal credentials for teaching mathematics at the junior high school levels.

Based on our impressions of the teachers' competencies and on talks with school principals, it was concluded that identification of suitable candidates to be specially trained, was not possible at this time. Hence, it was decided to postpone, for the time being, the plan to invite promising teachers to be specially trained to gradually take over a leading role in their schools.

The information gathered about available equipment revealed that in school HR there were 19 Apple 2E microcomputers and access to the minicomputer Toam-system; in school MKR there were 12 Atari microcomputers; in school MKG there were 8 Apple 2E microcomputers (all of

them out of order!) and 25 IBM PC were acquired during the school year; and in school AY there was only access to minicomputer Toam-system. However, mathematics software relevant to the junior high school curriculum exists only for the Commodore, Apple and IBM PC micro-computers.

With respect to audio-visual aids it was found that every school was equipped with 1-2 overhead projectors and a television set.

2. In-School Guidance

The main component of the intervention program was the in-school guidance which was coordinated by a counsellor assigned to each of the participating schools. There were three counsellors, one of them responsible for school HR, one for AY and one for both schools MKR and MKG. All three counsellors were excellent veteran teachers, two of them had been working part-time with the mathematics group for several years, involved in most of the activities of the curiculum center. The counsellors had on-going teaching experience and were serving as the heads of the mathematics departments in their respective schools.

Taking into account the budgetary constraints, counsellors were assigned to work within the school sites one day a week (in addition to the work related to the project within the Weizmann Institute).

The role of the counsellor within the school was to provide group and individual guidance for the teachers, in addition to assistance with managerial aspects. The counsellor had to initiate meetings of the mathematics team in order to discuss and advise on the curriculum, its implementation and adaptation to the specific level of students. In these meetings, the counsellor was supposed to raise teacher awareness of the

lack of student prerequisite knowledge and to recommend systematic treatment for remediation. Curriculum planning, pace of instruction, books and teaching aids, selected topics to be taught and methods to evaluate student achievement, were also themes to be elaborated in the group meetings.

Another type of group activity to be organized and coordinated by the counsellor was the "open lesson" - i.e., lessons taught by one of the teachers or the counsellor and observed and discussed by the rest of the mathematics teaching staff.

The role of the counsellor with respect to the individual guidance was to provide the mathematics teacher with assistance and feedback based mainly on classroom observation. During the observation and the subsequent discussion with the observed teacher, the counsellor had to provide suggestions regarding the various aspects of instruction such as planning of lessons, teaching style, cognitive level of questioning, time on task, homework given and difficulties encountered in the classroom.

Another role of the counsellor was to organize and to help with the administration of the evaluation measures, and to report to the project center on all the activities of the Aronberg Project within the school.

It should be pointed out that the counsellors did not have, and were not supposed to be, involved in any administrative supervising authority. This fact was emphasized at the outset of the project to all teachers and school principals involved. Indeed, it was suggested to the counsellors to create a supportive and encouraging atmosphere in every contact with the teachers.

3. The Workshop Course

The workshop course was planned to consist of 18 meetings to be held at the Weizmann Institute. It was offered to all the mathematics teachers in the participating schools. The course was aimed at enhancing both the mathematical and the didactical competencies of the teachers. The specific content and activities of the workshops were planned and prepared by the project team together with other Weizmann staff members. Two main parts to each workshop were planned: one part dealing with mathematical topics (2 hours) and the other with didactical aspects of the curriculum (3 hours).

The mathematical subjects, that had been chosen, were mainly concerned with strengthening the understanding of the structure of number systems and the ideas of groups (finite, infinite and symmetry groups), coordinate geometry (2 and 3 dimensions), linear algebra (methods for solving systems of linear equations) and the quadratic function. Most of the planned material, explanations and exercises were prepared with emphasis on their relationship to both the topics being taught at the junior high level and practical applications.

The didactical sessions were planned to be devoted to creative activities (2 of the 3 hours) and to an open discussion of teaching issues (1 hour). The structured creative activities were: dealing with classroom worksheets and games, introducing and experiencing computer software integrated with the Rehovot Mathematics Program, developing and preparing tools for evaluation of achievement in the classroom, and planning long-term classroom activities.

The various activities included in the Aronberg Project were to be evaluated systematically, for two purposes:

(1) to assess the impact of the project on the participating teachers and on their students.

(2) to supply the project staff and the participating schools with continuous feedback.

The evaluation instruments included achievement tests, a classroom environment scale, classroom observation forms and various questionnaires administered to teachers.

In general the instruments were administered at least twice in order to determine the progressive effect of the project activities. The evaluation plan of the project is displayed in Tables 2 and 3. Table 2 presents the evaluation design and time - table for assessment of teacher competencies and reactions to the project. Table 3 gives the evaluation design and time-table for testing of students.

Table 2 : The Evaluation Design and Time-Table for Assessment of Teachers' Competencies and Reactions to the Project

September 1986	October 1986	December 1986	January 1987	May - June 1987
Needs Assessment Questionnaire	Knowledge Measure (Pre)	Class Environment Scale	Interviews (sample)	Knowledge Measure (Post) Class Environment Scale Contribution Assessment Questionnaire Interviews (sample)
<——— Classroom Observation and Evaluation Forms ———>				

Table 3 : The Evaluation Design and Time-Table for Assessment of Students

School year 1986/7	End of school year 1985/6	September 1986	December 1986	January 1987	May-June 1987	June 1987
Level A & B						
7		Prerequisite Tests: Natural Numbers Common Fractions Decimals	Class Environment Scale	Common Fractions (after Treatment)	Decimals (after Treatment) Class Environment Scale	Grade 7 test
8	Grade 7 test	Prerequisite Test: Elementary Geometry	Class Environment Scale	Elementary Geometry (after Treatment)	Class Environment Scale	Grade 8 test
9	Grade 8 test		Class Environment Scale		Class Environment Scale	Grade 9 test
Level C						
7		Prerequisite Tests: Natural Numbers Common Fractions Decimals				Grade 7 test
8		Grade 7 test				Grade 8 test
9		Grade 8 test				Grade 9 test

4. A Description of the Evaluation Instruments

Several of the instruments which were to be used, already existed and had been used previously in other projects. The remainder were specially developed for the Aronberg Project. A description of each instrument and its purpose is presented below. First, measures given to the teachers are described, followed by those administered to the students.

(i) Observation forms. Two types of forms were used: a Classroom Observation Form and a Classroom Evaluation Form. These forms were developed on the basis of experience gained from one year of intensive classroom observation as part of another project (Tel-Aviv Project).

The Classroom Observation Form was constructed to record the events that occur during the observed lesson, without any direct evaluation. The topics recorded on this form related to what is considered important in a good lesson and were thus meant to "steer" the teacher in the desired direction. For example, the form related to the nature of classwork, teaching aids used, cognitive level of questions asked, level of student involvement and the mathematical content taught. An additional section required the observer to comment on the overall lesson and to make recommendations for planning subsequent lessons. The complete Classroom Observation Form is included in Appendix 1-A. The form has three copies -- the original was given to the teacher during the discussion following the lesson, one copy remained in the counsellor's file and the other was kept by the project evaluation staff.

One of the main purposes of the Classroom Observation Form was to focus the teacher-counsellor discussion after each lesson on specific

points. Furthermore, by giving one copy of the observation form to the teacher, it was hoped that the teacher's motivation to change would increase.

The Classroom Evaluation Form required the counsellor to rate the teacher's performance (e.g., lesson preparation, use of teaching aids, correct mathematics, class discipline, clarity of explanations, etc.) on a scale from 1 to 5. In addition, the observer had to provide a general score (1-5) of the lesson observed. The form also required the counsellor to take decisions on specific objectives and subsequent action. The complete Classroom Evaluation Form is included in Appendix 1-B.

The Classroom Evaluation Form was completed by the counsellor after the lesson and was not seen by the teacher. This form has two copies -- one for the counsellor's file, and one for the project evaluation staff. There were three purposes in filling out the evaluation forms throughout the school year: one was to compile a continuous record for detecting change in teacher behavior; the second was to increase counsellor awareness of individual teacher needs; and the third was to provide the evaluation staff with feedback on the counsellor's work.

(ii) Needs and Contribution Assessment Questionnaires. The Needs Assessment and the Contribution Assessment questionnaires, in somewhat different versions, were used successfully in the past to evaluate both in-service summer courses and in-school guidance programs (Ben-Chaim et al., 1983; Fresko & Ben-Chaim, 1984, 1986a).

The Needs Assessment questionnaire was given to the teachers as a

pretest measure in an effort to get some idea of which topics and activities they felt important and hoped the project would concentrate upon. The intention was to plan project activities around these areas. The questionnaire was composed of three parts: 1) needs concerning the managerial and pedagogical aspects of teaching in the Rehovot Program (17 items), 2) needs concerning specific mathematical topics in the curriculum (22 items) and 3) preferences concerning the operational modes for inservice activities (6 items).

The teachers were requested to indicate on a scale of 1 - "not important" to 5 - "very important" the extent to which they attributed personal importance to the inclusion of each activity in the intervention program. The Needs Assessment Questionnaire is presented in Appendix 2A.

In the Contribution Assessment Questionnaire, which served as a posttest measure, the teachers were asked to rate the project's contribution to their individual needs in relation to each section in the Needs Assessment Questionnaire. A 5-point response scale was provided for this task as well, which ranged from 1 - "contributed nothing" to 5 - "contributed very much". The Contribution Assessment Questionnaire is presented in Appendix 2B.

(iii) Teacher Knowledge Measure. This pre-post measure was developed by the project staff in order to assess the effect of the mathematical section of the workshops on the teachers' mathematical competency. This subject matter test was constructed around major ideas in the junior high-school curriculum. Each topic on the test was concerned with a specific theme in the curriculum. The items were created to reflect

mathematical thinking in each of these different topics. A complete listing of the 14 items appears in Appendix 3. The first ten items tested some type of "transfer of learning" (either "close" or "lateral"), and the rest related to the specific mathematics content of the workshop (such as linear and abstract algebra).

(iv) Interviews. It was planned at the outset of the project to conduct a mid-year and an end of year interview of a sample of the participating teachers in the project. The purpose of the interview was to get teachers' impressions of the various activities of the project and how they were affected by them. The interview was pre-structured in so far as questions were prepared in advance. Questions related to the main activities of the project, such as the in-school guidance and the workshops (see Appendix 4).

The mid-year interviews were indeed carried out, however, at the end of the school year a "summing up" session was held with each group of teachers from the different schools instead of individual interviews.

(v) Curriculum-Based Achievement Tests for students. In order to measure the impact of the project on student performance, it was planned to administer achievement tests before the start of the project and at the end of the school year.

A single set of achievement tests was developed for both Level A and Level B students, who essentially study the same material but at different levels of difficulty, and another set was developed for Level C. The grade 7 and grade 8 tests for Levels A-B were adapted from previously used instruments. The Level A-B achievement test for grade 9

and the tests for Level C (grades 7, 8, 9) were created for the Aronberg Project. Each test was administered to additional classes of students in other schools outside the project, in order to validate the tests and also to provide a baseline for comparison. In each test several items served as anchor items. In the Level A-B tests, several items were included to examine knowledge of common fractions and decimals.

In general, all tests were composed of sub-tests related to specific topics in the curriculum. Appendix 5 contains the Curriculum-Based Achievement Tests for ability groups A and B grades 7, 8, 9(Appendix 5A, 5B, 5C) and the tests for Level C, grade 7, 8 and 9 (Appendix 5D, 5E, 5F).

(vi) Prerequisite Knowledge Tests. The prerequisite knowledge tests covered the topics of natural numbers, fractions, decimals, and elementary geometry.

These tests are a part of a comprehensive remedial program created by the Mathematics Group at the Weizmann Institute to deal with the lack of prerequisite arithmetic and basic geometry skills among a large part of the junior high school population. They were designed to treat prerequisite knowledge without greatly disturbing progress through the regular junior high school curriculum (see Hershkowitz, 1979b; Dreyfus et al., 1987). The tests were mainly diagnostic and they enabled the teachers (together with the counsellors) to decide on the appropriate level of treatment. Instructional units covering each of the above topics exist and were used as necessary.

Prerequisite tests were administered to grade 7 and 8 students at the

beginning of the school year. In grade 7, the Natural Numbers Test, the Common Fractions Test and the Decimal Test were administered. Remedial treatment was given for the latter two topics. In grade 8 the Elementary Geometry Test was administered and this topic was treated. After treatment, tests were administered again as posttests. Appendix 6 contains the four prerequisite knowledge tests: Natural Numbers Test - Appendix 6A; Common Fractions Test - Appendix 6B; Decimal Test - Appendix 6C; and Elementary Geometry Test - Appendix 6D.

(vii) Class Environment Scale. The Class Environment Scale used in the project was a modified version of an existing instrument. This measure was developed to examine the following nine properties: competitiveness, goal-direction, formality, speed, difficulty, satisfaction, inquiry orientation, teaching style and diversity of instructional materials. The first six areas were adapted from the Learning Environment Inventory (Anderson, 1973; Chavez, 1984), while the last three sub-scales were created specifically because of their relevance to the particular classroom orientation in many modern mathematics programs. The questionnaire, which includes 35 items, appears in Appendix 7. Level A and B students as well as their teachers were given this questionnaire. This measure was not appropriate for use with Level C students, since it requires a level of verbal ability which they could not be assumed to possess.

One purpose of using this measure in the Aronberg Project was to provide greater insight into the learning environment of the participating mathematics classrooms. Another purpose was to determine the impact of the intervention program by using the Class Environment

Scale as an additional evaluation tool.

It should be pointed out that numerous studies have shown that learning environment variables account for a significant portion of the variance in pupil achievement in various school subjects including mathematics (Anderson, 1973; Hofstein & Ben-Zvi, 1980; O'Reilly, 1975).

(viii) Attitude Questionnaires. Although not planned at the outset of the project, two attitude questionnaires which measure attitudes towards mathematics (one for Levels A-B and one for Level C, in grades 7 through 9)were developed. The questionnaire for Levels A and B consisted of 25 items which check three areas: importance of mathematics, sense of satisfaction, and anxiety. The items are given in Appendix 8A. The second attitude questionnaire for Level C, consisted of 16 items which check six areas: satisfaction, difficulty, anxiety, teaching strategies, speed and diversity. The items are given in Appendix 8B.

The data from the Level A-B questionnaire was intended to complement the class environment data and/or in relation to student achievement. The purpose of administering the second questionnaire to Level C was similar to that of using the Class Environment Scale for Levels A and B.

5. Data Collection Procedures

The following is a description of the procedures used to collect data from the teachers, on the teachers and from the students.

The data gathered from the teachers were:

* Needs and contribution assessment - each teacher completed the Needs Assessment questionnaire at the start of the school year, and the Contribution Assessment Questionnaire at the end of the school year.
* Mathematical Knowledge - each teacher that participated in the workshop course took the Teacher Knowledge Measure twice, in the first and last meetings of the course.
* Teacher perception of class learning environment - for each class taught, the teacher filled out the Class Environment Scale twice, in January and June 1987, while their students filled out the same questionnaire.
* Teacher impressions on the project - a sample of teachers provided intermediate impressions through interviews which were conducted in the schools by one of the project evaluation staff during February 1987. In addition teacher feedback was collected during the "summing-up" session in each school, at the end of the school-year.

Two other sorts of data were gathered on the teachers:

* Educational background - school authorities, at the request of the project center, provided information on educational background and teaching experience of the mathematics teachers.
* Teaching competency - each counsellor filled out Classroom Observation and Evaluation Forms to describe and evaluate the various aspects of teacher performance throughout the school year.

The data gathered from the students were:

* Curriculum achievement - all Level A and B students, grades 7 through 9 in the participating schools, took the appropriate Curriculum-Based Achievement Test twice, at the end of the school year 85/86 and 86/87. Level C students, grades 8 and 9 took the appropriate Curriculum-Based

Achievement Test at the start of the school year 86/87, and all Level C students, grades 7 through 9 were tested at the end of the school year 86/87. In addition, achievement data was gathered from several non-participating schools in the project.

All the tests were administered during the regular school day by the classroom math teachers with the assistance of the counsellor or other project staff. The time needed for the administration of each instrument did not exceed the regular math hour.

* Prerequisite knowledge - all grade 7 students took Prerequisite Knowledge Tests at the beginning of the school year 86/87. If a systematic treatment of a topic was given either to grade 7 or 8 students, then it was followed by posttesting of the students.

* Student perception of class learning environment - all Level A and B students, grades 7 through 9 filled out the Class Environment Scale twice, in December and June 1987.

These questionnaires were anonymous and the time needed for their administration was about 15 minutes.

* Student attitudes towards mathematics: all Level A and B students, and Level C students filled out the appropriate Attitude Questionnaire in January 1987. The time needed for administration of these questionnaires was also about 15 minutes.

IV. IMPLEMENTATION

1. Frequency and Types of Project Activities

The following is a short description of the project activities that took place throughout the 1986-87 school year after the participating schools were selected in May 1986.

(i) In-school activities. In each school the activities included:

* About fifty class observations by the counsellor followed by individual conferences with the observed teachers.
* Three to four demonstration lessons given either by the counsellor or by one of the teachers, followed by group discussions.
* Three to four mathematics team meetings coordinated either by the counsellor or the project director. These meetings were devoted to overall planning, discussion of mathematical and didactical issues, pretest results and feedback from the teachers on the project activities.
* Several demonstration lessons led by project staff, to introduce and discuss with the teachers the usage of microcomputer software within the junior high school mathematics curriculum.
* Frequent counsellor-teacher meetings to assist the teacher in planning a unit of instruction ,in evaluating students and/or in adapting material to the class.

(ii) The workshop course. As planned, 18 five-hour workshops were held at the Weizmann Institute on the following dates: Oct. 28; Nov. 11, 18; Dec. 2, 9, 23; Jan. 6, 20, 27; Feb. 10, 17, 24; March 10, 17, 24; May 12, 19, 26.

The topics included in the mathematical section of the course (2 hours each session) were:

* Number systems - natural, rational and real numbers: integers, binary operations and order in these systems (3 sessions).
* Algebraic structure - introduction to groups and fields as a generalization of number systems, with non-numerical examples, e.g. symmetry group (3 sessions).
* Graphical representation of sets and numbers - coordinate geometry of two and three dimensions (4 sessions).
* Linear algebra - linear equations and inequalities, applications to geometry and linear programming. Methods for solving systems of linear equations, e.g. Gauss elimination method and echelon form (4 sessions).
* Problem solving - investigating solutions of open questions (1 session).
* Deductive systems - the quadratic function as an example of a deductive system (3 sessions).

Whenever appropriate and available, the explanations were accompanied by visual aids, including concrete models, microcomputer simulations, video-tapes and transparencies. In addition, for each topic, there were in-class and take-home exercises to help the teachers to see the interconnectedness of the concepts and their linkage to the curriculum.

The sessions of the didactical section were devoted to creative activities and to an open discussion of teaching issues. The structured creative activities dealt with:

Worksheets and games - introducing, designing and preparing classroom worksheets and games, for selected curricular topics for each of the ability levels (6 sessions of two hours each).

* Assignment projects - activities with open-ended mathematical problems of

broad scope which relate to several topics in the curriculum and apply a variety of mathematical techniques and knowledge (3 sessions of two hours each).

* Calculators - hands-on experience with scientific calculators, their use within the curriculum for discovering conventions of priority in arithmetic computations, and as a tool for scientific notation for small and large numbers (1 session of three hours).
* Microcomputer software - presentation of and experience with software developed by the Rehovot math group to be used as an integral part of the learning process. The software was accompanied by a teacher manual and a student booklet with a detailed explanation of suggested activities with and without the computer (3 sessions of three hours).
* Elementary statistics - introduction to basic statistical notions included in the 7th grade curriculum and discussion of the importance of elementary statistics in every-day life.
* Planning long-term classroom instruction - for each class taught by the teacher, individual guidance was given, in order to plan in detail the instruction for the next 2-3 months (2 sessions of three hours).
* Evaluation of student achievement - methods of preparation and evaluation of achievement tests in the classroom were discussed. Following the correction of actual student test papers by the teachers, which resulted in large discrepancies between the scores, discussion took place on how to mark a test.

Discussion sessions (usually 1 hour each) dealt with the following issues:

* What constitutes a good lesson?
* Characteristics of the ideal mathematics teacher.

* What characterizes a lesson after which one has a feeling of accomplishment and satisfaction?
* Typical difficulties of students in mathematics and how to cope with them.
* Identifying and treating typical mathematical mistakes made by students.
* How to make mathematics more attractive for students (changing attitudes and atmosphere).
* The role of questions in the classroom, with regard to teacher behavior.

(iii) Activities of the project staff. In addition to the in-school guidance responsibilities and to conducting the workshop course, the project staff was engaged in:

* Weekly meetings - these meetings were devoted to planning the actual implementation of the project activities, and discussing difficulties encountered in the field. The counsellors also provided informal information and impressions about operation in the field to the project director and the evaluators.
* Study days - three study days, each of 4 hours, were held in the Weizmann Institute for the staffs of the Aronberg and Tel-Aviv projects. In each meeting two issues, selected from the professional literature, were presented. The issues were:

(1) how to organize a class lesson for investigations, including topics which are appropriately taught through investigations; (2) "wait-time" - the influence of waiting 5-10 seconds after asking a question before requesting a response, as opposed to the usual 2-second wait; (3) coaching - another way of analyzing the relationship between counsellor and teacher; (4) "the art of questioning" - advantages and disadvantages of different styles of questioning; (5) mastery learning - a concept

developed by Benjamin Bloom (Chicago) for encouraging maximum learning by all pupils; and (6) guided observation of video-taped lessons that showed ways of implementing group work in mathematics lessons.

After the theoretical presentations, there were discussions on how the counsellor could apply the ideas in the counselling sessions in order to encourage the teachers to acquire and use these techniques in the classroom.

* Evaluation - throughout the operation of the project, on-going documentation and analysis of the data gathered were conducted.
* Report - whenever it was appropriate and/or available, feedback and results were given to the school authorities and the teachers. The Steering Committee was continuously informed of the progress of the project. In addition, a preliminary report and three progress reports were submitted to the Aronberg Foundation.

2. Implementation Difficulties

The problems associated with implementing the Aronberg program fall into two categories: 1) those which deal with attitudinal problems arising from the heterogenous nature of the teachers' background, outlook and motivation; and 2) those which deal with technical and objective difficulties arising from the scheduling practices in the schools, equipment problems and often "external" complicating elements. The problems discussed here summarize some of the impressions we have gathered through various informal observations of the teachers and discussions with them. The quantitative data, which appear in the next chapter, will be used to document specific trends and teaching problems which we present here in a general form.

(i) Teacher attitudinal problems. A general attitudinal problem seemed to exist with the teachers from the outset of the program, and it was one we never completely solved during the relatively short period of the project intervention. For example, from the very beginning we had to convince the teachers that everyone of them, individually, could benefit from the type of guidance program we were offering. We did this in several ways. First, by trying to show them that the students in their schools were far below national norms in subject matter. The teachers readily accepted this fact. But the implication that these student deficiencies were, at least in part, due to their collective inefficient teaching was a conclusion we wanted them to arrive at implicitly. Necessarily, we never explicitly raised this issue nor pointed an accusing finger; the idea was not to humiliate, embarrass or denigrate. Discussions soon revealed that this conclusion was in abstract terms, rejected outright. They thought that student failure occured not as a result of ineffective teaching, but rather from factors related solely to the students themselves. Collectively, they as teachers, saw no responsibility here. Hence from the outset, we had trouble persuading some of the teachers of the worth of our activities, and how they could benefit from them. As many of the veteran teachers related at various times throughout the year "our program was fine, but for beginning poorly prepared teachers; we are well-prepared experienced teachers".

Indeed, many of them were experienced teachers, but only in the sense that they had taught for many years. In fact, only 4 of the 20 were trained in mathematics, 9 had degrees in other subjects, 3 were trained only as primary (K-6) teachers and 4 had no formal training at all. Nevertheless, at the end of the year most of them admitted to having

benefitted from the program, at least in some way.

We also tried to convince the teachers of their own lack of preparedness for handling mathematics teaching in junior high school. For example, the teacher background test given at the start of the year can be roughly described, as documenting that the majority of the teachers themselves approach mathematics in a mechanical way. To them, not just to their students, mathematics is a large cookbook, which one learns to open for a recipe. Mathematical thinking even at the simplest level was foreign to most of them. It was clear from the Teacher Knowledge Test, as well as from their classroom performance, that the aesthetics of mathematical thought is something they heretofore had not experienced. The workshop course, in part, had this as one of its goals. But again the attitudinal problem entered. Many of the teachers participated in the workshops under duress; their principals forced them. They did not do the required homework, and their attendance was spotty. In short, they could not understand why they needed to know mathematics at a level which seemed to them "infinitely" higher than what they were teaching. Some teachers seemed to hold the attitude that if they could do 7th grade mathematics, then they could also teach it. In fact, even this was not true. We found that not all the teachers could do the problems they were teaching in grade 7. Techniques were not the problem; mathematical thinking, as required in many of the non-standard problems in the junior high school texts and supplements, threw them. The workshops were supposed to remedy this, at least in part, but the teachers started to complain about the level, content and intent of the mathematical component of the workshops, almost from the start, resulting in changes of the workshops accordingly. Nevertheless, their overall

attitude toward learning mathematics themselves was never really surmounted during the 18 workshops (90 hours) offered. Again, it must be emphasized that, of necessity, our goal was not to embarrass them into acting like "model students" and subsequently "model teachers". This would have defeated the object of the program irretrievably. The idea was to work with them, and great care was taken not to alienate them. As indicated from the first proposal for the Aronberg Project, we assumed that it would take more than a year to make a significant impact, and our experience with this sort of teacher behavior was one of the reasons. Teacher attitudes change gradually, as little by little they see some of the results of such a project and the enhanced achievement of their students.

Another major tension in the program was having the observer in the classroom. Many of the teachers felt this was an intrusion and that they were under surveillance. Although we tried hard to change this feeling it seemed to persist. No matter how experienced one seems to be, this ill-at-ease feeling occurs when being observed. Indeed, at the beginning some teachers refused to let the counsellor observe their lessons by finding all sorts of excuses. The observation forms were also a contributing factor in this feeling of uneasiness.

Toward the end of the school year, this fear of being observed abated, although it never disappeared. Regarding the observations, the counsellors also felt sometimes uneasy in their role. For example, in some cases the teachers were making mathematical mistakes in the classroom, but the counsellor was reluctant to jump in and save the lesson, for fear of embarrassing the teacher in front of the students.

In such cases, the students had to wait until the next lesson for the damage to be repaired. Again in our experience, this teacher-counsellor tension diminished with time and success.

The attitudinal problem seemed to surface in still another domain of activities: the demonstration lessons. From the needs assessment data it was found that the teachers wanted the counsellors to teach demonstration lessons and full lessons to their classes. It was felt, however, that by so doing, the counsellor would lower the status of the teacher in the eyes of the students. In fact, in some of the cases, when the counsellors did take over the teaching, they felt that this denigration really occured. Nevertheless, most of the teachers were not enthusiastic about volunteering to give demonstration lessons, presumably because of fear of "making fools of themselves". Inevitably, the purpose of such lessons, especially in the situation in which we were working, is to find fault rather than give praise.

The teachers varied greatly in their internal motivation to improve. Those with positive attitudes took our work seriously, others just seemed to tolerate us. Although they were collectively positive toward our end-goals, their participation in the project was not uniformly enthusiastic.

(ii) Technical and objective difficulties. Certain technical difficulties arose which should have been avoided from the outset if school management and the teachers would have cooperated the way they promised before the project started.

Before agreeing to accept a school into the Aronberg Project all principals and the teachers were interviewed. The purposes of the project were explained and verbal agreements were obtained from them that they would participate and meet certain minimal requirements. For example, it was required that all mathematics teachers in the school participate in the program, that they attend workshops, meet with the observer after each lesson, and keep to a certain pace in their teaching of the curriculum. The principals and the teachers of the participating schools agreed to these conditions, but in reality this did not happen. For example, the teachers were to have a free period after teaching the "observed" class. This time was to be used for consultation with the counsellor, reflecting on what was taught and for planning the next lessons. This "free time" did not always materialize;generally teachers had to run to the next class. Thus the discussion of their lessons was relegated to short periods between classes. Another major scheduling problem took place in school HR. The required "free day" for teachers to attend the workshop course was not met; hence the teachers from this school received only several in-school activities as a substitute for the workshop course.

A more profound, although objective problem occured in school MKG. Due to teacher shortage, the students in this school were not taught math for approximately 30% of the school year. The principal could not

find the 2-3 teachers he required, qualified or not. Teachers who were hired left after a few weeks. There were always excuses, but the end result remained: the students simply were not taught.

Although the problems discussed above are administrative in character, it should be noted that the school principals really did try to solve them, however the system just worked against them. For example, in Israel a full-time teaching load is 24 contact hours per week. A teacher is not required to (nor paid for) non-teaching and extra-curricular hours in the school. Hence, they tend to have concentrated programs and condensed schedules, which often resulted in their not having the necessary free time after lessons. Usually, the school authorities compromise with the teachers because they have no choice: the mathematics teacher shortage is particularly acute in development towns. Furthermore, due to small school size, the teachers in the participating schools faced very heterogeneous classes even though the students were grouped into three ability levels. Frequently, the top ability level includes Level A and B students and the second B and C students. Obviously, such classes need very competent teachers and this was far from the case in most of these schools.

Another manpower problem was observed regarding equipment. As indicated, the schools had overhead projectors, microcomputers etc., but often they were locked away in a room and not used. For example, the schools did not have the manpower to run a microcomputer room so that the teachers could use it. Moreover, most of the teachers had no knowledge of how to utilize the equipment in a classroom setting.

An additional administrative problem, which was typical of the schools in the project (and, in general, of schools in Israeli development towns), was related to having the required textbooks on time. Frequently there was a delay in the texts reaching the classroom. This forced the teachers to fall even further behind with specific assignments.

Obviously, the implementation difficulties related to teachers attitudinal problems, to technical and managerial difficulties and especially, to objective conditions, hindered an efficient running of the project.

It should once again be emphasized that when preparing this project, we may not have envisaged the total extent of the above problems, but we did expect most of them to a greater or lesser degree from past experience with similar activities. After all, these problems are peculiar to this population only in their severity, not in their essence. However, we expected that if we gradually gained the teachers confidence, so that the counsellors so to speak "merged" with the school system, we could make more substantial progress in subsequent years. As we shall report in the next chapter, student achievement is at a catastrophic low - and it is <u>certainly not</u> because these students are potentially ineducable. The design of this project has the flexibility, in our view and experience, to make a positive impact, but it needs time and resources.

V. DATA ANALYSIS AND RESULTS

This chapter presents a summary of the data collected during the intervention of the project, the analysis of data, and results based on this analysis. It consists of six sections:

1. Teacher entry behavior - including their educational background, needs assessment data and their performance on the Teacher Knowledge Measure at the outset of the workshop course.
2. Teacher performance in the classroom - qualitative and quantitative analysis of the data obtained from the Classroom Observation and Evaluation Forms.
3. The learning climate in the classroom - analysis and comparison of teachers' and students' perceptions of the mathematics classroom environment, complemented by student attitudes toward mathematics.
4. The effect of the mathematical part of the workshop course on teacher's knowledge - comparison of posttest with pretest results on the Teacher Knowledge Measure.
5. Teacher feedback and impressions of the Aronberg Project intervention - including analysis of the mid-year interviews, the "summing-up" sessions, and the contribution assessment data.
6. The effect on students achievement - pre and post performance on the Curriculum-Based Achievement Tests and comparison of student performance on prerequisite knowledge.

1. Teacher Entry Behavior

(i) Educational background. As indicated before, school authorities provided information on the educational background and teaching experience of the mathematics teachers. Regarding formal education, the distribution of the 20 mathematics teachers in the participating schools was as follows.

Only 4 teachers had the officially required academic degree in mathematics and the certificate to teach mathematics in junior high schools; 9 other teachers possessed an academic degree in fields other than mathematics; 3 other teachers had completed a conventional elementary teacher training program at a teacher training college; and the remaining 4 teachers had two years of technical post-secondary education without pedagogical training.

With respect to the number of years experience in the mathematics teaching profession, two distinct groups were identified. In the first group were 10 teachers who could be classified as beginners, 4 of them in their first year of teaching and the rest with 2-3 years experience. The other 10 teachers in the second group could be classified as experienced (i.e. more than 5 years experience).

(ii) Needs assessment data. The Needs Assessment Questionnaire (see Appendix 2-A) was completed by 18 teachers. The results of this survey are presented for the whole group of teachers in the project and not by school, since the number of teachers per school was small and the results were similar for the different schools.

Table 4 presents the mean results on the importance (scale 1-5) attributed to teaching strategies and activities. It can be seen that,

even though the teachers felt that everything was important, there was some variance. For example, they attributed less importance to learning about the use of transparencies, mathematical games, pocket calculators and microcomputers than they did to other managerial and pedagogical areas. Of particular note are their responses to the importance of having an overall picture of the Rehovot Program, different ways of presenting problematic topics and reinforcement of prerequisite knowledge.

Table 5 presents the mean results on the importance (scale 1-5) attributed to treatment of curricular topics. This part of the survey gives a topical breakdown of areas in the curriculum. With the exception of number bases, the teachers felt all topics were important. It should be noted that several of the teachers were not teaching all grade levels and ability levels, a fact that could influence the importance they attributed to specific topics.

Table 6 presents the mean results on the importance (scale 1-5) attributed to the different modes of in-service activity. The teachers preferred in-school group guidance and "open lessons" given by counsellors rather than counsellor observation in class or "open lessons" given by the teachers. It seems that they showed a reluctance to be active and preferred to be passive.

Table 4 : Mean Importance (scale 1-5) Attributed to Specific Teaching Strategies and Activities

	$\bar{X}$
1. Familiarization with the Rehovot Program textbooks	4.61
2. Familiarization with teacher manual	4.28
3. Planning amount of material to be covered	4.05
4. Reinforcement of prerequisite knowledge	4.50
5. Introducing new topics	4.33
6. Planning lessons	4.22
7. Planning tests	4.28
8. Use of transparencies	2.94
9. Use of pocket calculator	3.00
10. Planning worksheets	3.55
11. Use of mathematical games	3.39
12. Use of microcomputers	3.29
13. Instructional approaches for mixed ability groups	4.41
14. Instructional approaches for ability groups or special cases	4.28
15. Adapting material to different ability levels	4.12
16. Teaching problematic topics	4.50
17. Difficulties encountered by different types of pupils	4.65

Table 5 : Mean Importance (scale 1-5) Attributed to Treatment of Specific Curriculum Topics

		$\bar{x}$
Grade 7	1. Number bases	2.35
	2. Signed numbers	4.23
	3. Coordinate systems and graphical representations	3.47
	4. Statistics (central measures of tendency)	3.41
	5. Algebraic expressions	4.06
	6. Equations and inequalities	4.47
Grade 8	1. Set algebra	3.47
	2. Algebraic techniques (simplification)	4.23
	3. Solving equations & inequalities	4.12
	4. Graphical representation of two equations with two unknowns	3.65
	5. Word problems	4.29
Grade 8-9	1. The deductive structure and the logical principles of Euclidean geometry	3.61
	2. The basic concepts of Euclidean geometry such as: definitions, axioms, propositions and proofs	3.86
	3. Congruence of geometrical figures	3.93
	4. Similarity of geometrical figures	4.23
	5. The polygons (triangles, quadrilaterals, ...) and their properties	4.08
	6. The circle	3.78
Grade 9	1. Basic concepts of functions	3.86
	2. Algebraic and graphical representations of functions	3.64
	3. Linear functions	3.64
	4. Quadratic functions	3.71
	5. Solving quadratic equations	4.07

Table 6 : Mean Importance (scale 1-5) Attributed to Different Modes of In-Service Activities

	$\bar{X}$
1. In-school group guidance	3.94
2. Counsellor observation in class, followed by a discussion	3.47
3. Individual guidance	3.61
4. Observation and discussion of "open lessons" given by other teachers	3.50
5. Observation and discussion of "open lessons" given by counsellors	3.78
6. Meetings with teachers from other schools	2.81

(iii) Teacher subject matter knowledge. The Teacher Knowledge Measure (see Appendix 3) was administered to the 16 teachers that attended the first day of the workshop course. The distribution of the pretest scores for the 16 teachers is presented in Table 7.

An item analysis of the questions revealed that only those questions of a mechanical nature were handled more or less satisfactorily by most of the teachers (see Table 8). Questions slightly out of the ordinary, in which the teachers had to think, were missed by almost all. At best, their knowledge was spotty. But more alarming, was the discovery that they seemed incapable of thinking their way through even standard-type problems.

Table 7: Teacher Knowledge Measure - Distribution and Mean of Pretest Scores

Total No. Correct out of 14	Frequency
0	1
1	1
2	0
3	2
4	2
5	6
6	1
7	1
8	1
9	1
10-14	0
N = 16 Teachers	
$\bar{X}$ = 4.6 correct	

Table 8: Teacher Knowledge Measure - Item analysis of Questions on Part I of the Pretest

	Question Number									
Response Choice	1	2	3	4	5	6	7	8	9	10
A	2					1	5	4		2
B		13*	1	1	4	8	1*	1	1	5*
C	12*		6*		9*	1			5	2
D		2	3	1	1	1*		3*	7*	1
E	1		5	13*			4	2	1	1
No response	1	1	1	1	2	5	6	6	2	5

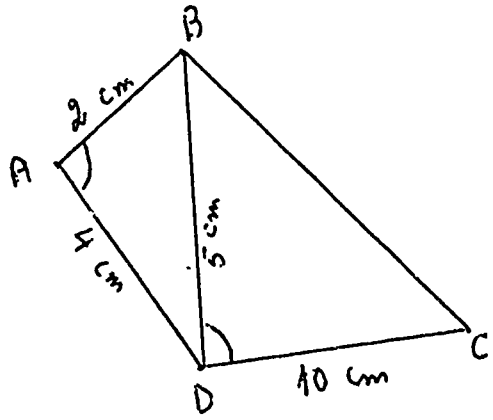
a) Part II (items 11-14) consisted of open-ended questions. On this part, two teachers answered correctly 2 questions each.

* Indicates the number of teachers (out of 16) who gave the correct response.

For example, in item 6 the teachers were asked to determine the units digit in the expansion of 387^{453} (see Appendix 3). Only one of the 16 teachers solved this question correctly. Of interest here is how they approached the problem. The units digit in 7^n is 7, 9, 3, 1 for n=1,2,3,4 respectively, and for larger n the sequence repeats itself. Hence, the problem is to determine the remainder when 453 is divided by 4. The idea

of raising 7 to successive powers of n and looking for a pattern, did not occur to them. Instead, they approached the problem mechanically and tried to expand 387^{453}.

Another problem (item 10) dealt with finding the perimeter of ABCD in the following figure, given that ∠ BAD = ∠ BDC.



Only five of the 16 solved this correctly, even though such problems are central to the curriculum.

2. Teachers Performance in the Classroom

The following data (qualitative and quantitative) are based on the information gathered by the counsellors from their classroom observations throughout the school year. This information was reported on the two types of observation forms: The Classroom Observation Form (see Appendix 1A) and the Classroom Evaluation Form (see Appendix 1B). Teacher performance in the classroom at the beginning of the project can also be considered a component of teacher entry behavior.

Based on the observations in the first period, a number of problematic teaching areas were identified. One area was preparation of lessons. In general, lessons tended to be prepared in an off-hand manner, that is, the teachers would look at the book immediately before class to see what the next topic was, but did not check to see if their students needed to do all the exercises or think about their presentation of the topic. The use of teacher guides was not a regular habit.

One consequence of the improper preparation of lessons was an inefficient use of class time. Often the teacher asked the students to read the text, an activity which they could do at home, rather than discuss with them the concepts involved.

Another example of the inefficient use of class time was the checking of homework. Teachers tended to spend too much time checking each individual exercise rather than concentrating on specific problems. Too often, the process of checking itself took almost the whole class period and thus left no time for practising new work.

Teaching tended to be frontal. Practically no group work and not nearly enough individual work was done. Textbooks and blackboard tended to be the only materials used.

The cognitive level of questioning was another area which needed attention. The majority of questions asked by the teachers were on an information-knowledge level, very few required comprehension and understanding, and none required analysis.

Teacher awareness of student misunderstandings was an additional problem area. Often teachers did not seem to understand the real question the student was asking. Sometimes the teachers failed to realize the overall difficulties the students encountered, and repeated ineffective explanations.

As indicated, quantitative data on teacher performance was gathered through the Classroom Evaluation Form. The number of observed lessons for each teacher was partitioned into 2-3 parts in order to relate to first and last periods of observations. For each statement a mean score was calculated for each period of observation. The analysis of the quantitative data, by school, by teacher, is given in Appendix 9A, 9B, 9C and 9D. The summary of the quantitative data in the first period verifies the above qualitative description of the entry teacher behavior in the classroom.

Following the intensive work of the project throughout the school year, teacher performance was reassessed. According to the descriptive part of the counsellor observation forms for the last period of the year, many teachers were giving more thought to preparing their lessons. As a

consequence, class time was used more efficiently, and higher level questions were asked. But, overall teaching methods had not significantly changed. Although less experienced teachers were using some of our worksheets and individualized work during the class period, the majority were still hesitant to try our suggestions for having the students work in small groups.

Asking questions which probe and require more than surface comprehension and understanding were beginning to be observed with some teachers. For example, the question of determining in general when a system of linear equations has an infinite number of solutions (or no solution) is at a higher level than finding the solution to a specific system. At least some of the teachers were themselves starting to think along such paths.

The quantitative data support some of the above trends. Specifically, seven important features which can determine the quality of a mathematics lesson were selected and analyzed in depth. These are: preparation of the lesson, whether the lesson was interesting, whether the mathematics was correct, efficient use of time, awareness of student difficulties, varied teaching methods, and varied cognitive level of questioning (all appear in the evaluation form). The overall mean scores on each of the above features for the first and last period of the observation are presented in Table 9. Graphical representations of the distribution of the teachers means on each feature for the first and last period are depicted in Figure 2(A-G).

Table 9: The Mean Scores (scale 1-5) on Selected Features of the Observations by Time

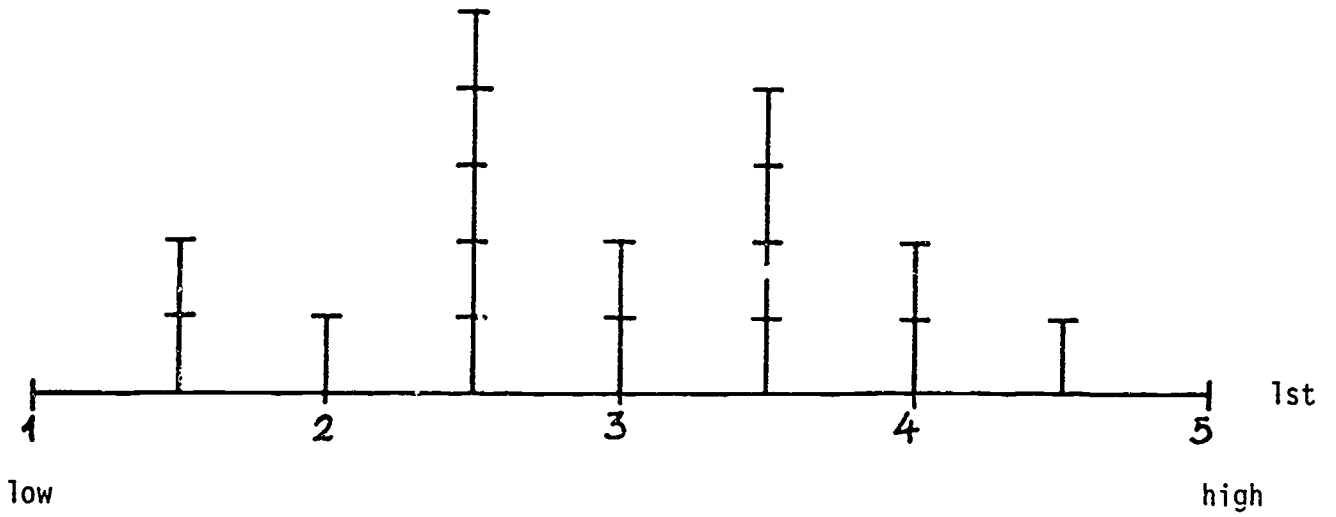
Feature	First Period $\bar{X}$	Last Period $\bar{X}$
a. Lesson preparation	2.9	3.5
b. Lesson was interesting	2.8	2.9
c. Correct mathematics	3.6	3.7
d. Efficient use of time	2.7	3.0
e. Awareness of student difficulties	2.8	2.8
f. Varied teaching methods	1.9	2.3
g. Varied cognitive level of questioning	2.0	2.0

From Table 9 and Figure 2 it can be seen that there was a definite trend toward change in a positive direction on most of the important features, although the means are far from being satisfactory. In particular, the improvement is most significant in the preparation of lessons, efficient use of time and varied teaching methods. These areas were most emphasized and worked on with the teachers.

The relatively short period of intervention and the implementation difficulties explain the low stable means on features E and G (Table 9).

Figure 2A

LESSON PREPARATION		1st	Last
	$\bar{X}$ =	2.94	3.45
N = 17	Mdn =	3.00	4.00



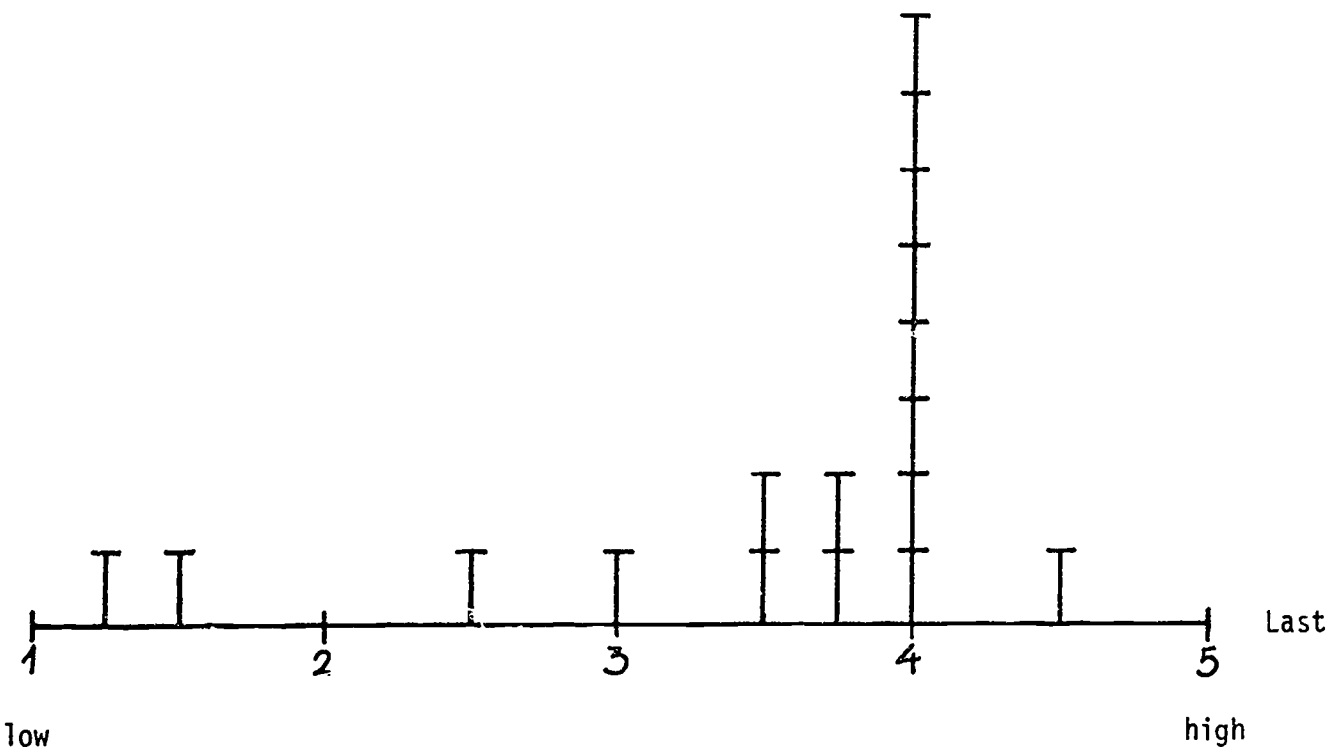
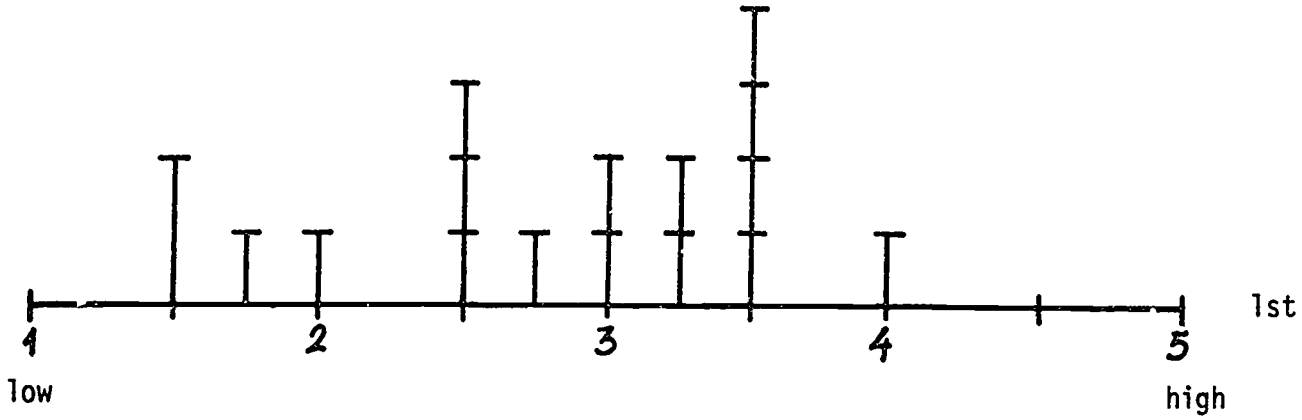


Figure 2: Distribution of Teacher Performance for First and Last Period of the observation (each vertical unit represents one teacher)

Figure 2B

LESSON WAS INTERESTING		1st	Last
N = 17	$\bar{X}$ =	2.82	2.91
	Mdn =	3.00	3.25



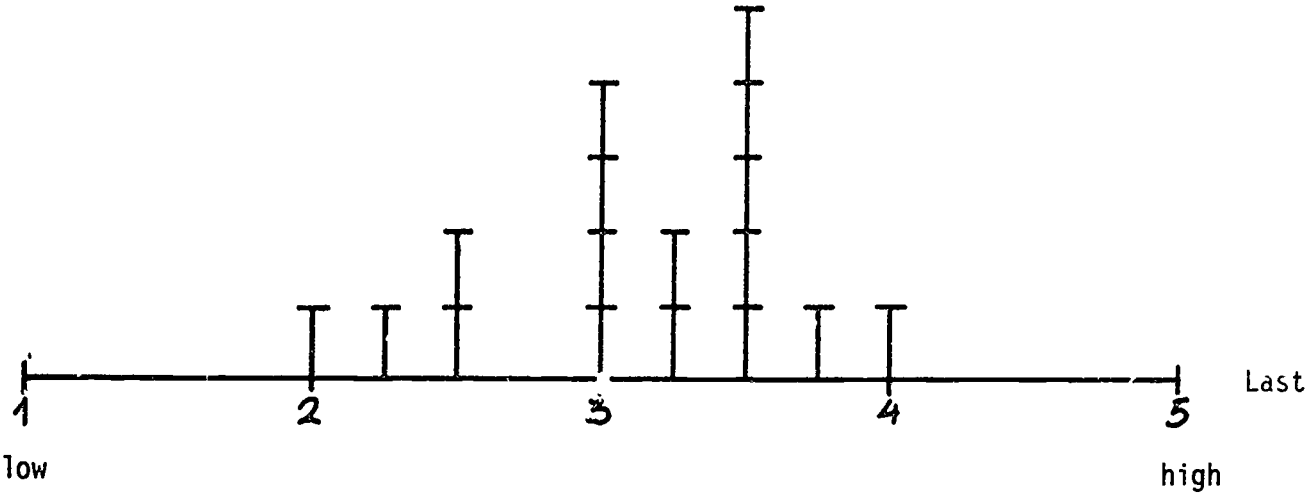
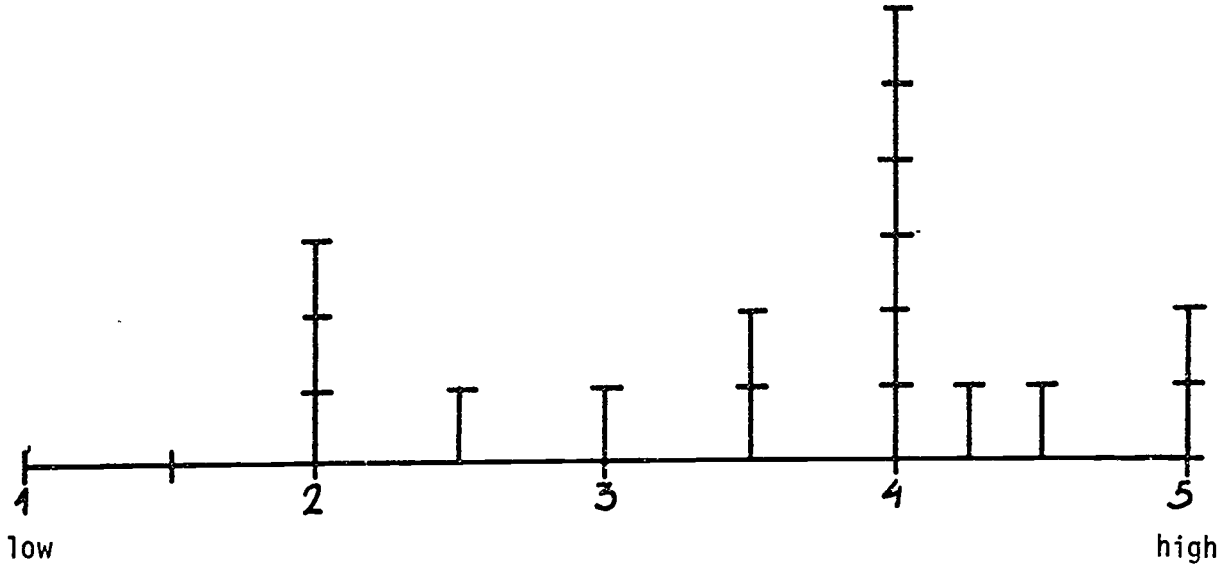


Figure 2C

		1st	Last
CORRECT MATH	$\bar{X}$ =	3.62	3.74
N = 17	Mdn =	4.00	4.00



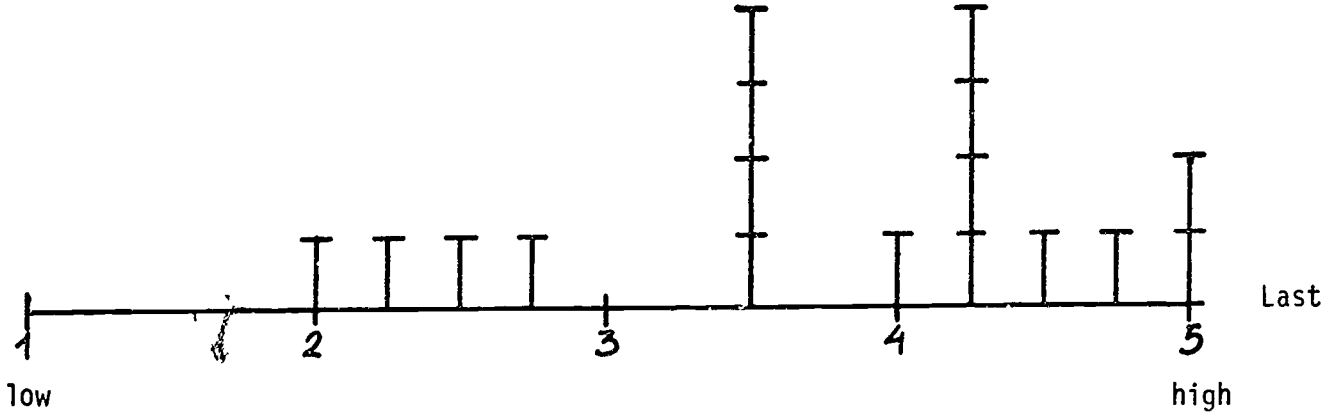
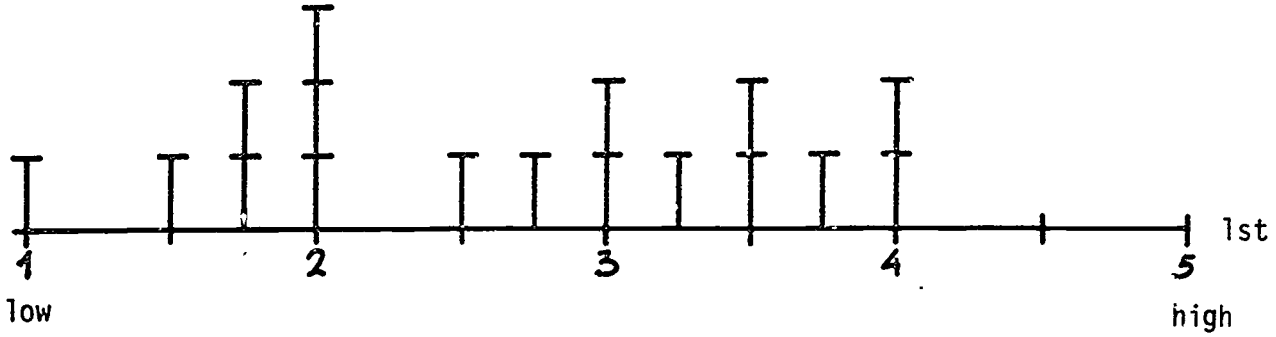


Figure 2D

		1st	Last
EFFICIENT USE OF TIME	$\bar{X}$ =	2.67	3.03
	Mdn =	2.75	2.75

N = 17



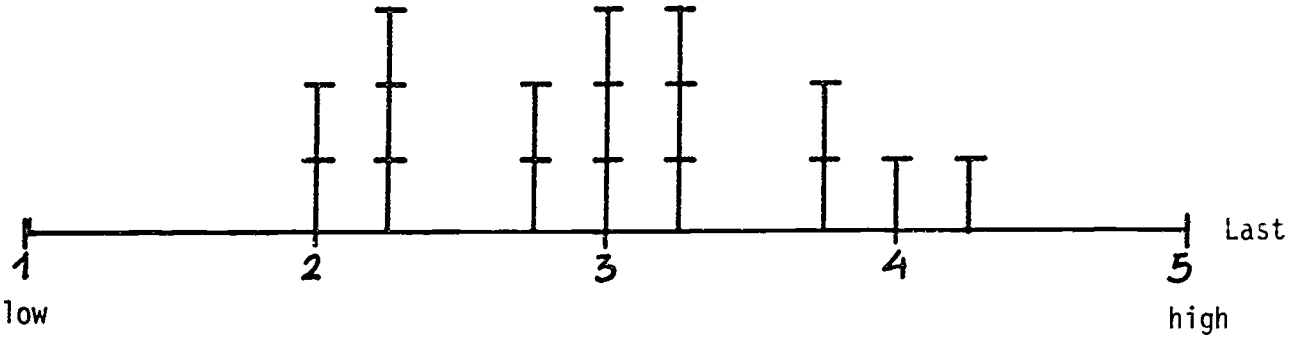
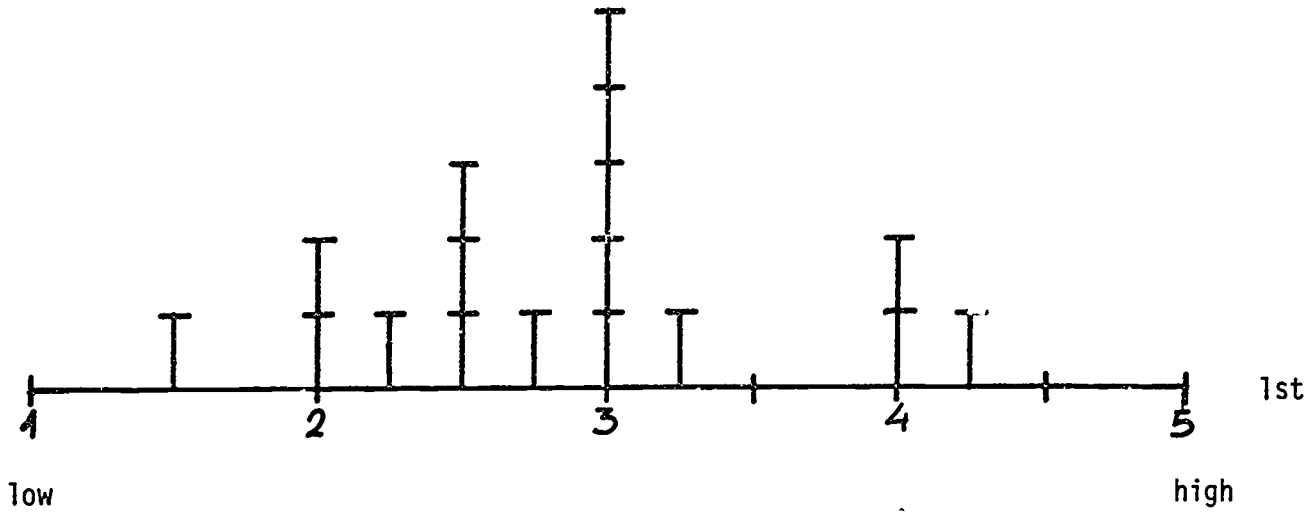


Figure 2E

AWARENESS OF STUD. DIFF.		1st	Last
N = 17	$\bar{X}$ =	2.81	2.80
	Mdn =	3.00	3.00



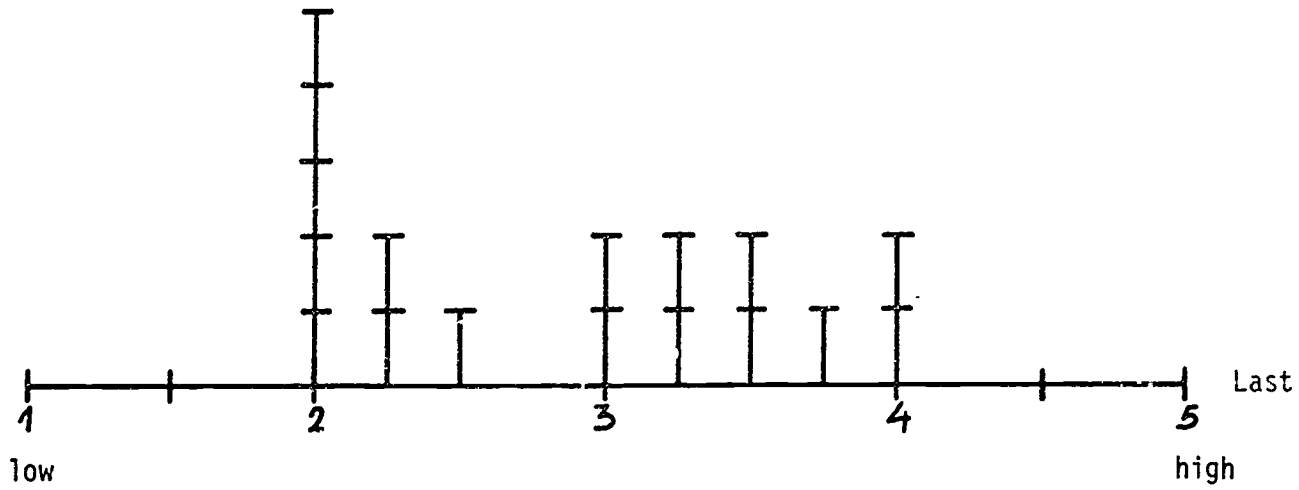
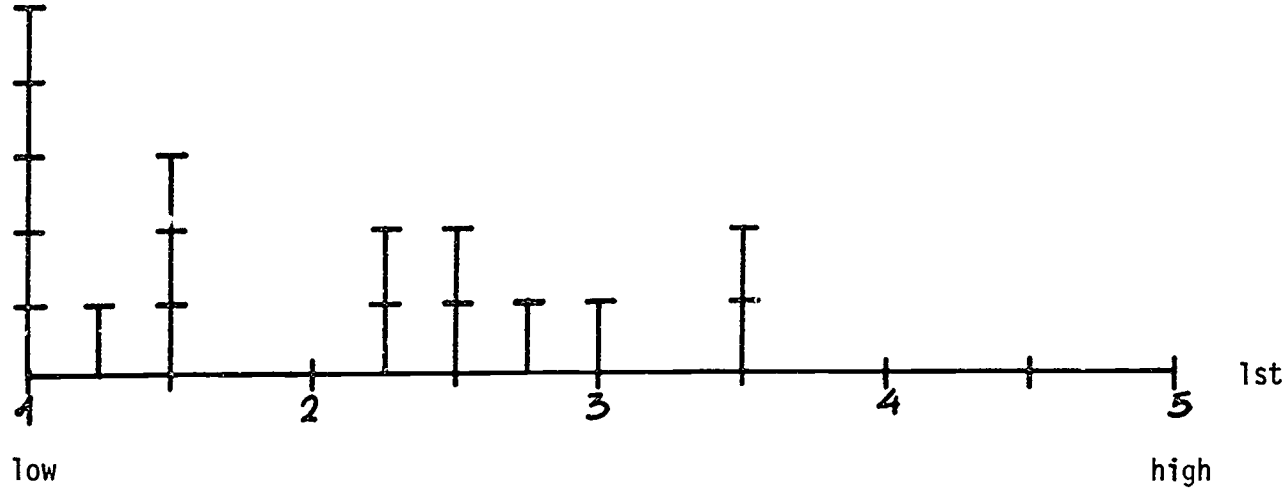


Figure 2F

VARIED TEACH. METHODS

N = 17

	1st	Last
$\bar{X}$ =	1.95	2.26
Mdn =	1.50	2.50



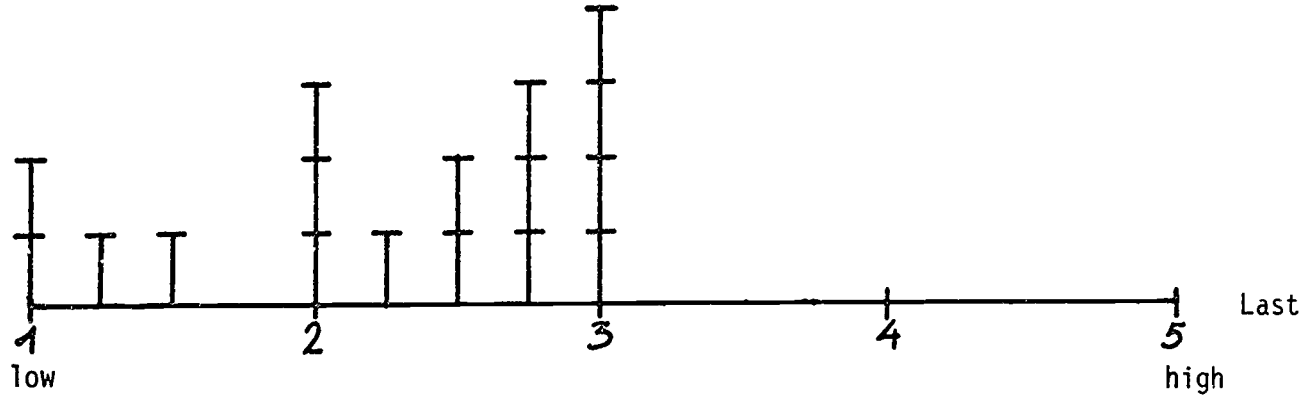
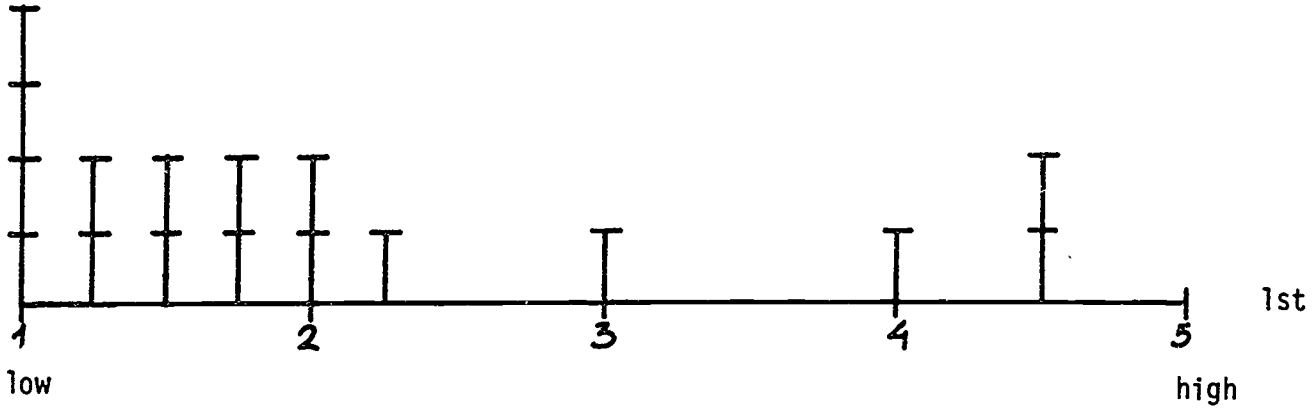
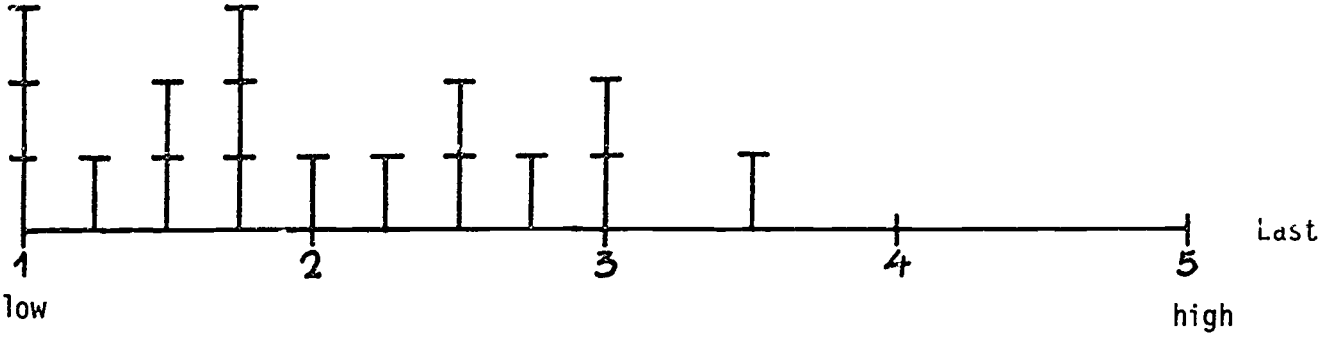


Figure 2G

VARIED COGNITIVE LEVEL OF QUES.		1st	Last
N = 17	$\bar{X}$ =	2.00	2.06
	Mdn =	1.75	1.75





Awareness of student difficulties and the asking of questions of varied cognitive levels are two areas which require more teacher competency and proficiency. With respect to feature C ("mathematics correct"), even though the mean scores were the highest, they are still far from being satisfactory. The teachers were rated only on the mathematics they taught and whether they made mistakes while explaining or solving the exercises they presented to the students.

The overall positive trend in teacher performance in the classroom, was also indicated by the change in the general evaluation of the observed lessons. The mean score for the first period was 2.9 compared to a mean of 3.2 for the last period.

Three short case studies are presented below which depict the observed behavior of three typical teachers. The first, Sh. can be characterized as an "ineffective teacher" upon whom the project had little effect; the second, Gi. can be characterized as an "effective teacher" already at the project's start; and the third, Mo. was originally categorized as "ineffective", however towards the end of the year, a definite positive change could be noted in his classroom behavior.

a. Sh. can be characterized as an <u>ineffective teacher</u>. His lessons are not prepared, with the result that the class proceeds exercise by exercise through the textbook. Most of his lessons are lectures, and he continues to utilize the ineffective technique of sending a student to explain at the blackboard followed by his reexplaining the same exercise.

Sh. knows mathematics, but feels that it is sufficient to "tell"

students what to do and how to do it and that they do not need to learn why. He listens to the students, and relates to their questions in a positive way and this helps create a good atmosphere in his lessons and he has few discipline problems. But his lessons are not interesting. He uses no teaching aids except the textbook. Even in the seventh grade class, he made no effective use of them, although the textbook includes games and puzzle pages.

The counsellor concentrated this year on familiarizing him with the syllabus and with the appropriate textbooks. She tried to teach him how to use the texts effectively but found little improvement. He is a warm-hearted person and cares about his students, but is not willing to spent even a minute outside of class preparing. He never learned methodology of teaching, and claims that he is "quite soon" leaving teaching, and thus it is not worth making an effort.

b. Gi. can be described as a traditional effective teacher. Her mathematics is correct and her explanations are clear. She uses class time efficiently, and generally has no discipline problems in class. Her students work seriously on their assignments and there is a positive atmosphere in her classroom.

Gi's lessons consist of explanations to the whole class, individual seat-work, and individual help. Never, during the lessons that the counsellor visited was there any group work. And the counsellor did not see any use of games or other "interesting" teaching aids - just the usual textbook and the infrequent additional worksheet. This is definitely an area which could be improved.

The other area in which improvement is needed is in the cognitive level of questioning. All the questions used by Gi. tested either knowledge or comprehension. Only on two occasions were some questions requiring higher order thinking posed - and this in spite of the fact that almost all lessons observed were with bright students.

During this year, the counsellor worked with Gi. on improving the effectiveness of her lessons. Gi. learned that it is possible to divide up the class time and to teach several subjects in the same lesson. In this area, a definite improvement was observed.

c. Mo. in contrast, is a teacher whose teaching has notedly improved this year. He might be considered as a teacher who moved from inefficient towards effective teaching. He started the year concerned with techniques only and even dictated rules that the students had in their textbooks. His lessons were unprepared, and because his mathematics is not especially strong, this often resulted in confused explanations and inappropriate examples.

The counsellor continually worked with him on preparation of lessons, planning them together and indirectly teaching him the necessary mathematics. By the end of the year, Mo.'s explanations had improved and his use of class time became more efficient. Also by the end of the year, some lessons were more varied -- instead of just frontal explanations and some classwork, the counsellor found more variety of teaching styles and a slight improvement in the level of questioning.

Mo. is a teacher who changed this year. Whether these changes will become permanent or not without the support of a counsellor is hard to

say.

Several other aspects, which also relate to teacher performance in the classroom, were surveyed through the assessment of the mathematics classroom environment as perceived by students and teachers. The results are presented in the next section.

3. The Learning Climate in the Classroom and Students' Attitudes Toward Mathematics

Analysis and comparison of students' and teachers' perceptions of the mathematics classroom environment, and data on students' attitudes toward mathematics are reported in this section.

(i) The learning climate in the classroom. All Level A and B students (n=576), grades 7 through 9 (28 classes), and their teachers (n=16) filled out the Class Environment questionnaire (Appendix 7) twice, in December 1986 and June 1987. Following the item analysis of the questionnaire, it was decided to delete two items (no. 19 and 31) and to form 12 subscales, 4 of them of a single item each. The partitioning of the questionnaire into subscales and the reliability coefficient for each subscale with more than one or two items, are presented in Table 10. All the reliability coefficients are of a satisfactory level (from 0.72 to 0.84). The intercorrelation coefficients of the 8 subscales with more than one or two items are given in Table 11. Of important note is the significant correlation between the three areas of satisfaction, difficulty and speed. Another strong relationship can be noticed between goal-direction and both satisfaction and difficulty. Similar results were found in a previous study in which this instrument was administered (see Fresko & Ben-Chaim, 1986b).

Table 10: Subscales of the Class Environment Scale and Reliability Coefficients

Subscale	Item No.	Reliability Coeff.*
Difficulty	1,10,21,30	.60
Inquiry	2,11,28	.60
Satisfaction	4,12,20,26,32	.79
Speed	5,13,22,29	.54
Diversity	6,18,27	.52
Competitiveness	7,15,23,33	.84
Goal Direction	8,16,24,34	.65
Formality	17,25	-
Transparencies	14	
Group work	9	
Use of board	3	
Individual work	35	

* Based on n=576 students

Table 11: Class Environment Subscale Intercorrelations

(based on means of 28 classes)

Scale	Scale Intercorrelations							
	Sat.	Sp.	Dif.	Inq.	G.D.	Com.	Div.	For.
Satisfaction	-							
Speed	.41*	-						
Difficulty	.68***	.57***	-					
Inquiry	18	.04	.16	-				
Goal direction	.76***	.23	.57***	.31	-			
Competitiveness	.26	.12	.08	.20	.02	-		
Diversity	.03	.04	.10	.33	.23	.03	-	
Formality	.30	.30	.26	.06	.09	.35	.44**	-

*p < .05

**p < .01

***p < .001

Since the Class Environment Scale is a measure of the learning environment in the mathematics classroom, means on the different subscales were calculated by class as a unit of analysis. Appendix 11 includes the subscales means on the pre and post data of the students and their teachers for each of the 28 classes. In addition, the differences between the post and pre means of the students and of the teachers are presented, as well as the differences between teachers' and students' means on the pre and on the post. The pre-post means of the classes by grade (7,8,9) and by ability level (A,B) are presented in Table 12. It can be observed that inquiry, satisfaction, goal direction, use of board and individual work are the subscales with highest means on the pre, regardless of grade and ability level. On the other hand, the diversity of teaching methods and use of transparencies have the two lowest means, a result that was also verified by the counsellors' reports. It can also be seen that, while the students felt that difficulty increased with grade level, the satisfaction decreased. The results of the intercorrelation analysis (see Table 11) support this relation.

Table 12: Class Environment Subscales - Means (scale 1-4)

by Grade (7,8,9) and by Ability Level (A,B)

GRADE=7 N=9 CLASSES

SUBSCALE	LEVEL A&B PRE	LEVEL A&B POST	LEVEL A PRE	LEVEL A POST	LEVEL B PRE	LEVEL B POST
difficulty	2.12	2.20	2.15	2.33	2.10	2.09
inquiry	3.05	3.02	2.99	2.95	3.10	3.08
satisfaction	3.32	3.03	3.22	2.79	3.40	3.23
speed	2.20	2.34	2.28	2.54	2.14	2.18
diversity	1.77	1.79	1.56	1.53	1.94	2.00
competitiveness	2.43	2.37	2.32	2.31	2.51	2.41
goal direction	3.43	3.26	3.42	3.14	3.43	3.36
formality	2.91	2.86	2.72	2.63	3.06	3.05
transparencies	1.04	1.01	1.02	1.00	1.06	1.02
group work	2.24	2.31	2.43	2.25	2.10	2.36
use of board	3.81	3.78	3.88	3.77	3.76	3.79
individ. work	3.45	3.30	3.52	2.95	3.40	3.58

GRADE=8 N=10 CLASSES

SUBSCALE	LEVEL A&B PRE	LEVEL A&B POST	LEVEL A PRE	LEVEL A POST	LEVEL B PRE	LEVEL B POST
difficulty	2.20	2.38	2.15	2.40	2.26	2.36
inquiry	2.96	2.88	3.21	3.05	2.71	2.72
satisfaction	2.92	2.73	3.09	2.70	2.76	2.76
speed	2.19	2.29	2.11	2.26	2.26	2.32
diversity	2.03	2.20	2.18	2.21	1.89	2.20
competitiveness	2.51	2.30	2.44	2.15	2.58	2.45
goal direction	3.23	3.15	3.33	3.20	3.14	3.11
formality	2.53	2.58	2.41	2.58	2.65	2.58
transparencies	1.08	1.30	1.08	1.17	1.08	1.43
group work	2.39	2.34	2.52	2.56	2.26	2.[illegible]
use of board	3.70	3.64	3.77	3.77	3.64	3.50
individ. work	3.22	3.19	3.30	3.19	3.13	3.19

GRADE=9 N=9 CLASSES

SUBSCALE	LEVEL A&B PRE	LEVEL A&B POST	LEVEL A PRE	LEVEL A POST	LEVEL B PRE	LEVEL B POST
difficulty	2.37	2.35	2.36	2.39	2.38	2.30
inquiry	2.91	2.91	3.07	3.07	2.71	2.71
satisfaction	2.85	2.73	2.93	2.65	2.75	2.83
speed	2.28	2.32	2.28	2.37	2.2[illegible]	2.27
diversity	1.71	1.72	1.89	1.90	1.49	1.50
competitiveness	2.31	2.17	2.14	2.09	2.51	2.28
goal direction	3.23	3.19	3.31	3.22	3.12	3.16
formality	2.66	2.55	2.46	2.39	2.92	2.74
transparencies	1.23	1.52	1.36	1.61	1.07	1.40
group work	2.41	2.40	2.42	2.41	2.38	2.38
use of board	3.77	3.57	3.72	3.66	3.84	3.45
individ. work	3.26	3.12	3.39	2.91	3.10	3.38

The main purpose of this instrument was to acquire greater insight into the learning environment of the participating mathematics classrooms, and this was achieved from the results of the pretesting. The second purpose of using this instrument was to measure change. however, the posttesting did not indicate any clear change in the learning environment which could be related to the intervention program. Two reasons might explain this result: (1) the relatively short period between the pre and post testing, and/ or (2) the administration of the pre-testing 4 months after the beginning of the project, which might mean that part of the impact was already measured at that time. The observed phenomenon of a decrease in the satisfaction between pre and posttesting was also found in other studies and projects run by the mathematics group in Rehovot. It may be attributable to the general lassitude towards the end of the school year.

An in-depth examination of the teachers' ratings and the differences between teacher and student pre and post scores (as presented in Appendix 11), reveal interesting findings. Taking into account an absolute difference greater than 0.10, it was found that for the majority of the classes, pre and post, the teachers evaluated competitiveness as higher than the students. On the other hand, regarding goal-direction, for about half of the classes the teachers evaluated it lower than the students. The most interesting finding is related to the three intercorrelated subscales: difficulty, speed and satisfaction. The distribution of the differences between teacher and student means on these three subscales is given in Table 13.

Table 13: The Distribution of Differences Between Teacher and Student Means (n=28) on Three Subscales of the Class Environment Scale

Subscale	pre (teach.- stud.)			post (teach. - stud.)		
	>0.1	=	<-0.1	>0.1	=	<-0.1
Difficulty	14	10	4	16	3	9
Speed	7	4	17	7	8	13
Satisfaction	4	8	16	8	5	15

The distributions of the differences are similar for the pre and post results. The teachers tended to evaluate the learning of mathematics as more difficult than the students actually felt. On the other hand, with respect to speed and satisfaction the picture was reversed. It seems that evaluating difficulty as higher than actually felt, resulted in teachers' evaluating speed slower (because they tried to teach slower) and satisfaction lower (because the material is difficult) than the students.

To conclude, the teachers' perception of the mathematics classroom environment was quite different from that of the students on several important subscales.

(ii) Student attitudes toward mathematics. As indicated, data on Level A and B student attitudes were gathered in order to complement the data obtained from the Class Environment Scale. Student attitudes were surveyed through the Attitude Questionnaire (see Appendix 8A). The 25 items were partitioned into the following three areas: importance of mathematics (items 1, 4, 7, 10, 12, 18, 21, 23, 25), sense of satisfaction (items 2,

5, 14, 16, 19, 20, 22), and anxiety (items 3, 6, 8, 9, 11, 13, 15, 17, 24). The reliability coefficients were 0.57, 0.80 and 0.76, respectively. Means and standard deviations for the three subscales by grade (7, 8, 9) and by ability (A and B) are presented in Table 14. The graphical representation of these results is given in Figure 3 (A, B, and C).

Generally speaking, the results indicate that the overall importance ratings and satisfaction ratings were high and that anxiety was relatively low.

In addition, it can be seen that in all grades there were no differences between the attitudes of Level A students and those of Level B. However, a clear trend existed with respect to grade level differences on each subscale. More specifically, students in higher grades tended to rate the importance of mathematics lower, than those in lower grades, to report less satisfaction and to indicate greater anxiety. It should be noted that with respect to satisfaction, a similar pattern was observed on the Class Environment satisfaction subscale.

Table 14 : Level A and B Attitude Questionnaire Subscales - Student Means (scale 1-4) and Standard Deviations by Grade(7,8,9) and by Level

	N	IMPORTANCE		SATISFACTION		ANXIETY	
		$\bar{X}$	S.D	$\bar{X}$	S.D	$\bar{X}$	S.D
7th GRADE	219	3.46	0.30	3.39	0.50	1.81	0.47
LEVEL A	85	3.51	0.22	3.40	0.46	1.82	0.44
LEVEL B	134	3.43	0.34	3.38	0.52	1.81	0.50
8th GRADE	195	3.36	0.31	3.12	0.53	2.03	0.48
LEVEL A	108	3.39	0.29	3.16	0.56	2.04	0.51
LEVEL B	87	3.33	0.32	3.07	0.49	2.02	0.45
9th GRADE	168	3.29	0.36	2.99	0.58	2.13	0.54
LEVEL A	100	3.28	0.36	2.99	0.58	2.09	0.54
LEVEL B	68	3.30	0.38	2.99	0.58	2.19	0.54

Figure 3A

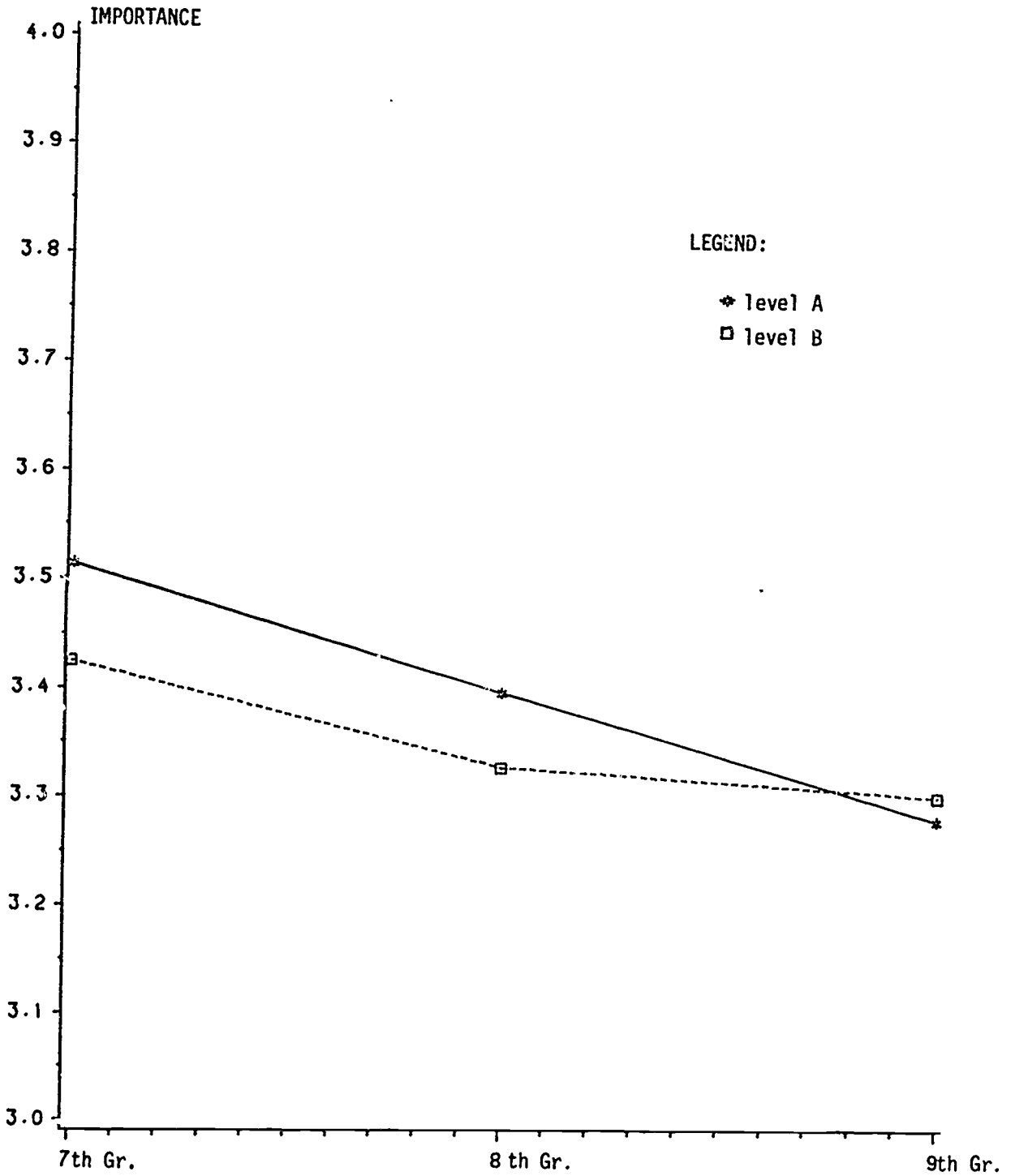


Figure 3: Graphical Representation of Students Attitudes Toward Mathematics, by Grade (7,8,9) and by Ability Level.

Figure 3B

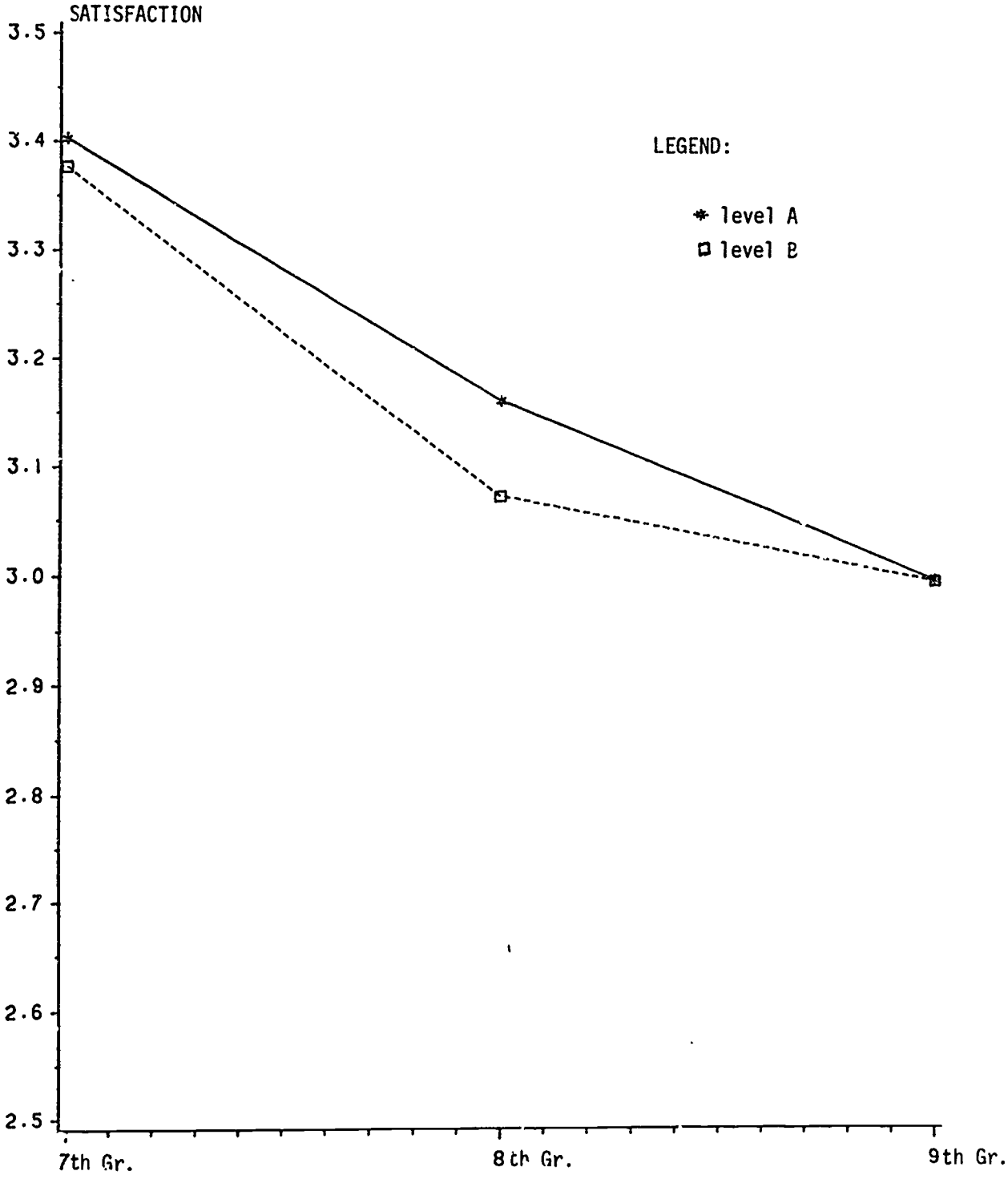
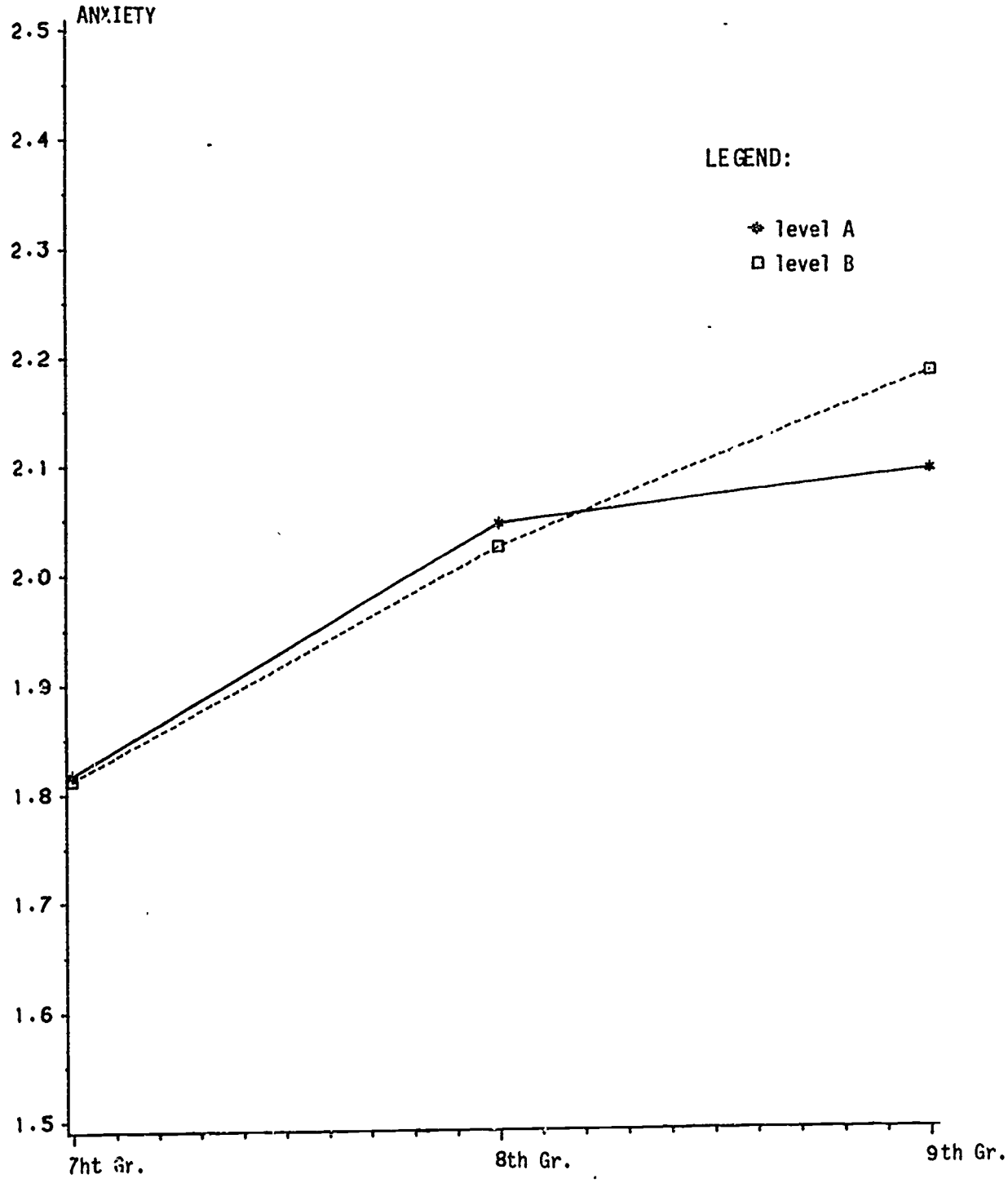

SATISFACTION
3.5
3.4
3.3
3.2
3.1
3.0
2.9
2.8
2.7
2.6
2.5
LEGEND:
level A
level B
7th Gr.
8th Gr.
9th Gr.

Figure 3C


ANXIETY
2.5
2.4
2.3
2.2
2.1
2.0
1.9
1.8
1.7
1.6
1.5
LEGEND:
level A
level B
7ht Gr.
8th Gr.
9th Gr.

(iii) Level C student attitudes. Level C students were not given the Class Environment Scale; instead, they were given the Level C Attitude Questionnaire (see Appendix 8B) which checks six areas: satisfaction (items 1, 8, 9), difficulty (items 2, 7, 13), anxiety (items 3, 6, 11), teaching strategies (items 4, 10), speed (items 5, 14, 16), and diversity of instruction (items 12, 15). Means and standard deviations for the six subscales by grade (7, 8, 9) are presented in Table 15.

Table 15: Level C attitude Questionnaire Subscales - Students Means (scale 1-4) and Standard Deviations by Grade (7,8,9)

	GRADE 7 (N=89)		GRADE 8 (N=92)		GRADE 9 (N=68)	
SUBSCALE	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Satisfaction	3.59	0.56	3.28	0.63	3.07	0.65
Difficulty	1.63	0.64	1.73	0.53	1.91	0.52
Anxiety	1.78	0.43	1.70	0.52	1.86	0.59
Teach. Strategy	2.58	0.55	2.48	0.66	2.49	0.56
Speed	1.75	0.54	1.79	0.56	1.74	0.51
Diversity	2.12	0.76	1.97	0.55	1.82	0.44

On the whole, few differences can be found by grade level on the subscales. Nevertheless, it can be seen that, on satisfaction and difficulty, the trends in Level C are similar to those which were observed for Level A and B students, i.e. satisfaction decreases with grade level and difficulty

increases. In addition, it is of interest to note that relatively speaking ratings are high on teaching strategies. Such results were not observed for Levels A and B. It is possible that in these "slow" classes teachers make a greater attempt to utilize less standard approaches.

4. The Effect on Teachers' Mathematical Knowledge

The effect of the mathematical part of the workshop course on teachers knowledge was assessed by administrating the Teacher Knowledge Measure (Appendix 3) to the 12 participating teachers during the last workshop meeting. The distribution of the posttest scores for the 12 teachers is presented in Table 16. The teachers had an overall significant gain from the pretest to the posttest. There was a mean score of 4.6 (out of 14) on the pretest (see Table 7) compared with a mean score of 8.6 on the posttest (see Table 16).

A breakdown analysis for the multiple-choice questions (items 1-10 on the test) is presented in Table 17. It is of note here that nearly half of the teachers could handle the most difficult of the non-standard questions; for example, on Question no. 6 which asked the teachers to determine the units digit in the expansion of 387^{453}. Their performance is even more noteworthy on the non-standard questions 8 and 10.

Table 16: Teacher Knowledge Measure - Distribution and Mean of Posttest Scores

Total No. Correct out of 14	Frequency
0-4	0
5	1
6	1
7	1
8	3
9	1
10	4
11	0
12	0
13	1
14	0
n = 12 Teachers	
$\bar{X}$ = 8.6 Correct	

Table 17: Teacher Knowledge Measure - Item Analysis of Questions on Part I of the Exam

	Question Number									
Response choice	1	2	3	4	5	6	7	8	9	10
A	1					1				
B		12*	3			3	9*	3	1	6*
C	11*		8*		11*					1
D					1	5*		7*	11*	
E			1	11*		2	1	1		2
No response				1		1	2	1		3

* indicates the number of teachers (out of 12) with correct response.

Focusing on technique questions from the first part of the test (items 1, 2, 4, 5), the mean score jumped from an average of 73% correct to an average of 94% correct. With respect to non-standard questions (items 3, 6-10), they went from a mean score of 24% correct to a mean of 64% correct.

For both categories of questions this is a significant improvement, particularly because neither these types of questions nor the ideas underlying them were discussed in the sessions. These particular items had been included in the test in order to measure transfer.

Regarding the second part of the test (items 11-14), the overall performance of the teachers was less impressive than on the first part.

A breakdown analysis of individual performance on the two parts of the test for pretest and posttest is presented in Table 18 for the 12 teachers who took both exams. Of particular importance is that all teachers improved, even the weakest of them. On the first part of the test there was an improvement from 50% to 75% correct. On the second part from 8% to only 31% correct. There is some gain on the second part, with the majority of teachers getting at least one question correct. Such a small change was unexpected, since the topics (abstract and linear algebra) and their underlying notions were specifically discussed in the workshops. We believe that the majority of teachers failed to master this material, which is difficult not only conceptually but technically too, because of their deficient background and lack of prerequisite skills, coupled with their poor attendance in the workshops.

In summary, there was a positive effect of the mathematical section of the workshop course on teacher knowledge. This improvement occurred in spite of the teachers' attitudinal problems which have already been discussed. They made significant gains, although there is still room for much improvement. Hopefully, this progress will sustain itself and develop further with future intervention.

Table 18: Pretest vs. Posttest Scores of Teachers on the Two Parts of the Teacher Knowledge Measure

	Part 1 (item 1-10) Correct		Part 2 (item 11-14) Correct	
Teacher	Pre	Post	Pre	Post
A	5	7	0	0
B	4	7	0	2
C	6	8	2	0
D	5	7	0	1
E	5	4	0	2
F	5	8	0	2
G	5	5	0	0
H	5	9	2	1
I	3	8	0	1
J	3	8	0	0
K	9	9	0	4
L	5	10	0	1

5. Teacher Feedback and Impressions of the Aronberg Project

Impressions from the mid-year interviews, the contribution assessment questionnaire and the summing-up sessions, form the data base for this section.

(i) Summary of the mid-year interviews with teachers. A sample of six teachers were interviewed at length to get their intermediate impressions of the project and how it had affected them. The interview was structured, with specific questions being asked about impressions of the in-school activities, the pedagogical and mathematical components of the workshops at the Weizmann Institute, and their general expectations from participation in the Aronberg Project. The questions asked and a synopsis of their replies are given in Appendix 10.

In general, teachers at mid-year presented both positive and negative impressions of the project's contribution to them individually. Beginning teachers and those with minimal formal training in mathematics felt the project was making a considerable contribution to them professionally. More experienced teachers and those with a more formal mathematics background were less enthusiastic about the project's contribution. But change does not come without hard work on their part, and this the majority (experienced and inexperienced) seemed to accept only in theory, not in practice. Hence, at mid-year, the contribution and influence of the Aronberg Project to the teachers individually was perceived as being far from ideal, but at the same time, far from minimal. At mid-year, teachers started to realize the importance of taking an active role in the activities themselves, but this they did with something less than complete enthusiasm.

with something less than complete enthusiasm.

(ii) Contribution assessment results. The Contribution Assessment Questionnaire (Appendix 2B) was administered toward the end of the school year. This questionnaire has three parts to it. For the first section, the teachers had to assess the project's contribution to curricular topics in specific categories; e.g., using the pocket calculator, planning tests, adapting material to different ability levels, etc. The teachers were asked to make similar assessments in the second and third sections of the questionnaire. In the second section they assessed treatment of curricular topics and in the third section, the teachers assessed the contribution of the guidance given, individually and in groups, by the counsellor, the open lessons and the workshops. The mean results are presented in Tables 19, 20, 21.

From Table 19, it can be observed that the teachers attributed a relatively high contribution to familiarization with the Rehovot Program textbooks and manuals, teaching problematic topics, planning lessons and worksheets and planning the amount to be covered. All of these topics were specially treated in the project's activities. Use of transparencies and microcomputers were rated as the lowest on the contribution scale, in-spite of use and presentation by the project staff of these aids. Possibly, the technical difficulties mentioned earlier prevented the teachers from using the equipment.

Table 19: Mean Contribution (scale 1-5) Attributed to Specific Teaching Strategies and Activities

	$\bar{X}$
1. Familiarization with the Rehovot Program textbooks	3.20
2. Familiarization with teacher manuals	3.00
3. Planning amount of material to be covered	3.00
4. Reinforcement of prerequisite knowledge	2.60
5. Introduction new topics	2.87
6. Planning lessons	3.27
7. Planning tests	2.80
8. Use of transparencies	2.13
9. Use of pocket calculator	2.73
10. Planning worksheets	3.27
11. Use of mathematical games	2.73
12. Use of microcomputers	2.27
13. Instructional approaches for mixed ability groups	2.40
14. Instructional approaches for ability groups or special classes	2.60
15. Adapting material to different ability levels	2.53
16. Teaching problematic topics	3.71
17. Difficulties encountered by different types of pupils	2.47

Table 20: Mean Contribution (scale 1-5) Attributed to Treatment of Specific Curriculum Topics

	$\bar{X}$
1. Treatment of topics included in Grade 7 curriculum (e.g. signed numbers, coordinated systems and graphical representation, statistics, equations and inequalities	3.14
2. Treatment of topics included in Grade 8 curriculum (e.g. set algebra, algebraic techniques, solving equations & inequalities, word problems)	2.61
3. Treatment of topics included in Grade 9 curriculum (e.g. algebraic and graphical representation, linear functions, quadratic functions)	3.50
4. Treatment of topics included in the junior high school Euclidean geometry curriculum (e.g.axioms congruence and similarity,polygons).	

Table 21: Mean Contribution (scale 1-5) Attributed to Different Modes of In-service Activities

	$\bar{X}$
1. In-school group guidance	2.53
2. Observation in class followed by a discussion	4.20
3. Individual guidance	3.73
4. Observation and discussion of "open lessons" given by colleagues	3.07
5. Observation and discussion of "open lessons" given by counsellors	1.54
6. Meeting teachers from other schools in the workshop course	2.08

The needs and contribution scales are different. Hence, in comparing them we looked at the rank of the topics in each scale, rather than the discrepancy for each item. In comparing the contribution ratings in Table 19 with the importance rating in Table 4, one notes that most of the topics ranked high on the contribution scale were also marked among the topics of high importance. Nevertheless, there is a discrepancy in the ranking of topics 4, 7, 13, 14 and 17. Two of these topics (4 and 7) were treated, but maybe the treatment fell short of the perceived need of the teachers. It should be pointed out that the Needs/Contribution assessment questionnaires have been used before with a variety of populations and the perceived discrepancy between importance and contribution is common.

Looking at Table 20, it should be noted that the highest contribution score (given to treatment of topics included in the Grade 9 curriculum) is explained by the fact that these topics were treated in the workshops.

Of particular note, however, are the results presented in Table 21. Here, one sees that the teachers felt that the individual aspects of the project (counsellor observation, one-to-one guidance) were more beneficial to them than the group activities. In spite of their complaints about being under surveillance (see also the relative rank on the importance scale, Table 6), they singled out these aspects of the project as in-service activities which benefitted them most.

(iii) Teacher feedback at the end of the school year. This overall feeling of having gained from the project came through in the written comments and in the summing up sessions as well. In general, all teachers were positive in their reactions to the project. For example, in one school (HR), the teachers and the principal mentioned the improved interaction between the

mathematics staff.

In general, the project made the teachers think about their lessons, not just before going into the classroom but also afterwards . Although many voiced strong feelings against being observed, overall they felt that they were better teachers because of it.

The teachers commented specifically on their being able to cover more topics this year than they had in the past and the benefit derived from the feedback given through the observation sheets. The observer kept the teachers under pressure to keep to the curriculum schedule and although at times the teachers felt this pressure (some asked for a less frequent observation schedule), they realized its importance. The teachers started to use teaching aids, rather than just chalk and talk, and they often commented that there was not enough time to talk with the counsellor after the lessons. Many of the teachers wanted the counsellor to teach their class and to talk with them about didactical strategies before the lesson, not just after it. On the other hand, the more experienced teachers felt less positive toward the role of the counsellor, and some felt that only new teachers should be required to work with them.

With regard to the workshops, whereas a few of the teachers felt that their background had been enriched and that they had received a new perspective on the topics they teach, most felt the mathematical component was at too high a level. The workshops were revised continuously, but this problem persisted.

To sum up, given the short duration of the project intervention and the teachers' initial attitudinal problems, the overall impressions from the

above data sources are that the teachers expressed a certain satisfaction with the program. It should be added that the school principals were most positive from the beginning and throughout the school year. They were most cooperative and interested in getting feedback on student achievement and overall teaching of mathematics in their schools.

6. The Effects of the Project on Student Achievement

In order to measure the impact of the project on student performance, curriculum-based achievement tests were administered and the prerequisite knowledge of the students was measured.

(i) Results on the Prerequisite Knowledge tests. At the beginning of the school year, 7th grade students were tested on the basic concepts of natural numbers, fractions, and decimals which they should have learned in Grades 1-6. These questionnaires are presented in Appendix 6 (A, B, C). Several teachers in the program requested that, at this time, the students be given remediation in fractions only, and hence not all students in the program were tested on decimals at the beginning of the seventh grade.

The mean results on the prerequisite knowledge of 7th grade students in the program are presented in Table 22. From the Table it is clear that most students at the outset of the program had little trouble with operations with whole numbers, but a great deal of difficulty with concepts and exercises on fractions and decimals. Again, one can see a definite decline of mean scores across ability level. The overall mean score on both the fraction and decimal tests was around 50% correct. Bearing in mind, that students are expected, at least, to be at mastery level (80%) at the beginning of seventh grade, the severity of the situation is

obvious. Thus, the students were well behind even before they started junior high school. The same questionnaires were administered to entering seventh grade students in several suburban schools for base-line data. Their class means on natural numbers were around 90%, and on fractions and decimals were, on average, 25 percentage points higher than those of the schools in the project.

It was suggested to the 7th Grade teachers of Level A and B students to treat the topic of common fractions by the existing remediation units. Following this treatment, the students were posttested. The pre and post mean scores of these students on the common fraction prerequisite test are presented in Table 23. It can be seen that there were substantial gains in most of the classes, bringing half of them to a mastery level of over 75%. The only exception was a Level B class in school MKG, in which the students gained only a little. This can be explained by long periods of absence by their teacher and hence the topic was not treated properly.

Table 22: Mean Scores in Percentages on 7th Grade prerequisite Knowledge Tests, by School, by Level

School	Level	N	Natural Numbers		Common Fractions		Decimals	
			$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
HR	B (boys)	21	80	12	49	20	-	-
	B (girls)	30	83	14	61	22	-	-
	C (girls)	22	72	13	39	16	-	-
MKR	A	29	86	10	67	14	57	16
	B	26	78	12	49	20	44	18
	C	17	61	18	27	17	-	-
MKG	A	32	87	13	63	22	50	19
	B	35	72	20	44	16	35	17
	C	20	63	21	36	11	28	14
AY	A	28	83	11	78	19	68	16
	B	14	86	9	62	23	-	-
	B	22	66	19	44	19	-	-
	C	18	58	19	31	13	-	-

Table 23: Mean Scores in Percentages on 7th Grade Prerequisite Test on Common Fractions, by School, by Level

School	Level	N	Pre $\bar{X}$	Post $\bar{X}$
HR	B (boys)	17	49	73
	B (girls)	27	61	82
MKR	A	24	67	85
	B	28	49	64
MKG	A	38	63	88
	B	25	44	50
AY	B1	17	62	75
	B2	14	44	68

(ii) Pretest results on the curriculum-based achievement tests. The data gathered from the curriculum-based achievement tests for Level A and B students i. all three grade levels (Appendix 5A, 5B, 5C) which were administered at the end of the previous school year (June 1986) are analyzed by school, by grade and by ability level. The total test scores and sub-test scores in percentages per school are presented in Appendix 12 (A-D). Examination of the tables (in the Appendix) of the pretest results leads to the following observations.

* With respect to prerequisite knowledge (common fractions and decimals), the low achievement scores indicate the existence of a very fundamental problem in these schools. The only exception is Level A in school AY,

where achievement was considerably higher, though not at mastery level, for 7th grade students. An inquiry revealed that this group generally received six hours of mathematics per week instead of the usual four. It should be noted that the fractions and decimals sub-tests included the most difficult items from the tests of prerequisite knowledge. It should also be noted, that the results on fractions and decimals do not improve by the end of junior-high school years without specific remediation.

* The achievement tests clearly distinguish between Levels A and B. The overall test results for Level B students were extremely low.
* The results on the different sub-tests indicate that achievement was considerably lower in some areas than in others. Apparently, many of these topics were not covered because the pace of instruction was slower than it should be. Even on the anchor items there was no consistent improvement from grade 7 to 9 in all participating schools.
* The overall test results were not only low in an absolute sense, but also in comparison with other suburban schools (see Tables 24-26).

Table 24: Grade 7 Achievement Test Mean Scores in Percentages, by School, by Level

School	Level A & B $\bar{X}$	Level A $\bar{X}$	Level B $\bar{X}$
HR (n=72)	30	36	16
MKR (n=41)	26	36	16
MKG (n=53)	56	67	43
AY (n=65)	51	72	34
*			
Moshav G. (n=78)	53	65	32
Moshav S. (n=52)	64	75	42
Inner-city School V. (n=137)	42	49	33
Inner-city School T. (n=446)	56 (not divided into ability levels)		
Suburban School B. (n=71)	73**	76	50
Suburban School D. (n=91)	81	86	68

* The schools above this line were tested at the end of Grade 7 (June '86) The schools below this line were tested at the beginning of Grade 8 (Nov. '85).

** Includes Level A only

Table 25: Grade 8 Achievement Test Mean Scores in Percentages, by School, by Level

School	Level A & B $\bar{X}$	Level A $\bar{X}$	Level B $\bar{X}$
HR (n=53)	31	45	17
MKR (n=32)	20	35	12
MKG (n=40)	36	39	34
AY (n=61)	44	79	25
*			
Moshav G. (n=88)	47	58	33
Moshav S. (n=25)	37	43	30
Inner-city School V. (n=127)	41	46	31
Inner-city School T. (n=354)	46	55	30
Suburban School B. (n=63)	74**	74	-
Suburban School D. (n=140)	74	83	60

* The schools above this line were tested at the end of Grade 8 (June '86) The schools below this line were tested at the beginning of Grade 9 (Nov. '85).

** Includes level A only

Table 26: Grade 9 Achievement Test Mean Scores in Percentages, by School, by Level

School	Level A & B $\bar{X}$	Level A $\bar{X}$	Level B $\bar{X}$
HR (n=39)	18	28	15
MKR (n=29)	22	35	12
MKG (n=26)	51*	51	
AY (n=43)	35	55	24
Moshav G. (n=22)	41	52	29
Moshav S. (n=115)	31	38	22
Inner-city School V. (n=115)	31	38	22
Suburban School B. (n=104)	57	72	37
Suburban School D. (n=37)	79*	79	

* Includes level A only.

With respect to Level C students, only those who started 8th and 9th grade (at the beginning of the school year) were tested on 7th and 8th grade material respectively (see Appendix 5D and 5E). The results are presented in Appendix 13 (A, B). One sees in this Appendix that the same pattern repeats itself. Overall mean scores remain way under the 40% mark, while the Level C students of the suburban school which was tested scored, on the average, 20-25 points higher. Breaking down the results by specific topics suggests that on several of them the achievement is so poor that either the topics were ignored by the teachers or were taught very poorly. Impressions gathered from conversations with the teachers imply that either the topics were skipped or the pace was so slow that they did not reach the point at which we tested them. Even if one looks at the anchor item means, the improvement from grade 8 to grade 9 was not remarkable.

(iii) Posttest results on the curriculum-based achievement tests. The data gathered from the curriculum-based achievement tests (for Level A and B students in all three grade levels), which were administered at the end of the school year (June 1987), were also analyzed by school, by grade and by level. The total test scores and sub-test scores in percentages per school are presented in Appendix 14 (A-D). Comparison of posttest results in this Appendix with the pretest results in Appendix 12 leads to the following observations.

* With respect to the sub-test of prerequisite knowledge (common fractions and decimals) and anchor items, there was a remarkable gain in almost all Level A and B classes tested. To illustrate this, the pre and post means of the same groups of students tested on these sub-tests are presented by school in Table 27.
* The posttest results on the different sub-tests of the regular curriculum

indicate that achievement was considerably higher in most of them than on the pretest. Apparently, many of the topics which were treated this year, were not covered or treated in depth in the previous year.

* The overall posttest results for the majority of the Level A and B classes tested are higher than the pretest results.
* Comparison of the means by grade and ability level for two successive years (the same test but different students) is presented in Table 28. The overall picture in Table 28 is encouraging. Particularly, in schools HR and MKR, which were relatively lower than the other schools, there was a visable gain in every Level A and B class. Regarding school AY, there was almost no gain in most of the classes, except for Level A students in Grade 9 where the gain was particularly high. As to school MKG, there was a decline in most of the classes, which is explained by the fact that students in this school were not taught math for approximately 30% of the school year, as indicated in the implementation difficulties section in Chapter IV.

With respect to Level C students, the posttest data gathered on them is presented for each grade level in Appendix 15 (A-C). As indicated before there was no pretesting of Level C students in Grade 9. Comparing the overall pre and posttest results for Grade 7 and 8 students, there was a slight positive change in most of the Level C classes (see Table 28). It should be pointed out that Levels C in these schools include many students who normally should be in special education classes.

To conclude this section on the impact of the project intervention on student achievement, the overall results show a moderate change in the positive direction.

Table 27: Comparison of Pre-Post Means in Percentages on Sub-Tests of Common Fractions, Decimals and Anchor Items, by School, by Grade and by Level

School	Grade in June 86	Level	Common Fractions		Decimals		Anchor Items	
			June 86	June 87	June 86	June 87	June 86	June 87
HR	7	A (girls)	29	72	52	94	45	82
		A (boys)	23	31	21	37	17	43
		B (girls)	30	50	33	64	27	40
	8	A (girls)	38	77	62	68	60	73
		B (boys)	20	48	30	62	31	72
MKR	7	A	30	67	32	74	34	79
		B	17	53	22	39	19	48
	8	A	53	89	42	89	65	86
MKG	7	A	51	60	61	76	64	76
		B	41	19	19	24	47	31
	8	A	53	59	27	59	56	78
		B	18	35	11	62	55	48
AY	7	A	52	82	67	90	70	77
		B1	33	35	31	53	37	59
		B2	38	50	23	32	33	25
	8	A	85	90	76	78	78	87
		B1	27	50	43	65	53	72
		B2	32	47	29	37	26	42

Table 28: Comparison of Pre-Post Means in Percentages by School, by Grade and by Level

School	Grade	Level A		Level B		Level C	
		June 86 Pre	June 87 Post	June 86 Pre	June 87 Post	Sep. 86 Pre	June 87 Post
HR	7	36	-	16	42	45	42
	8	45	68	16	38	46	50
	9	28	-	15	38		53
MKG	7	67	57	43	26	35	34
	8	39	67	34	13	31	39
	9	51	44	-	21		53
MKR	7	36	47	16	57	33	42
	8	35	49	12	22	32	49
	9	35	76	12	-		46
AY	7	72	69	34	33	35	34
	8	79	78	25	33	36	40
	9	55	70	24	30		47

VI. SUMMARY, IMPLICATIONS AND RECOMMENDATIONS

The preceding chapters of this final report on the Aronberg Project were devoted to a discussion of the problem, a delineation of the project's purpose, the background and rationale to the project, a presentation of the methodology, a description of its implementation and the difficulties encountered, and the analysis of the data. This final chapter of the report, is devoted to (1) a general summary of the project including the findings, (2) implications resulting from its comprehensive approach, and (3) recommendations for implementation of educational intervention programs.

1. Summary

Socially deprived schools in general, and mainly those in development towns, tend to be characterized by a high proportion of untrained mathematics teachers. The teachers in these schools are usually from socially deprived backgrounds themselves, and ill-equipped to deal even with ordinary classes, let alone with the special problem of the socially deprived. The existing shortage of competent mathematics teachers at the junior and senior high school level, makes the problem even more severe. Typically, the socially deprived students are characterized by under-achievement in junior high school mathematics, a problem which does not, however, start in junior high school. The Aronberg Project was aimed at the socially deprived student population of small development towns. Based on the accumulated experience of the mathematics group at the Weizmann Institute and reports in the professional literature, it was decided to try to cope with the problem

by a comprehensive approach which also takes into account most of the components involved in the instruction of mathematics. The main focus of the intervention program was the mathematics teacher, under the assumption that lasting change can only be accomplished in this way. It was assumed that the teachers are a vital element in solving the achievement problems of the socially deprived students. Hence, the goal of the Aronberg Project was to enrich teachers' mathematical knowledge and improve their didactical skills. Specifically, the project operated in four comprehensive junior high schools, located in three development towns, not far from the Weizmann Institute. The intervention involved all the mathematics teachers (n=20) in these schools, and their students (about one thousand). Based on official school reports and on our initial findings, it was found that most of the teachers lacked the appropriate formal credentials for teaching mathematics at the junior high school level.

The intervention program had two main components. One was the in-school guidance which was coordinated by a counsellor assigned to each of the participating schools. The second was a course of workshops for the teachers at the Weizmann Institute.

The role of the counsellor within the school was to provide group and individual guidance for the teachers and, in addition, to assist with managerial aspects of instruction. The counsellors provided the mathematics teachers with feedback based mainly on classroom observations. Curriculum planning, pace of instruction, books and teaching aids, selected topics to be taught and methods of evaluating student achievement, were some of the themes elaborated upon in the

group meetings and in the conferences with the individual teachers. The counsellors did not possess any administrative supervising authority. Indeed, they did their best to create a supportive and encouraging atmosphere in every contact with the teachers. Obviously, the counsellor's role is very complicated and requires both experience and high competency.

The workshop course (which consisted of 18 meetings x 5 hours) was aimed at enhancing both the mathematical and the didactical competencies of the teachers. The mathematical subjects were mainly concerned with strengthening their understanding of the structure of the real number system, coordinate geometry, linear algebra and the quadratic function. Most of the planned material, explanations and exercises were prepared with emphasis on their relationship to both the topics being taught at the junior high level and practical applications. The didactical sessions were devoted to creative activities such as dealing with classroom worksheets and games, and developing and preparing tools for evaluation of achievement in the classroom. Open discussion of teaching issues was also an integral part of almost each didactical session.

The various activities of the Aronberg Project were evaluated systematically in order to assess the impact of the project on the participating teachers and on their students, and in order to supply the project staff and the participating schools with continuous feedback. The evaluation instruments included student achievement tests, a classroom environment scale, classroom observation forms and various questionnaires administered to the teachers, including needs and contribution assessment and a teacher mathematical knowledge test. In

general, the instruments were administered at least twice in order to determine the progressive effect of the project activities.

The implementation of the Aronberg Project faced several difficulties which fall into two categories. One category consisted of attitudinal problems arising from the heterogeneous nature of the teachers' background, outlook and motivation. The second category included the technical and objective difficulties arising from the scheduling practices in the schools, equipment problems and often "external" complicating factors. At the outset of the project most of the teachers seemed not to be aware of their lack of preparedness to handle the teaching of mathematics. They also, collectively as teachers, saw no responsibility for their students' failure. Another major tension in the program was the presence of the observer in the classroom. Many of the teachers felt this was an intrusion and that they were under surveillance. Toward the end of the school year, it seems that we succeeded in awakening teacher awareness of the need to change and were able to diminish the teacher-counsellor tension.

The analysis of the data gathered by the counsellors through their classroom observations, showed that at the start of the school year the teachers' performance in the classroom was deficient in many ways: in preparation of lessons,in efficient use of time, in varying teaching methods, and in awareness of student difficulties. The data accumulated during the project indicate an overall positive change in teacher performance in the classroom, especially with respect to lesson preparation and efficient use of time, but teacher performance still needs improvement in other areas: most particularly, in varying teaching

materials, asking questions and awareness of student difficulties.

Another area, in which the impact of the project was in evidence, is the teachers' mathematical knowledge. Specifically, the mathematical section of the workshop course had a positive effect on teacher knowledge. Most of the teachers who participated in the course made significant gains, and some of them more than doubled their performance from pre to post testing.

With respect to student achievement, the results indicate an overall improvement in most of the classes tested. Nevertheless, the achievement at the end of the school year was still unsatisfactory, especially for the Level B students. Specifically, in two schools, every grade and ability level made noticeable gains on the Curriculum-Based Achievement Tests and Prerequisite Knowledge sub-tests. In another school, while in the 7th and 8th grade classes there was almost no change, in all 9th grade classes there were relatively high gains, especially for Level A students. In only one school, due to a severe problem of teacher turnover, the achievement of several classes did not improve and occasionally even declined.

Feedback from the teachers was obtained through mid-year interviews, summing up sessions and the contribution assessment questionnaires. The teachers expressed an overall feeling of having gained from the project and were positive in their reaction to the project. Towards the end they realized the importance of the observations and the interaction with the counsellors. These feelings were supported by the contribution assessment data.

The trends noted here are in a positive direction, but must be viewed as one small step on a long road. Changes in teacher behavior are difficult to achieve. Not only must incompetent behavior be ameliorated but first the teacher must be made aware that such changes are necessary. We believe that we have accomplished this awareness, awakening in the teacher a consciousness of accountability. Again, we emphasize that there is no "magic formula" to effecting significant change in such a short period of time. Professional growth and development takes time.

2. Implications

The total intervention model of this project which was holistic, necessarily dictates several general rules of operation. One is that all teachers in the school participate in the project and that all aspects of their managerial and didactical activities be assessed and discussed. The teachers themselves form a heterogeneous group, not only in their formal mathematics background and motivation to improve their teaching, but also in their sense of commitment to the program. As mentioned earlier, many of the teachers initially refused to accept any responsibility whatsoever for the poor performance of their own students in particular, and of the school in general. Hence, the teachers must first accept some sense of being held accountable for their activities in the classroom. Large numbers of students fail year after year and, perhaps, some part of the causes for this failure lies with the teachers themselves and their sense of commitment toward excellence. If the teachers hold themselves responsible for their students' behavior, at least to some degree, then, and only then, can a meaningful remediation

of their pedagogical skills occur.

Hence, one of the first steps in a program of this type is to help the teachers accept the idea that they must accept some responsibility for the performances of their students. Convincing them of this, however, is not easy accomplished and relies heavily on having a skilled project staff.

Another implication of this comprehensive approach, is that staff members must be highly competent in several areas. Not only must they possess a comprehensive understanding of the cognitive and structural aspects of the curriculum, but they must be very sensitive to the problems surrounding the teachers. Indeed, the project staff members must also be "psychologists".

Participating in a total intervention program such as this is frustrating for both project staff and the teachers. On the one hand, the project staff members must awaken a sense of responsibility in the teacher as well as impart to them technical and didactical skills. On the other hand, such skills are not easily acquired, and developing a sensitivity toward the learning problems of students takes patience, especially when one does not see immediate results in the classroom. Hence, for both the teachers and the counsellors, patience and interaction are of prime importance, and the intervention program must be flexible enough to allow these to occur. Progress is slow, but it can occur if there is a positive atmosphere in the work with the teachers, and this depends solely on the project staff.

It is also important that the staff members have an opportunity to

meet and discuss problems with one another on a regular basis. This interaction is further enhanced if they meet with members working on similar projects. The strength of a total intervention program such as the Aronberg Project depends on its personnel, and great care must be taken in choosing it.

An additional implication is related to the evaluation of the program. Several different evaluation instruments must be constructed in order to assess the overall importance of such a program. The instruments must be sensitive enough to detect changes in teacher behavior in the classroom, in their attitudinal and cognitive level, and changes in student performance. These instruments must be tailor-made to fit the population. Attitudinal questionnaires for example, may be appropriate for 7th grades in the A and B level, but not for those in the C level, because of the reading demands they make. Evaluating the impact of a program is something which must be taken into account from its very beginning, often before work with the teachers even starts. Moreover, instruments must be reliable and valid for an accurate documentation to take place, and development of such instruments takes time.

The most important implication of the nature of such an intervention is with regard to the length of operation. It is hard to be precise about a time scale for intervention programs like the Aronberg Project. However, all our experience has shown that one year of work is certainly not enough. From the data, we can document definite positive trends in the cognitive development, awareness and motivation of the teachers. But the quantum leaps everyone wants to occur just cannot happen over

night. These massive changes need time. We are trying to achieve permanent changes in the way a person thinks and behaves. Our experience with the Tel-Aviv Project, a different but similar intervention program, indicates that a minimal commitment of three years of intensive work with the teachers is required. Such a long term commitment is expensive, but this seems to be the only realistic path for obtaining substantive changes, and needs to be seen in the light of the thousands of children teachers teach in the course of their careers.

3. Recommendations

Based on our one year experience in operating the Aronberg Project by the comprehensive approach, the following recommendations for implementing educational intervention programs, are put forth.

1. A minimum commitment of at least 3 years should be made by all parties involved before commencing the project.
2. School principals should be involved with the program from its start to try to ensure the necessary conditions for a smooth implementation of the project.
3. Teachers should be convinced of the necessity for their full participation in the project from the outset. This can be done by discussing with them the hard data which exist concerning the standing of their students and themselves in the overall national educational picture. Also, special efforts should be made to impart the feeling that they, the teachers, are equal in status to all the project participants, and that their opinions and feelings are important and will be considered in planning activities. It should be made clear to teachers and principals that the counsellor's role

is a purely professional one, and that he does not hold any official power in the occupational life of the teachers. On the other hand, teachers commitment to participate should be genuine, and serious efforts on their part to improve should be rewarded financially or in other ways.

4. It is desirable to have in the program, schools with at least 5 mathematics teachers, in order for in-school activities to be efficient. In the event that a workshop course is planned, it should include at least 20 teachers, in order to facilitate group work with teachers of similar backgrounds and needs.
5. In the first stage of the intervention, the focus of the in-school activities should be on both assisting the teachers with the managerial aspects of the curriculum and identifying deficiencies in teacher performance by frequent in-class observations. Soon after this stage, the counsellors should initiate group activities through demonstration lessons given either by themselves or by one of the better teachers.
6. Promising teachers from each of the participating schools should be identified and specially trained in order to gradually take over a leading role in their schools with support from the project staff.
7. The intervention program should be accompanied by continuous evaluation of teacher and student behavior. The feedback should also be used as a tool for promoting teacher motivation to proceed with the program.

REFERENCES

Anderson, G.J. (1973). The Assessment of Learning Environment. A manual for the Learning Environment Inventory and the My class Inventory. Halifax: Atlanta Institute of Education.

Ben-Chaim, D., Hershkowitz, R., & Bruckheimer, M. (1983). Inservice guidance: the consumer's view: survey and analysis. Studies in Educational Evaluation, 9, pp. 361-367.

Burnett-Strother, D. (1983). Inservice education. Practical applications of research, Newsletter of PHI DELTA KAPPA'S Center on Evaluation, Development and Research, 5(3). Bloomington, IN.

Chavez, R.C. (1984). The use of high-inference measures to study classroom climate: a review. Review of Educational Research, 54 (2), pp. 237-261.

Dreyfus, T., Hershkowitz, R., & Bruckheimer, M. (1987). Processes in the transition from syllabus to Curriculum. ZDM, 87/1, pp. 19-25.

Fresko, B. & Ben-Chaim, D. (1984). An Evaluation of Two In-service Courses for Mathematics Teachers. Rehovot: Department of Science Teaching, The Weizmann Institute of Science, 71P.

Fresko, B. & Ben-Chaim, D. (1986a). An Evaluation of In-service Courses for Mathematics Teachers - summer 1984 (Technical Report M86/1). Rehovot, Israel, Department of Science Teaching, The Weizmann Institute of Science.

Fresko, B., & Ben-Chaim, D. (1986b). Learning environment differences in the mathematics classroom. In Proceedings of the Tenth International PME Conference, London, England, 20-25 July, pp. 342-347.

Friedlander, A., Bruckheimer, M. & Albert, J. (in press). Counselling: A model for in-service teacher education. ZDM.

Good, T. & Brophy, J. (1974). An empirical investigation: Changing teacher and student behavior. Journal of Educational Psychology, 66, pp. 399-405.

Hershkowitz, R. (1979a). Entry behavior: the first false assumption. In D. Tall (Ed.) Proceedings of the Third International Conference for the Psychology of Mathematics Education. Warwick, U.K.: Mathematics Education Research Center, pp. 108-112.

-------- (1979b). Remedial Program for Reducing the Lack in Prerequisite Knowledge, (in Hebrew). Unpublished master thesis. Tel-Aviv University.

Hershkowitz, R. & Israeli, R. (1981). Who Is the Mathematics Teacher in Grades 7, 8 and 9 ? (Technical Report M81/4). Rehovot, Israel, Department of Science Teaching, Weizmann Institute of Science (in Hebrew).

Hofstein, A., & Ben-Zvi, R. (1980). The relationship between students' attitudes and achievement and classroom learning environment. Paper presented at the National Association for Research in Science Teaching Conference in Boston, Mass., April 11-13.

McLaughlin, M. & Marsh, D. (1979). Staff development and school change.

In Lieberman & Miller (Eds.), Staff Development: New Demands, New Realities, New Perspectives. New York, N.Y.: Columbia University, Teacher College Press, pp. 69-94.

O'Reilly, R. (1975). Classroom climate and achievement in secondary school mathematics classes. The Alberta Journal of Educational Research, 21, pp. 241-248.

Schein, E.H. (1972). Professional Education. New-York, N.Y.: McGraw-Hill, pp. 75-84.

Showers, B. (1983). Coaching: a training component for facilitating transfer of training. Paper presented at the annual meeting of the AERA, Montreal, Canada, April 11-15, 22P.

Shulman, L. (1979). Research on teaching: the missing link in curriculum implementation. In P. Tamir et al. (Eds.) Curriculum Implementation and its Relationship to Curriculum Development in Science. Jerusalem: Israel, Science Teaching Center, pp. 77-84.

Skemp, R.R. (1985). PMP: a progress report. In The Proceedings of the Ninth International Conference for the Psychology of Mathematics Education, Vol. 1. Noordwijkerhout, The Netherlands, pp. 447-452.

-------- (1986). From theory into practice. Unpublished manuscript. University of Warwick.

Wade, R.K. (1985). What makes a difference in inservice teacher education? A meta-analysis of research. Educational Leadership, December 1984/January 1985, pp. 48-54.

APPENDICES

APPENDIX 1-A

CLASSROOM OBSERVATION FORM

DATE _____

TEACHER _____

GRADE _____ LEVEL _____

COUNSELLOR _____

1. Lesson topic _____

2. Homework correction _____

_____

3. Teaching aids: textbook, worksheet, game, overhead projector, etc._____

4. Nature of classwork (portion of lesson)

	most	half	third	little	none
Frontal					
Group work					
Individual work					

5. Cognitive level of questions

	most	half	third	little	none
Knowledge and technique					
Comprehension and application					
Analysis and synthesis					

6. Class participation: most of the class, about half the class, a few

7. Homework assignment _____

_____

8. Comments on the mathematics _____

_____

*9. Were the objectives of the lesson attained? _____

_____

10. Other comments _____

_____

11. Recommendations _____

_____

---

* To be completed after the lesson, during the discussion with the observed teacher.

APPENDIX 1-B

CLASSROOM EVALUATION FORM

(SUMMARY OF CLASS OBSERVATION)

TEACHER _____ DATE _____

GRADE _____ LEVEL _____ EVALUATION (1-5) _____

COUNSELLOR _____

I. PREPARATION AND PLANNING

1) Prepared the lesson

2) Material presented at the appropriate level

3) Use of teaching aids

(worksheets, games, overhead projector, etc.)

4) Lesson was interesting

5) Mathematics was correct

II. ORGANIZATION OF THE LESSON

1) Efficient use of time

2) Efficient checking of homework

3) Discipline

4) Class has good work habits

5) Students had done their homework

III. TEACHING

1) Class atmosphere

2) Class participation

3) Appropriate response to students' remarks

4) Awareness of students' difficulties

5) Assigned appropriate homework

6) Clear explanations

7) Varied teaching methods

8) Varied cognitive level of questioning

IV. Were the objectives of the lesson obtained?_____

_____

V. Representative episode from the lesson (positive or negative)

_____

VI. Counsellor's recommendations for future work _____

_____

APPENDIX 2-A

Needs Assessment Questionnaire

Name: _____ School: _____

In planning the in-service activities for the teachers in the Aronberg Project, we would like to take into consideration the needs of each teacher. Below you will find a list of topics and modes of operation for activities. Next to each item, indicate to what extent its inclusion in the program is important to you.

I. Teaching Strategies and Activities

	Not at all important ⟷ Very important				
	1	2	3	4	5
1. Familiarization with the Rehovot Program textbooks					
2. Familiarization with teacher manuals					
3. Planning amount of material to be covered					
4. Reinforcement of prerequisite knowledge					
5. Introducing new topics					
6. Planning lessons					
7. Planning tests					
8. Use of transparencies					
9. Use of pocket calculator					
10. Planning worksheets					
11. Use of mathematical games					
12. Use of microcomputers					
13. Instructional approaches for mixed ability groups					
14. Instructional approaches for ability groups or special classes.....					
15. Adapting material to different ability levels					
16. Teaching problematic topics					
17. Difficulties encountered by different types of pupils ..					

18. Additional suggestions: _____

_____

_____

II. Treatment of specific curriculum topics

		Not at all important ⟷ Very important				
		1	2	3	4	5
Grade 7	1. Number bases					
	2. Signed numbers					
	3. Coordinate systems and graphical representations					
	4. Statistics (central measures of tendency).					
	5. Algebraic expressions					
	6. Equations and inequalities					
Grade 8	1. Set algebra					
	2. Algebraic techniques (simplification)					
	3. Solving equations & inequalities					
	4. Graphical representation of two equations with two unknowns					
	5. Word problems					
Grade 8-9	1. The deductive structure and the logical principles of Euclidean geometry					
	2. The basic concepts of Euclidian geometry such as: definitions, axioms, propositions and proofs					
	3. Congruence of geometrical figures.....					
	4. Similarity of geometrical figures					
	5. The polygons (triangles, quadrilaterals, ...) and their properties					
	6. The circle					
Grade 9	1. Basic concepts of functions					
	2. Algebraic and graphical representations of functions					
	3. Linear functions					
	4. Quadratic functions					
	5. Solving quadratic equations					

Additional suggestions: _____

III. Modes for in-service activities

	Not at all important ⟷ Very important				
	1	2	3	4	5
1. In-school group guidance					
2. Counsellor observation in class, followed by a discussion					
3. Individual guidance					
4. Observation and discussion of "open lessons" given by colleagues					
5. Observation and discussion of "open lessons" given by counsellors					
6. Meetings with teachers from other schools					

Additional suggestions: _____

_____

_____

APPENDIX 2-B

Contribution Assessment Questionnaire

Name: _____ School: _____

After one year of activities, we would like to get your opinion as to how much they have contributed to you. Please indicate next to each item to what extent you were helped.

I. Teaching Strategies and Activities

	Contributed nothing ← → Contributed very much				
	1	2	3	4	5
1. Familiarization with the Rehovot Program textbooks					
2. Familiarization with teacher manuals					
3. Planning amount of material to be covered					
4. Reinforcement of prerequisite knowledge					
5. Introducing new topics					
6. Planning lessons					
7. Planning tests					
8. Use of transparencies					
9. Use of pocket calculator					
10. Planning worksheets					
11. Use of mathematical games					
12. Use of microcomputers					
13. Instructional approaches for mixed ability groups					
14. Instructional approaches for ability groups or special classes					
15. Adapting material to different ability levels					
16. Teaching problematic topics					
17. Difficulties encountered by different types of pupils .					

II. Treatment of Specific Curriculum Topics

Contributed nothing ⟷ Contributed very much

	1	2	3	4	5
1. Treatment of topics included in Grade 7 curriculum (e.g. signed numbers, coordinated systems and graphical representation, statistics, equations and inequalities).....					
2. Treatment of topics included in Grade 8 curriculum (e.g. set algebra, algebraic techniques, solving equations & inequalities, word problems)					
3. Treatment of topics included in Grade 9 curriculum (e.g. algebraic and graphical representation, linear functions, quadratic functions).....					
4. Treatment of topics included in the junior high school curriculum for Euclidean geometry (e.g. axioms, congruence and similarity of geometrical figures, polygons and their properties).....					

III. Modes for in-service activities

	Contributed nothing ⟷ Contributed very much				
	1	2	3	4	5
1. In-school group guidance					
2. Counsellor observation in class followed by a discussion					
3. Individual guidance					
4. Observation and discussion of "open lessons" given by colleagues					
5. Observation and discussion of "open lessons" given by counsellors					
6. Meeting in the workshop course teachers from other schools					

IV. In general, what is your feeling about the project activities?

V. Conclusions and recommendations for a similar project in the future?

APPENDIX 3

Teacher Knowledge Measure

Aronberg Project - Mathematics Workshops

Mathematics Questionnaire

Name : _____

Date : _____

Part I: Indicate the correct answer.

1) One of the shorter sides of a right-triangle is increased by 10% while the other is decreased by 10%. How does the area of the new triangle compare to that of the old?

A. There is no difference.
B. The area is larger by 1%.
C. The area is smaller by 1%.
D. The area is larger by 5%.
E. The area is larger by 10%.

2) Calculate $(1 - \frac{1}{2})\cdot(1 - \frac{1}{3})\cdot(1 - \frac{1}{4})\cdot(1 - \frac{1}{5}) \ldots \cdot(1 - \frac{1}{10}) = ?$

A. $\frac{1}{9}$ B. $\frac{1}{10}$ C. $\frac{1}{2}$ D. $\frac{10}{11}$ E. $\frac{11}{12}$.

3) How many of the numbers between 100 and 400 contain the digit 2 ?

A. 100 B. 120 C. 138 D. 140 E. 148

4) In a particular school there are 1200 students. Every student has 5 lessons each day. Every teacher, teaches 4 lessons each day. In each lesson there are 30 students and one teacher. How many teachers are there in this school?

A. 30 B. 32 C. 40 D. 45 E. 50

5) Find the area of the triangle in the diagram.
The vertical and horizontal distance between adjacent points is one unit.

A. $\frac{\sqrt{2}}{2}$ B. $\frac{\sqrt{3}}{2}$ C. $\frac{3}{2}$ D. $\frac{5}{2}$ E. 4

6) What is the units digit in 387^{453} ?

A. 1 B. 3 C. 5 D. 7 E. 9

7) Given $S = 1! + 2! + 3! + \ldots + 99!$

What is the units digit in S ?

A. 0 B. 3 C. 5 D. 8 E. 9

8) Given $f(a, b, c) = \frac{a}{|a|} + \frac{b}{|b|} + \frac{c}{|c|} + \frac{abc}{|abc|}$

where a, b, and c are non zero real numbers.

What is the range of f?

A. $\{0\}$ B. $\{4\}$ C. $\{-4\}$ D. $\{-4,0,4\}$ E. $\{$all whole numbers$\}$

9) If $x \neq 0$, which values of x satisfy the inequality

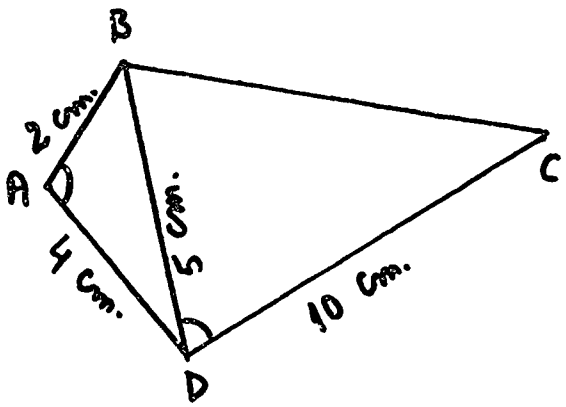
$$\frac{|x - |x||}{x} > 0$$

A. $x \neq 0$ B. $x \geq 0$ C. $x < 0$ D. No value of x

E. Every whole value of x except $x = 0$.

10) In the diagram, $\measuredangle BAD = \measuredangle BDC$.

The perimeter of ABCD is



A. $\frac{89}{4}$ cm B. $\frac{57}{2}$ cm C. 30 cm

D. 40 cm E. $\frac{49}{2}$ cm

Part II: Answer the following questions.

11) Given the set of natural numbers 1, 2, 3, ... and the new numbers

$\overline{1}, \overline{2}, \overline{3}, \ldots$

The operation * is defined in the following way

(i) For each natural number a there is a number $\overline{a}$ such that $a * \overline{a} = 1$.

(ii) The operation * is associative.

(iii) The operation * between any two natural numbers is ordinary addition.

(iv) The operation * between any two numbers gives a unique answer.

A. Compute: $5 * \overline{5} =$

B. Compute: $3 * 6 =$

C. Compute: $9 * \overline{4} =$

D. Prove that $5 * \overline{2} = \overline{2} * 5$ Explain all steps.

E. Compute: $\overline{3} * 7 =$ Explain all steps.

12) Is it possible to define an operation between the rational numbers in the following way?

$$\frac{a}{b} * \frac{c}{d} = \frac{a + c}{b + d}$$

Explain!

13) Given the following system of inequalities

$$x_1 \geq 0$$

$$x_2 \geq 0$$

$$x_1 + x_2 \leq 3$$

$$x_1 + 2x_2 \leq 4$$

Find the maximum of the function $y = 5x_1 + 12x_2$ under the constraints of this system.

14) A manufacturer produces 4 products A, B, C and D, each of which requires wood, plastic and steel in its construction. A requires 2 units of wood, 1 unit of plastic, and 4 units of steel. B requires 1 unit of wood, 3 units of plastic, and 2 units of steel. C requires 3 units of wood, 2 units of plastic, and 1 unit of steel. D requires 6 units of wood, no units of plastic, and 3 units of steel. The manufacturer has only 5 units of wood, 2 units of plastic, and 9 units of steel. His profit is 5 new shekel on each A, 4 new shekel on each B, 2 new shekel on each C, and 3 new shekel on each D.

The manufacturer wants to maximize his profit. Give the system of constraints and the target function of the problem.

APPENDIX 4

Interview Questions

The questions asked in the interview are listed below.

A. Questions on the in-school activities.

1. In general, do you feel the in-school activities have any effect?
2. How do you feel about the personal guidance?
3. What is your opinion of the observation form that the counsellor gives you after the lesson?
4. What would you like to change in the project's in-school activities?

B. Questions on the activities held in the Weizmann Institute.

1. What is your opinion of the mathematics part of the weekly workshops?
2. What is your opinion of the didactical part of the weekly workshops?
3. What changes would you like to be made?

C. A question on the overall project.

1. In general, what do you expect of the project?

All these questions were used to structure the discussion, various items came up during the interview and were pursued in depth.

APPENDIX 5-A

Curriculum - Based Achievement Test

Grade 7 - Level A & B

Name _____ School _____

Grade _____ Level _____

There is one correct answer for each question. Mark it.

1. $8 + 3 \cdot (5-6) =$

A) 5 B) 10 C) 11 D) -11 E) 17

2. $-2 \cdot 6 - 5 \cdot 2 =$

A) -2 B) 2 C) -14 D) -22 E) -34

3. $3 + \frac{8 - 4}{-2} =$

A) 5 B) 3 C) -5 D) 13 E) 1

4. $30 - 10:5 + 3 \cdot 4 =$

A) 28 B) 40 C) 124 D) 16 E) 20

5. The height of Jerusalem above sea level is (+ 800) m. The height of the Kinneret is (- 200) m.

What is the difference in height between these two places?

A) 600 m B) 1,200 m C) 1,000 m D) 400 m E) 1,600 m

6. Indicate the row in which the numbers appear in order of magnitude:

A) 0, -10, -2, 4, 15 B) -2,-10,0,4,15

C) 0, -2, 4, -10, 15 D) -10, -2, 0, 4, 15

E) 0, -2, -10, 4, 15

7. If (-7) is substituted for a in the expression $\frac{9 - a}{2}$ we obtain:

A) -1 B) 8 C) 1 D) -8 E) $11\frac{1}{2}$

8. Given the expression 4 + a, which number should be substituted for a to obtain 2?

A) 6 B) -6 C) 2 D) $\frac{1}{2}$ E) -2

9. $-(2x - 5) =$

A) -2x - 5 B) -7x C) 2x + 5 D) -2x + 5 E) 2x-5

10. An empty box weighs a kilograms. When the box is filled with books it weighs 40 kilograms.

Mark the expression which gives the weight of the books.

A) 40 + a B) 40 - a C) a - 40 D) 40·a E) 40:a

11. $2x + 5 - 3x =$

A) -x + 5 B) x + 5 C) 2x + 5 D) -x - 5 E) 4x

12. X represents the length of the route of the annual school outing. On the first day the students covered 5 km more than half of the length of the route.

Mark the expression which represents the distance travelled on the first day.

A) $\frac{x + 5}{2}$ B) $5\frac{1}{2}x$ C) $\frac{x}{2} + 5$ D) $\frac{5x}{2}$ E) $x + 2\frac{1}{2}$

13. In group A there are a students.
In group B there are b students.
In group B there are 5 students more than in group A.
Mark the correct statement.

A) $b = a - 5$ B) $b = a + 5$ C) $a > b - 5$ D) $b > a + 5$

E) $a > b + 5$

14. Which number satisfies the inequality $\frac{1 + 3x}{1 - 2x} > 0$?

A) 1 B) -1 C) 2 D) 3 E) 0

15. The number represented by a is multiplied by 5 and 3 is subtracted from the product. The result is larger than (-6).

Indicate the correct statement.

A) $5(a - 3) < -6$ B) $5(a - 3) > -6$ C) $3 - 5a > -6$

D) $5a - 3 > -6$ E) $5a - 3 < -6$

16. 8% of 400 is

A) 50 B) 320 C) 32 D) 0.32 E) 0.08

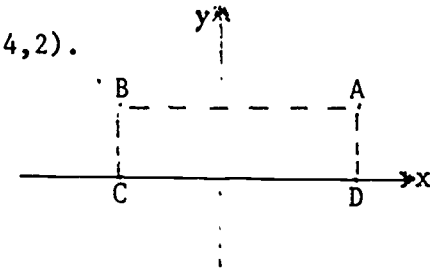
17. In the End-of-Year sale, all prices are reduced by 20%. K represents the price of a shirt before the reduction.

The reduction is represented by:

A) $\frac{k}{20}$ shekels B) $\frac{k \cdot 20}{100}$ shekels C) $\frac{80k}{100}$ shekels

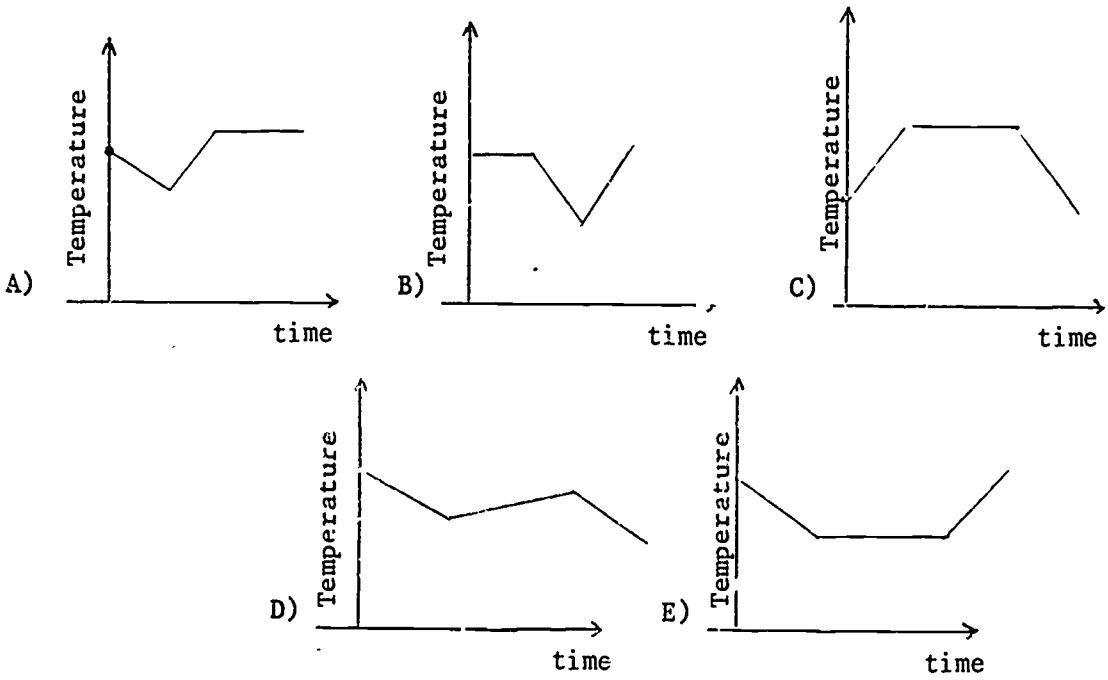
D) $\frac{k \cdot 100}{20}$ shekels E) k - 20 shekels

18. ABCD is a rectangle. The coordinates of A are (4,2).
The coordinates of B are (-3,).
Indicate the missing coordinate.



A) 2 B) -2 C) -4 D) 4 E) 3

19. The temperature of a sick person goes down in the morning, it does not change during the afternnon, but then goes up in the evening.
Indicate the graph which describes this situation.



20. If a and b are different, then: $\frac{a - b}{b - a} =$

A) 0 B) -1 C) 1 D) $\frac{a}{b} - \frac{b}{a}$ E) $\frac{a}{b} + \frac{b}{a}$

21. $12 : \frac{3}{4} =$

A) 9 B) 1 C) 16 D) $\frac{3}{48}$

22. $2\frac{1}{2} + 1\frac{2}{3} =$

A) $\frac{10}{5}$ B) $3\frac{3}{5}$ C) $4\frac{1}{6}$ D) $3\frac{1}{6}$

23. $\frac{2}{7}$ of 14 equals:

A) $14 : \frac{2}{7}$ B) $14 + \frac{2}{7}$ C) $14 - \frac{2}{7}$ D) $14 \times \frac{2}{7}$

24. $0.3 \times 0.2 =$

A) 0.6 B) 0.05

C) 0.06 D) 6

25. $15:60 =$

A) 4 B) 0.4

C) 2.5 D) 0.25

26. $10 - 6.30 =$

A) 4.30 B) 3.70

C) 3.30 D) 4.70

APPENDIX 5-B

Curriculum - Based Achievement Test

Grade 8 - Level A & B

Name _____ School _____

Grade _____ Level _____

For each question there is one correct answer. Mark it.

1. $-2 \cdot 6 - 5 \cdot 2 =$

A) -2 B) 2 C) -14 D) -22 E) -34

2. $3 + \frac{8 - 4}{-2} =$

A) 5 B) 3 C) -5 D) 13 E) 1

3. If (-7) is substituted for a in the expression $\frac{9 - a}{2}$ we obtain

A) -1 B) 8 C) 1 D) -8 E) $11\frac{1}{2}$

4. $-(2x - 5) =$

A) $-2x - 5$ B) $-7x$ C) $2x + 5$ D) $-2x + 5$ E) $2x - 5$

5. In the End-of-Year sale, all prices are reduced by 20%.
K represents the price of a shirt before the reduction.
The reduction is represented by

A) $\frac{k}{20}$ shekel B) $\frac{k \cdot 20}{100}$ shekel C) $-\frac{80k}{100}$ shekel

D) $\frac{k \cdot 100}{20}$ shekel E) k - 20 shekel

6. 8% of 400 is

A) 50 B) 320 C) 32 D) 0.32 E) 0.08

7. $(5^2)^3 =$

A) 5^8 B) $25 \cdot 3$ C) 5^6 D) 10^3 E) 5^5

8. $3^{-2} =$

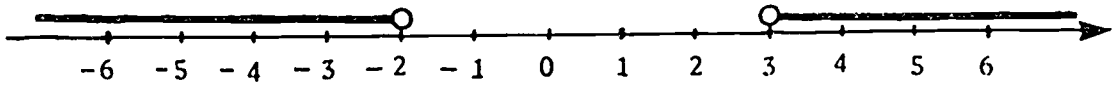
A) -6 B) 6 C) $-\frac{1}{9}$ D) $\frac{1}{9}$ E) -9

9. Given the sets $A = \{2,4,6,8\}$
$B = \{\text{even numbers between 1 and 9}\}$.

Which statement is false?

A) $A = B$ B) $A \subset B$ C) $B \subset A$ D) $A \cup B = B$ E) $A \cap B = \{\ \}$

10.



This graph represents which one of the following sets?

A) $\{a \mid a < -2 \text{ or } a > 3\}$ B) $\{a \mid -2 < a < 3\}$

C) $\{\ \}$ D) $\{a \mid 3 < a < -2\}$

E) $\{\text{all numbers}\}$

11. In group A there are a students.
In group B there are b students.
In group B there are 5 students more than in group A.

Mark the correct statement.

A) $b + 5 = a$ B) $b = a + 5$ C) $a > b - 5$ D) $b > a + 5$

E) $a > b + 5$

12. The sum of two numbers is 4 times their difference.
Indicate the corresponding statement.

A) $a + b > (a - b) \cdot 4$ B) $a + b = 4(a - b)$

C) $4(a + b) < a - b$ D) $a + b = a - b + 4$

E) $4(a + b) = a - b$

13. The price of a box of envelopes is 900 shekel. The price of a stamp is 140 shekel. Danny bought one box of envelopes and some stamps. He paid 3700 shekels in all. x represents the number of stamps he bought. Mark the corresponding equation.

A) $900 + 140x = 3700$ B) $x(900 + 140) = 3700$

C) $900x + 140 = 3700$ D) $140(900 + x) = 3700$

E) $\frac{900 + 140}{x} = 3700$

14. $(3x - 2)^2 + 4 =$

A) $9x^2$ B) $3x^2$ C) $9x^2 - 12x$ D) $9x^2 - 12x + 8$

E) $3x^2 - 12x + 8$

15. $(b \neq 0)$ $\dfrac{b + bc^2}{b} =$

A) $1 + bc^2$ B) $b + c^2$ C) $1 + c^2$

D) bc^2 E) c^2

16. $2ab(a - 3ab) =$

A) $2a^2b - 6a^2b^2$ B) $2a^2b - 6ab$

C) $2a^2b - 3ab$ D) $2a^2b - 3a^2b^2$

E) $2a^2b - 6ab^2$

17. The truth set of $-3x > 12$ is

A) $\{x \mid x > 4\}$ B) $\{x \mid x < 4\}$

C) $\{x \mid x < -4\}$ D) $\{x \mid x > -4\}$

E) $\{x \mid x > 15\}$

18. The solution of $2(x - 5) = 4(x + 1)$ is

A) $x = 5$ or $x = -1$ B) $x = -7$

C) $x = -3$ D) $x = -5\frac{1}{2}$

E) $x = 7$

19. Solve the following equation.

$$\frac{5x - 3}{2} + \frac{3x - 8}{4} = 3$$

20. Solve the following system of equations.

$$2x - y = 5$$

$$3(x - 1) + 2(y + 2) = 12$$

21. $12 : \frac{3}{4} =$

A) 9 B) 1 C) 16 D) $\frac{3}{48}$

22. $2\frac{1}{2} + 1\frac{2}{3} =$

A) $\frac{10}{5}$ B) $3\frac{3}{5}$ C) $4\frac{1}{6}$ D) $3\frac{1}{6}$

23. $\frac{2}{7}$ of 14 equals

A) $14 : \frac{2}{7}$ B) $14 + \frac{2}{7}$ C) $14 - \frac{2}{7}$ D) $14 \times \frac{2}{7}$

24. $0.3 \times 0.2 =$

A) 0.6 B) 0.05

C) 0.06 D) 6

25. $15:60 =$

A) 4 B) 0.4

C) 2.5 D) 0.25

26. $10 - 6.30 =$

A) 4.30 B) 3.70

C) 3.30 D) 4.70

APPENDIX 5-C

Curriculum - Based Achievement Test

Grade 9 - Level A & B

Name _____ School _____

Grade _____ Level _____

M/F

Mark the correct answers.

1. $7 : \frac{2}{3}$ is .

A) greater than 7 B) equal to 6 C) less than 7

2. $\frac{1}{4} + \frac{1}{8} =$

A) $\frac{1}{12}$ B) $\frac{3}{8}$ C) $\frac{2}{12}$ D) $\frac{2}{8}$

3. Mark the number greater than $\frac{2}{3}$.

A) $\frac{2}{5}$ B) $\frac{5}{6}$ C) $\frac{2}{4}$ D) $\frac{5}{9}$

4. $\frac{1}{8} =$

A) 0.125 B) 0.8 C) 0.025 D) 1.8

5. Which number lies between 0.1 to 0.2?

A) 0.15 B) 0.03 C) 0.21 D) 1.1

6. $0.012 : 0.4 =$

A) 0.003 B) 0.03 C) 0.3 D) 3

7. If (-7) is substituted for a in the expression $\frac{9 - a}{2}$ we obtain

A) -1 B) 8 C) 1 D) -8 E) $11\frac{1}{2}$

8. $-2 \cdot 6 - 5 \cdot 2 =$

A) -2 B) 2 C) -14 D) -22 E) -34

9. In the End-of-Year sale, all prices are reduced by 20%.
K represents the price of a shirt before the reduction.
The reduction is represented by:

A) $\frac{k}{20}$ shekel B) $\frac{k \cdot 20}{100}$ shekel C) $\frac{80k}{100}$ shekel

D) $\frac{k \cdot 100}{20}$ shekel E) k - 20 shekel

10. In group A there are a students.
In group B there are b students.
In group B there are 5 students more than in group A.

Mark the correct statement.

A) b + 5 = a B) b = a + 5 C) a > b - 5 D) b > a + 5

E) a > b + 5

11. The truth set to the equation $(a - b)x = (a - b)$ when $a \neq b$ is:

A) 1 B) $a^2 - b^2$ C) -1 D) $\frac{1}{a - b}$

E) 0

12. Which of the following expressions will always be negative?

A) $(-1 - a)^2$ B) $-(1 + a^2)$ C) $1 - a^2$ D) $-(1 + a)^2$

E) $-1 + a^2$

13. $(-\frac{1}{2} m^2n)^3 =$

A) $\frac{3}{2} m^6n^3$ B) $-\frac{1}{8} m^6n^3$ C) $-\frac{3}{2} m^5n^3$ D) $8m^6n^3$

E) $1\frac{1}{2} m^3n^3$

14. Indicate the missing expression in $(a + 2b)^2 = a^2 + |\_\_\_\_| + 4b^2$

A) $2ab$ B) $4a^2b^2$ C) $4ab$ D) 0 E) $2a^2b$

15. The slope of the line joining the points $(1,-1)$, $(-1,5)$ is:

A) 3 B) -3 C) $\frac{1}{3}$ D) $-\frac{1}{3}$ E) 2

16. The equation of the straight line with slope (-3), which meets the y-axis at the point $(0,1)$ is:

A) $3x - y - 1 = 0$ B) $x - 3y = 1$ C) $y + 3x - 1 = 0$

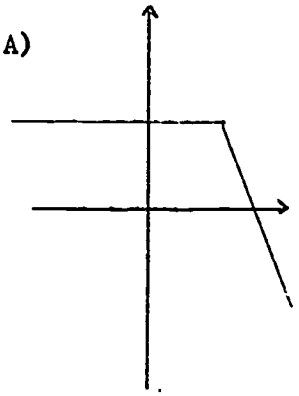
D) $y + 3x + 1 = 0$ E) $-3x + y = 1$

17. Given $f(x) = ax + 5$ and $f(6) = 8$, find $f(4)$.

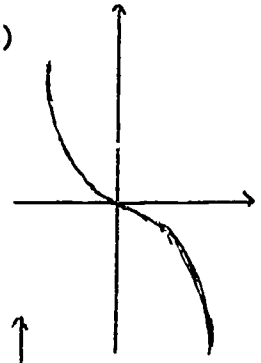
A. 6 B) 3 C) 7 D) 9 E) $\frac{1}{2}$

18. Indicate the graph which <u>does not</u> represent a function.

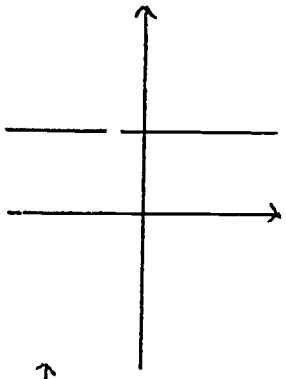
A)



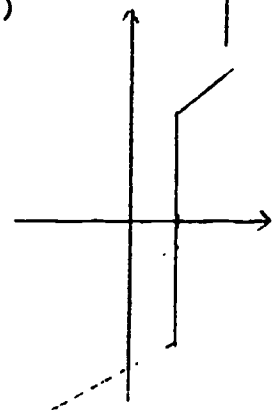
B)



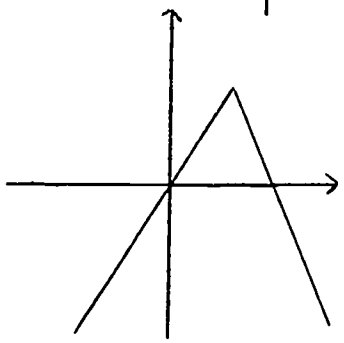
C)



D)



E)



19. Given the function $f(x) = x - 1$, indicate the image of $-\frac{1}{2}$.

A) $-1\frac{1}{2}$ B) -1 C) 0 D) $1\frac{1}{2}$ E) $\frac{1}{2}$

20. The equation of the straight line in the diagram is:

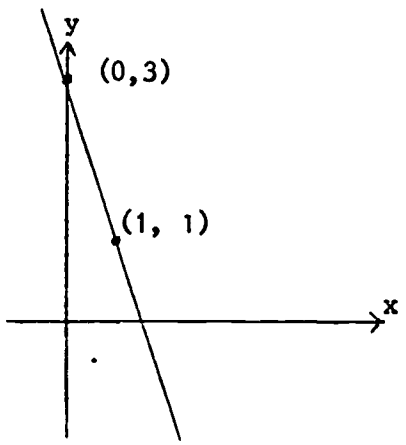
A) $y = -\frac{1}{2}x + 3$

B) $y = 2x + 3$

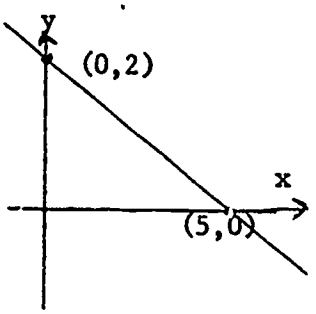
C) $y = \frac{1}{2}x + 3$

D) $y = -2x + 3$

E) $y = \frac{1}{2}x + \frac{1}{2}$



21. Indicate the domain for which the values of the functions given by the graph are positive:



A) $x > 5$ B) $x < 5$ C) $x > 0$

D) $0 < x < 5$ E) $2 < x < 5$

22. Given the theorem:

If a quadrilateral has three acute angles, then the fourth angle of the quadrilateral is obtuse.

One of the following claims is true. Which?

A) The theorem is true because it is possible to give an example:

B) The theorem is true. The sum of the angles in a quadrilateral is 360°. The sum of the three acute angles is less than 270° and hence the fourth angle is greater than 90°.

C) It is impossible to decide if the theorem is true, because we do not know the size of each angle in such a quadrilateral.

D) The theorem is not true, because it is possible to give a counter example.

23. Given the correct statement:

A quadrilateral with all sides equal is a parallelogram.
Indicate the correct reason.

A) Because the sides of every parallelogram are equal.

B) Because the quadrilateral is square.

C) Because the sides are equal, the angles are equal.

D) Because it has two pairs of opposite sides which are equal.

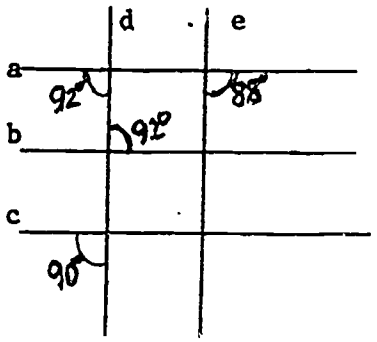
24. One of the following statements is not correct. Which?

A) a || b

B) a || c

C) c ⊥ d

D) d || e



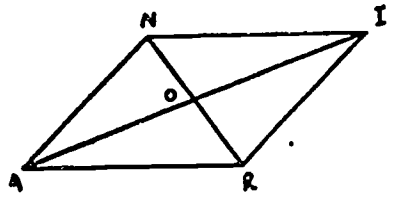
25. NIRA is a parallelogram.
One of the following statements is correct. Which?

A) IO is a median in Δ NIR.

B) Δ NIR is an isosceles triangle.

C) IO is an altitude in Δ NIR.

D) IO bisects ∢ NIR.



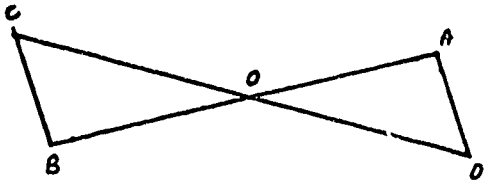
26. Given AD || CB. It follows that ∢ B = ∢ A:
Indicate the correct reason.

A) Because ΔAOD ≅ ΔBOC

B) Because alternate angles are equal.

C) Because ∢ A and ∢ B are alternate angles between the lines CB || AD.

D) Because the triangles ΔAOD and ΔBOC are isosceles triangles.



APPENDIX 5-D

Curriculum - Based Achievement Test

Grade 7 - Level C

Name _____ School _____

Grade _____ Level _____

For each question there is one correct answer. Mark it.

1. $2030 - 1478 =$

A) 662 B) 642 C) 652 D) 552

2. $257 \times 9 =$

A) 1853 B) 2286 C) 2313 D) 2303

3. There is no need to solve the following problem, but decide which arithmetic operation is necessary in order to solve it.

14 cans are placed into a carton. In each can there are 48 packages of crayons. How many packages of crayons are there in the carton?

A) Addition B) Subtraction C) Multiplication D) Division

4. $\frac{7}{4}$ is a number:

A) greater than 7 B) less than 2 C) greater than 4

D) less than 1

5. $\frac{1}{6}$ of the students in the class wear glasses. There are 24 students in the class. How many of them wear glasses?

A) 6 B) 12 C) 3 D) 4

6. $\frac{3}{5} + \frac{4}{5} =$

A) $\frac{7}{5}$ B) $\frac{7}{10}$ C) $\frac{9}{5}$ D) 4

7. $16 - 6:2 =$

A) 13 B) 3 C) 5 D) 11

8. $12 + 2 \cdot (5 - 1) =$

A) 56 B) 20 C) 21 D) 18

9. $\frac{10 - 4}{2} =$

A) 1 B) 8 C) 3 D) 7

10. Mark the smallest number:

A) -1 B) 0 C) $\frac{1}{2}$ D) -5

11. $(-2) \cdot (-5) =$

A) -10 B) 10 C) -7 D) 7

12. Which number is missing? $(+9) + \square = (+5)$

A) -4 B) 4 C) 0 D) -14

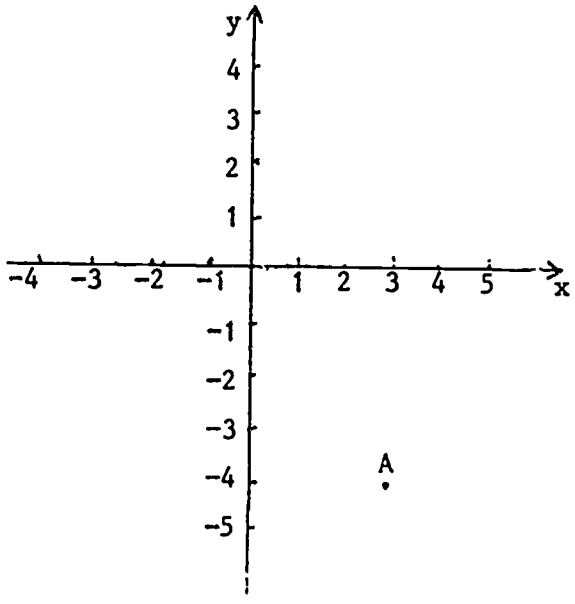
13. $5 - 8 + 10 =$

A) 13 B) -13 C) 23 D) 7

14. The coordinates of A are:

A) (3,4) B) (-3,-4)

C) (3, -4) D) (-4,3)



15. Another name for 20% is:

A) $\frac{1}{4}$ B) $\frac{1}{20}$ C) 20 D) $\frac{1}{5}$

16. The exercise which represents the computation of 25% of 160 is:

A) $\frac{25 \cdot 100}{160}$ B) $\frac{25 \cdot 160}{100}$ C) $25 \cdot 160$ D) $\frac{100 \cdot 160}{25}$

17. 50% of 200 shekels is:

A) 100 shekels B) 200 shekels C) 400 shekels D) 250 shekels

18. The price of a watch was 60 shekel. The price is raised by 25%, what is the new cost of the watch?

A) 75 shekels B) 85 shekels C) 200 shekels D) 250 shekels

19. If -3 is substituted for x in the expression $10 + 2x$, we obtain:

A) 4 B) 0 C) -36 D) 16

20. The solution of the equation $4a - 2 = 18$ is:

A) -5 B) 5 C) 4 D) -4

21. Indicate the expression equivalent to $3a + 4 + 2a - 1$.

A) $5a + 5$ B) $8a$ C) $a + 3$ D) $5a + 3$

22. $12 - 4x + 5x =$

A) $12 - 9x$ B) $3x$ C) $12 + x$ D) $12 - x$

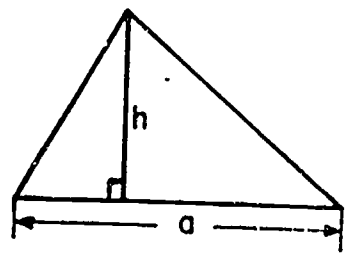
23. Danny has "a" stamps and Joseph has 15 stamps more.
The expression which represents the number of stamps they have <u>together</u> is:

A) $2a + 15$ B) $a + 15$ C) $a - 15$ D) $2a$

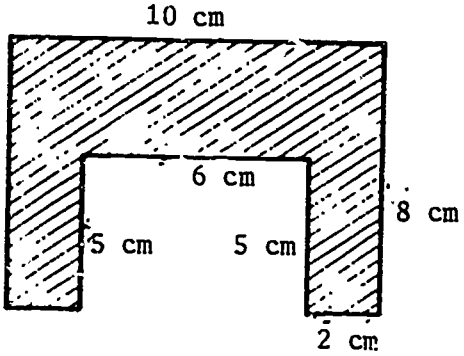
24. The expression which gives the area of the triangle is:

A) $a \cdot h$ B) $\frac{a + h}{2}$

C) $\frac{a \cdot h}{2}$ D) $a + h$



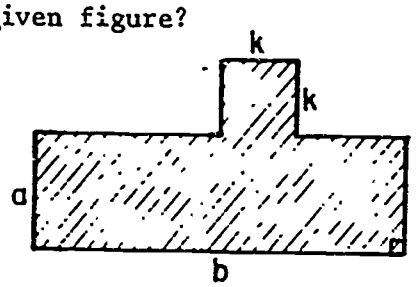
25. What is the area of the given figure?



A) 7 cm² B) 50 cm²

D) 10 cm² D) 110 cm²

26. Which expression represents the area of the given figure?



A) a + b + k² B) ab + 2k

C) ab + k² D) a + b + 2k

APPENDIX 5-E

Curriculum - Based Achievement Test

Grade 8 - Level C

Name _____ School _____

Grade _____ Level _____

M/F

For each question there is one correct answer. Mark it.

1. $2030 - 1478 =$

A) 662 B) 642 C) 652 D) 552

2. $257 \times 9 =$

A) 1853 B) 2286 C) 2313 D) 2303

3. There is no need to solve the following problem, but decide which arithmetic operation is necessary in order to solve it.

14 cans are placed into a carton. In each can there are 48 packages of crayons. How many packages of crayons are there in the carton?

A) Addition B) Subtraction C) Multiplication D) Division

4. $\frac{7}{4}$ is a number:

A) greater than 7 B) less than 2 C) greater than 4

D) less than 1

5. $\frac{1}{6}$ of the students in the class wear glasses. There are 24 students in the class. How many of them wear glasses?

A) 6 B) 12 C) 3 D) 4

6. 0.3^2 =

A) 0.9 B) 0.6 C) 0.09 D) 0.06

7. 45.4 - 3.12 =

A) 42.32 B) 42.48 C) 42.28 D) 1.42

8. 16 - 6:2 =

A) 13 B) 3 C) 5 D) 11

9. 12 + 2 (5 - 1) =

A) 56 B) 20 C) 21 D) 18

10. Indicate the smallest number.

A) -1 B) 0 C) $\frac{1}{2}$ D) -5

11. Indicate the missing number in (+9) + $\boxed{\quad}$ = (+5)

A) -4 B) 4 C) 0 D) -14

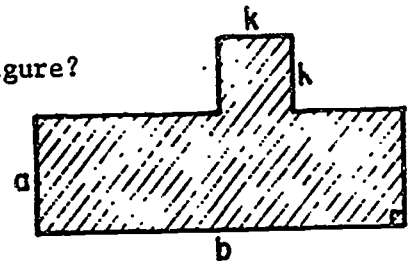
12. Another name for 20% is:

A) $\frac{1}{4}$ B) $\frac{1}{20}$ C) 20 D) $\frac{1}{5}$

13. 50% of 200 shekels is:

A) 100 shekel B) 200 shekel C) 400 shekel D) 250 shekel

14. Which expression describes the area of the figure?



A) $a + b + k^2$ B) $ab + 2k$

C) $ab + k^2$ D) $a + b + 2k$

15. If -3 is substituted for x in the expression $10 + 2x$, we obtain:

A) 4 B) 0 C) -36 D) 16

16. $12 - 4x + 5x =$

A) $12 - 9x$ B) $3x$ C) $12 + x$ D) $12 - x$

17. $2(a + 1) + 5(a + 3) =$

A) $7a + 4$ B) $7a + 17$ C) $2a + 4$ D) 24

18. If 3 is substituted into the expression $\frac{1 - 3a}{2}$ we obtain:

A) 5 B) 3 C) -3 D) -4

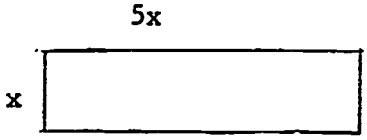
19. A merchant sells "a" shirts on the first day. On the second day he sells 3 shirts more than he did on the first day. Altogether he sold 13 shirts. Mark the corresponding equation.

A) $a + 3 = 13$ B) $3a = 13$ C) $a + 3 + 3 = 13$ D) $2a + 3 = 13$

20. The solution of the equation $\frac{m - 6}{2} = 2$ is:

A) 5 B) 2 C) 8 D) 10

21. The perimeter of the given rectangle is 90 cm.
Mark the correct equation.



A) $x + 5x = 90$ B) $x + 5x + x + 5x = 90$

C) $x \cdot 5x = 90$ D) $2x \cdot 5x = 90$

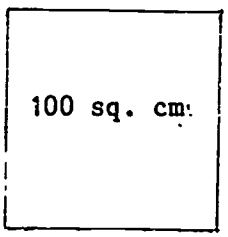
22. $10 + 2 \cdot \sqrt{36} - 3^2 =$

A) 63 B) 13 C) 16 D) 19

23. One of the following numbers is greater than 7. Which?

A) $\frac{1}{2} \cdot \sqrt{100}$ B) $\sqrt{50}$ C) $\sqrt{45}$ D) $2 + \sqrt{16}$

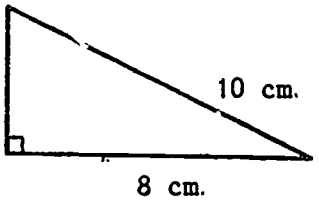
24. The area of the given square is 100 cm².
The length of its side is:



A) 10 cm B) 20 cm

C) 50 cm D) 25 cm

25. The missing length is:



A) 36 cm B) 18 cm

C) 2 cm D) 6 cm

APPENDIX 5-F

Curriculum - Based Achievement Test

Grade 9 - Level C

Name _____ School _____

Grade _____ Level _____

M/F

For each question there is one correct answer. Mark it.

1. 2030 - 1478 =

   A) 662 B) 642 C) 652 D) 552

2. 257 x 9 =

   A) 1853 B) 2286 C) 2313 D) 2303

3. There is no need to solve the following problem, but decide which arithmetic operation is necessary in order to solve it.

   14 cans are placed into a carton. In each can there are 48 packages of crayons. How many packages of crayons are there in the carton?

   A) Addition B) Subtraction C) Multiplication D) Division

4. $\frac{7}{4}$ is a number:

   A) greater than 7 B) less than 2 C) greater than 4 D) less than 1

5. $\frac{1}{6}$ of the students in the class wear glasses. There are 24 students in the class. How many of them wear glasses?

   A) 6 B) 12 C) 3 D) 4

6. 0.3^2 =

   A) 0.9 B) 0.6 C) 0.09 D) 0.06

7. $45.4 - 3.12 =$

A) 42.32 B) 42.48 C) 42.28 D) 1.42

8. $16 - 6 : 2 =$

A) 13 B) 3 C) 5 D) 11

9. $12 + 2(5 - 1) =$

A) 56 B) 20 C) 21 D) 18

10. Indicate the smallest number

A) -1 B) 0 C) $\frac{1}{2}$ D) -5

11. Indicate the missing number in $(+9) + |\square| = (+5)$

A) -4 B) 4 C) 0 D) -14

12. Another name for 20% is:

A) $\frac{1}{4}$ B) $\frac{1}{20}$ C) 20 D) $\frac{1}{5}$

13. 50% of 200 shekels is:

A) 100 shekel B) 200 shekel C) 400 shekel D) 250 shekel

14. If (-3) is substituted for x in the expression $10 + 2x$, we obtain

A) 4 B) 0 C) -36 D) 16

15. $12 - 4x + 5x =$

A) $12 - 9x$ B) $3x$ C) $12 + x$ D) $12 - x$

16. The solution of the equation $2(x + 4) = 24$ is :

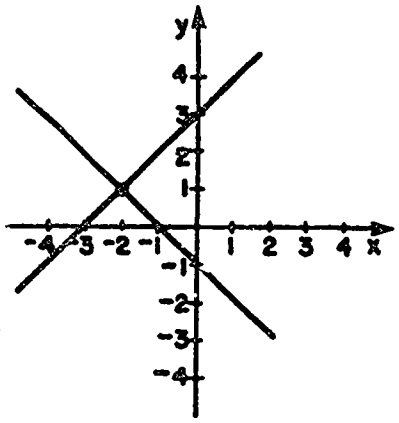
A) 10 B) 3 C) 8 D) 4

17. Solve the following system of equations and mark the solution.

$$y + 2x = 2$$
$$y = x + 8$$

A) (2, 10) B) (-2, 6) C) (-2, 10) D) (6, -2)

18. Mark the pair which corresponds to the intersection point of the two straight lines in the diagram.



A) (2, 1) B) (1, 2)

C) (-2, 1) D) (1, -2)

19. Mark the largest value:

A) 10% of 70 B) $3^2 - 2$

C) $2 \cdot \sqrt{16}$ D) $5 \cdot 1\frac{1}{2}$

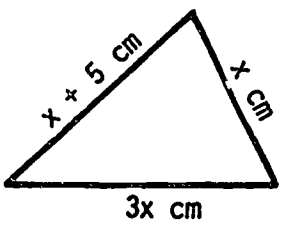
20. Substitute m = 4 in the formula $A = \frac{50 + 2m^2}{2}$ and mark the number obtained.

A) 41 B) 33 C) 66 D) 57

21. The sum of the ages of Yossi, Danny and Moshe is 24 years.
Danny is twice as old as Yossi and Moshe is 4 years older than Danny.
What is the age of Yossi? Mark the correct answer.

A) 4 years B) 5 years C) 3 years D) 6 years

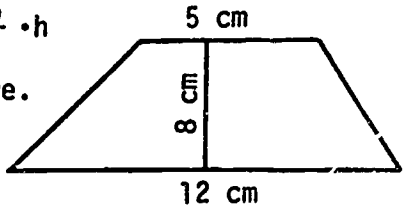
22. The perimeter of the triangle is 25 cm.
What is the length of its smallest side?



A) 3 cm B) 6 cm

C) 4 cm D) 9 cm

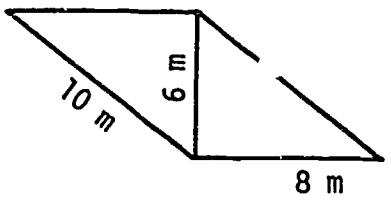
23. Use the formula for the area of a trapezoid $S = \frac{a+b}{2} \cdot h$ and calculate the area of the trapezoid in the figure.



A) 68 cm^2 B) 25 cm^2 C) 134 cm^2 D) 88 cm^2

24. Mark the perimeter of the parallelogram in the diagram.

A) 18 m B) 36 m C) 24 m D) 48 m



25. Mark the area of the parallelogram.

A) 80 m^2 B) 18 m^2 C) 96 m^2 D) 48 m^2

APPENDIX 6-A

Prerequisite Knowledge Test

Natural Numbers Test

Name _____ School _____

Grade _____ Level _____

Note:

There are 16 questions in this test. Mark the correct answer. For each question there is one correct answer.

Number Operations

1. 487 + 987 =

   a) 1464 b) 1474 c) 1364 d) 464

2. 595 + 968=

   a) 1563 b) 1553 c)1463 d) 1453

3. 3566 + 536=

   a) 3092 b) 3102 c) 4102 d)4002

4. 1757 - 789=

   a) 968 b) 1078 c) 978 d)1032

5. 2030 - 1478=

   a) 662 b) 642 c) 652 d) 552

6. 4102 - 3566=

   a) 546 b) 636 c) 536 d) 1464

7. 257 x 9 =

a) 1853 b) 2286 c) 2313 d) 2303

8. 203 x 42 =

a) 8126 b) 8526 c) 8546 d) 1218

9. 405 x 103 =

a) 40,015 b) 41,805 c) 41,715 d) 5265

10. 1360 : 4 =

a) 34 b) 340 c) 1090 d) 315

11. 1800 : 45

a) 4 b) 40 c) 310 d) 31

12. 741 : 19 =

a) 70 b) 39 c) 381 d) 309

Word Problems

Do not solve the following problems! Indicate the operation you would use to solve them.

13. There are 14 boxes in each carton. In each box there are 48 packages of crayons. How many packages of crayons in a carton.

a) addition b) subtraction c) multiplication d) division

14. 12 chocolate bars cost $ 3.50. How much does one chocolate bar cost?

a) addition b) subtraction c) multiplication d) division

15. Club members get a discount of 5 cents for each cake they buy at the cafeteria. One member bought 168 cakes during the year. What was the total discount he got during the year?

a) addition b) subtraction c) multiplcation d) division

16. The area of a lot is 420 m^2. The area of the house built on this lot is 115 m^2. What is the area of unbuilt land?

a) addition b) subtraction c) multiplication d) division

APPENDIX 6-B

Prerequisite Knowledge Test

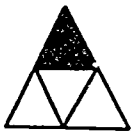
Common Fractions Test

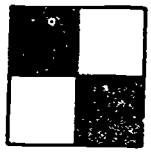
For each question there is one correct answer. Mark it on the answer sheet. Do not write in this booklet.

1. What part is shaded?

A) $\frac{6}{6}$ B) $\frac{5}{6}$ C) $\frac{1}{6}$ D) $\frac{1}{5}$

2. In which drawing is $\frac{1}{3}$ of the area shaded?



3. $\frac{1}{3}$ =

A) $\frac{3}{6}$ B) $\frac{3}{12}$ C) $\frac{3}{15}$ D) $\frac{5}{15}$

4. $\frac{4}{6}$ =

A) $\frac{2}{3}$ B) $\frac{1}{3}$ C) $\frac{2}{5}$ D) $\frac{3}{12}$

5. Which fraction is greater than $\frac{2}{3}$?

A) $\frac{2}{4}$ B) $\frac{2}{5}$ C) $\frac{5}{6}$ D) $\frac{5}{9}$

6. The largest number is

A) $\frac{4}{7}$ B) $\frac{4}{9}$ C) $\frac{4}{10}$ D) $\frac{4}{11}$

7. $\frac{7}{4}$ is

A) less than 1
B) less than 2
C) greater than 4
D) greater than 7

Multiplication

8. $\frac{11}{4}$ =

A) $2\frac{3}{4}$ B) $1\frac{1}{4}$ C) $8\frac{3}{44}$ D) $10\frac{1}{4}$

9. $3\frac{1}{6}$ =

A) $\frac{4}{6}$ B) $\frac{10}{6}$ C) $\frac{19}{6}$ D) $\frac{31}{6}$

10. $\frac{2}{3} \times \frac{4}{5}$ =

A) $\frac{6}{8}$ B) $\frac{12}{10}$ C) $\frac{10}{12}$ D) $\frac{8}{15}$

11. $\frac{2}{3} \times 4$ =

A) $\frac{6}{3}$ B) $\frac{8}{3}$ C) $\frac{2}{12}$ D) $\frac{8}{12}$

12. $5 \times \frac{3}{4}$ =

A) $\frac{15}{4}$ B) $\frac{20}{3}$ C) $\frac{3}{20}$ D) $\frac{15}{20}$

13. $8 \times \frac{3}{4}$ equals a number

A) less than 8 B) equal to 8 C) greater than 8

14. $\frac{2}{7}$ of 14 is the same as

A) $14 \div 7$ B) $14 + \frac{2}{7}$ C) $14 - \frac{2}{7}$ D) $14 \times \frac{2}{7}$

15. $\frac{1}{6}$ of the students in the class wear glasses. There are 24 students in the class. How many wear glasses?

A) 3 B) 4 C) 6 D) 12

Division

16. $5 \div 3$ can also be written

A) 5×3 B) $\frac{8}{5}$ C) $\frac{5}{3}$ D) $\frac{1}{5 \times 3}$

17. $\frac{5}{8} \div \frac{5}{2} =$

A) $\frac{1}{4}$ B) $1\frac{1}{4}$ C) 4 D) $\frac{25}{16}$

18. $\frac{3}{5} \div 2 =$

A) $\frac{5}{2}$ B) $\frac{6}{5}$ C) $\frac{5}{6}$ D) $\frac{3}{10}$

19. $12 \div \frac{3}{4} =$

A) $\frac{3}{48}$ B) 1 C) 9 D) 16

20. $7 \div \frac{2}{3}$ equals a number

A) greater than 7 B) equal to 7 C) less than 7

21. There are $1\frac{1}{2}$ bars of chocolate to be shared equally among 6 children. How much does each child get ?

A) $\frac{1}{6}$ of a bar B) $\frac{1}{4}$ of a bar C) $\frac{1}{2}$ of a bar D) 4 bars

22. A juice bottle holds $\frac{3}{4}$ of a quart. How many of these bottles can be filled from 3 quarts of juice?

A) $2\frac{1}{4}$ bottles B) 3 bottles C) $3\frac{3}{4}$ bottles D) 4 bottles

Addition and Subtraction

23. Complete and mark the correct answer.

$$\frac{5}{11} + \square = 1$$

A) $\frac{11}{5}$ B) $\frac{5}{11}$ C) $\frac{6}{11}$ D) $\frac{17}{22}$

24. $\frac{3}{5} + \frac{4}{5} =$

A) $\frac{4}{3}$ B) $\frac{7}{5}$ C) $\frac{9}{5}$ D) $\frac{9}{5}$

25 $\frac{1}{4} + \frac{1}{8} =$

A) $\frac{2}{8}$ B) $\frac{3}{8}$ C) $\frac{1}{12}$ D) $\frac{2}{12}$

26. $\frac{2}{5} - \frac{1}{3} =$

A) $\frac{1}{2}$ B) $\frac{1}{8}$ C) $\frac{1}{15}$ D) $\frac{3}{15}$

27. $6 - \frac{2}{3} =$

A) $5\frac{1}{3}$ B) $\frac{4}{3}$ C) $5\frac{2}{3}$ D) $6\frac{2}{3}$

28. $2\frac{1}{5} - \frac{3}{5} =$

A) $\frac{2}{5}$ B) $1\frac{2}{5}$ C) $1\frac{3}{5}$ D) $2\frac{2}{5}$

29. $2\frac{1}{2} + 1\frac{2}{3} =$

A) $3\frac{1}{6}$ B) $4\frac{1}{6}$ C) $3\frac{3}{5}$ D) $\frac{10}{5}$

30. A hike lasted 3 days. On the first day the hikers covered $\frac{1}{5}$ of the distance and $\frac{2}{5}$ of the distance on the second day. What distance did they hike on the 3rd day?

A) $\frac{1}{5}$ B) $\frac{7}{10}$ C) $\frac{3}{5}$ D) $\frac{2}{5}$

APPENDIX 6-C

Prerequisite Knowledge Test

Decimal Test

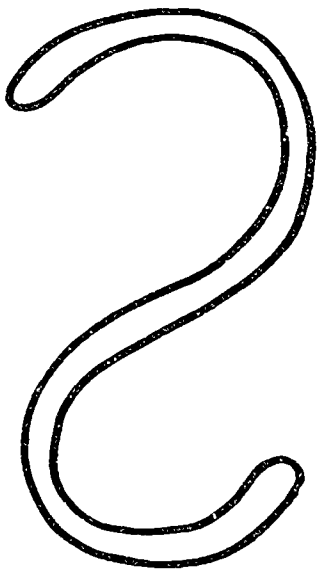
Note:

There are 30 questions in this test.

For each question there is one correct answer.

Do not write in this booklet.

Write your answers on the answer sheet.



Decimal concepts

1. In which of the following does the numeral 2 represent two tenths?

   A) 3.27 B) 3.72 C) 32.7 D) 23.7

2. Which number is greatest?

   A) 0.36 B) 2 C) 0.4 D) 1.11

3. Which of these numbers is between 0.1 and 0.2?

   A) 0.15 B) 0.03 C) 0.21 D) 1.1

4. $\frac{1}{8}$ =

   A) 0.125 B) 0.8 C) 0.025 D) 1.8

5. 0.25 =

   A) $2\frac{1}{2}$ B) $\frac{1}{4}$ C) $\frac{1}{25}$ D) $\frac{2}{5}$

6. 0.075 =

   A) $\frac{75}{10}$ B) $\frac{75}{100}$ C) $\frac{75}{1000}$ D) $\frac{100}{75}$

Addition and Subtraction

7. 3 + 2.4 =

A) 2.7 B) 2.1 C) 5.4 D) 0.54

8. 3.03 + 12.1 =

A) 15.04 B) 4.24 C) 15.4 D) 15.13

9. 10 - 6.30 =

A) 4.30 B) 3.70 C) 3.30 D) 4.70

10. 1.75 - 0.5 =

A) 1.25 B) 1.70 C) 0.125 D) 2.25

11. 1.08 - 0.9 =

A) 0.18 B) 0.99 C) 1.18 D) 0.9

12. Without figuring an exact answer, decide whether the sum 0.25 + 25 + 2.5 is approximately:

A) 0.75 B) 3 C) 30 D) 75

Multiplication

13. 0.3 x 100

A) 3 B) 0.3 C) 30 D) 0.003

14. 45 x 0.2 =

A) 90 B) 0.9 C) 0.090 D) 9

15. 2.53 x 0.1 =

A) 25.3 B) 0.253 C) 253 D) 2.54

16. 0.3 x 0.2 =

A) 0.6 B) 0.05 C) 0.06 D) 6

17. 3.2 x 0.12 =

A) 384 B) 38.4 C) 3.84 D) 0.384

18. Without figuring an exact answer, decide whether 10.3 x 20.4 is

A) less than 10 B) between 10 and 100

C) between 100 and 1000 D) greater than 1000

Division

19. 23.4 ÷ 100 =

A) 2340 B) 234 C) 2.34 D) 0.234

20. 15 ÷ 60 =

A) 4 B) 0.4 C) 2.5 D) 0.25

21. 60.3 ÷ 9 =

A) 6.7 B) 0.67 C) 6.63 D) 67

22. 63 ÷ 15 =

A) 4.2 B) 4.3 C) 0.42 D) 42

23. 3 ÷ 0.2 =

A) 1.5 B) 1.1 C) 15 D) 0.6

24. 0.012 ÷ 0.4 =

A) 0.003 B) 0.03 C) 0.3 D) 3

Word Problems

25. There are 536 pennies. How much is this in dollars?

A) $ 0.536 B) $ 5.36

C) $ 53.6 D) $ 536

26. 20 boxes of flour weigh 12 kilograms. How much does each one weigh?

A) 6 kg B) 1.8 kg C) 2.4 kg D) 0.6 kg

27. A two-month old tree is 80 cm tall. How much is this in meters? (1 meter = 100 cm)

A) 8 meters B) 800 meters

C) 0.8 meter D) 0.08 meter

28. In a class of 30 students, each person promised to write 5.5 pages for the class book. How many pages altogether?

A) 151.5 pages B) 165 pages

C) 155 pages D) 1650 pages

29. A club consists of 32 members. $ 4.80 was collected from each member. About how much was collected in all?

About:

A) $ 80 B) $ 150 C) $ 600 D) $ 1200

30. Ron bought a book for $ 2.40. How much change did he get from a 10 dollar bill?

A) $ 8.40 B) $ 7.40 C) $ 8.60 D) $ 7.60

APPENDIX 6-D

Prerequisite Knowledge Test

Elementary Geometry Test

GEOMETRY: Angles, Perimeter, Area

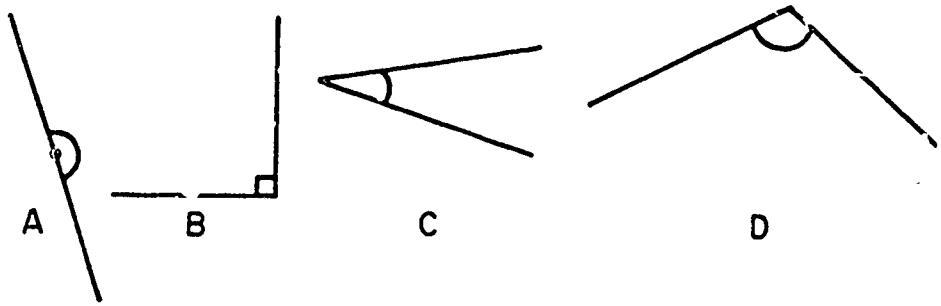
There is one correct answer for each question. Mark it on the answer sheet. Do not write in this booklet.

Angles

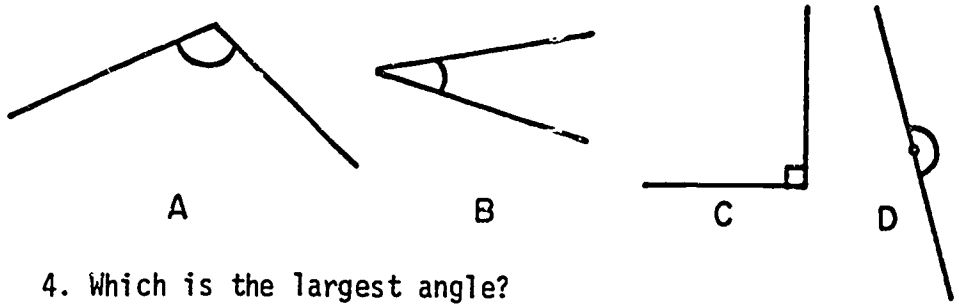
1. A right angle measures

   A) 45^0 B) 180^0 C) 90^0 D) 100^0

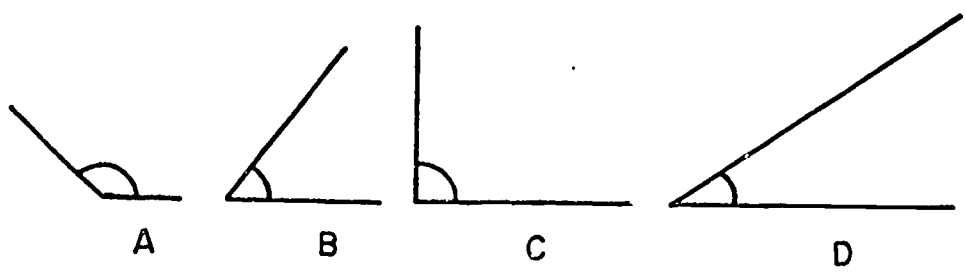
2. Which of these is an obtuse angle?



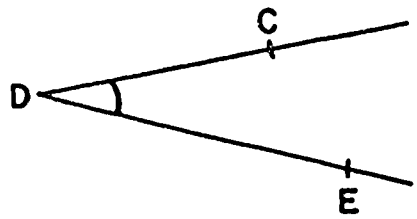
3. Which of these is a straight angle?



4. Which is the largest angle?

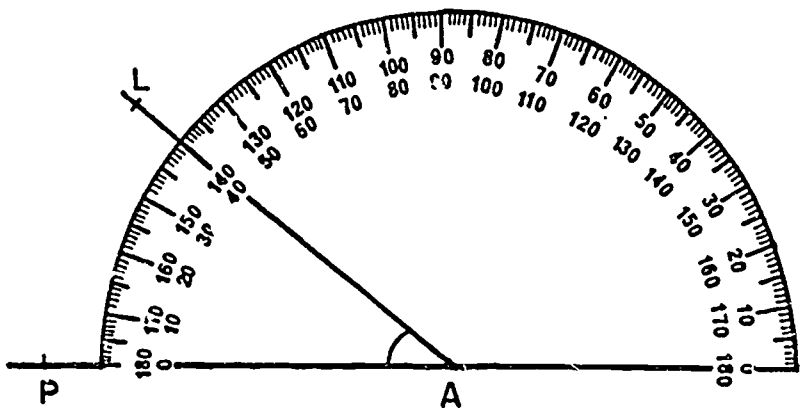


5. The angle in the drawing is:



A) ∢ C B) ∢ ECD C) ∢ DEC D) ∢ E E) ∢ CDE

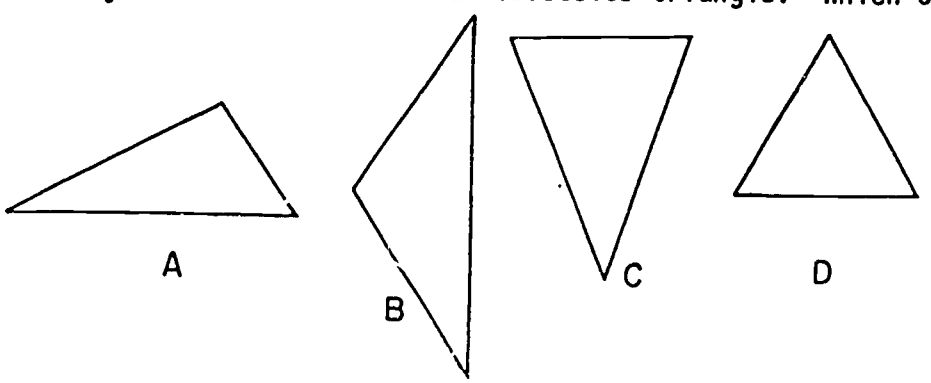
6. The angle in the drawing measures:



A) 100^0 B) 40^0 C) 180^0 D) 140^0

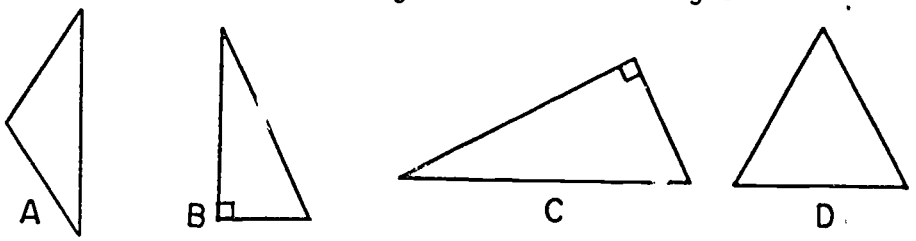
Identifying triangles and quadrilaterals

7. Only one of these is not an isosceles triangle. Which one?

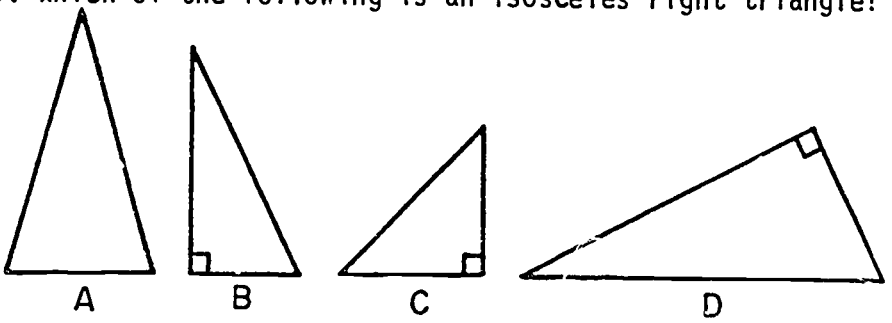


187

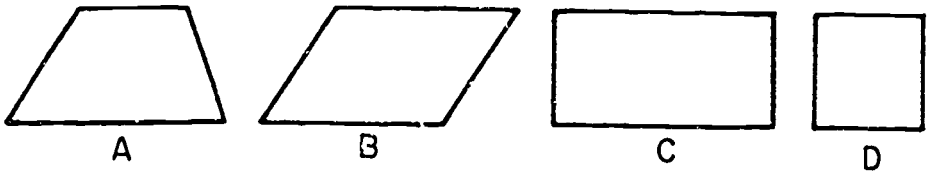
8. Which of the following is an acute triangle?



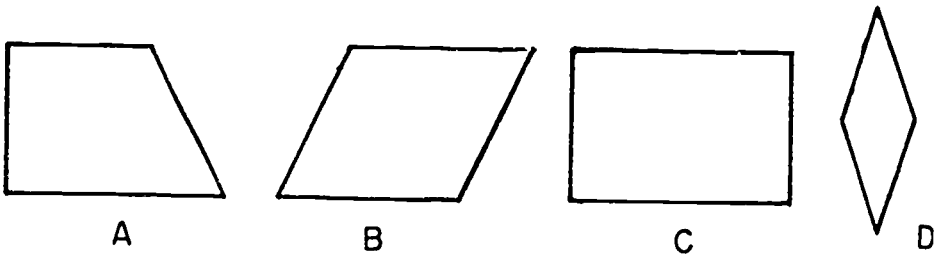
9. Which of the following is an isosceles right triangle?



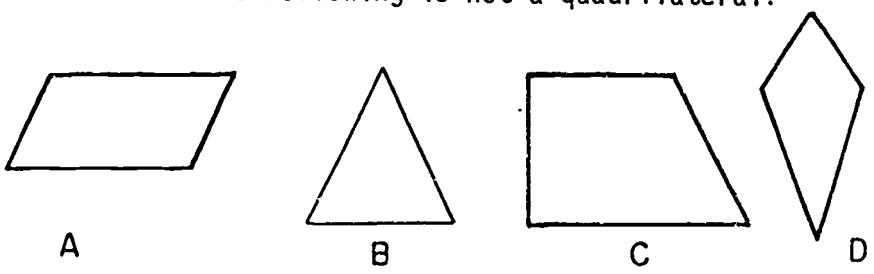
10. Which of the following is <u>not</u> a parallelogram?



11. Which of the following is a trapezoid?

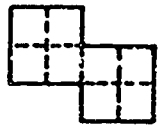


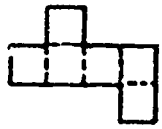
12. Which of the following is not a quadrilateral?

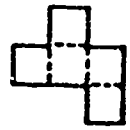


Perimeter

13. Which of the following has the same perimeter as 


A


B


C


D

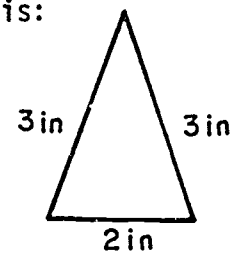
14. One side of the square measures 7 inches. The perimeter is:

A) 7 in. B) 14 in. C) 28 in. D) 29 in.

15. The perimeter of the triangle is:

A) 7 in. B) 8 in

C) 11 in. D) 18 in.

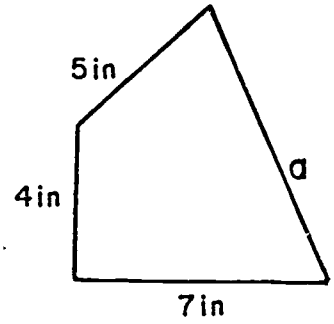


16. The perimeter measures 24 inches. How long is side a?

A) 8 in. B) 7 in.

C) 6 in. D) 5 in.

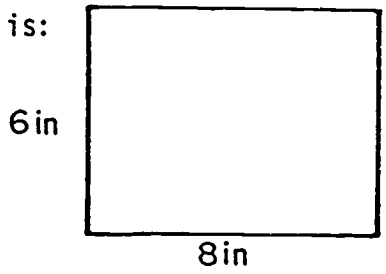
E) 4 in.



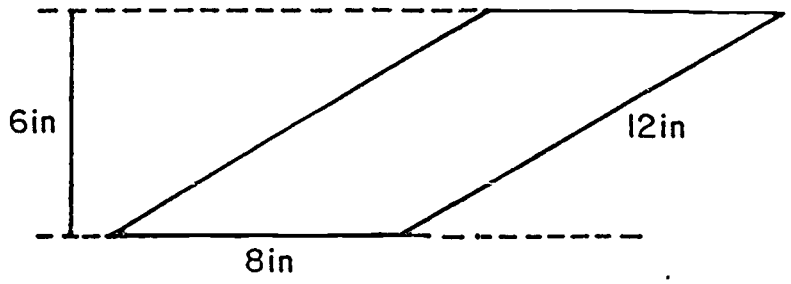
17. The perimeter or the rectangle is:

A) 24 in. B) 14 in.

C) 48 in. D) 28 in.

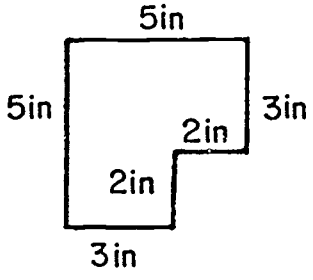


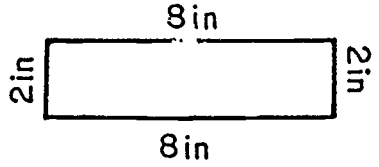
18. The perimeter of the parallelogram is:



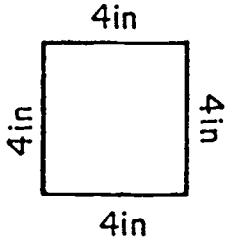
A) 20 in. B) 26 in. C) 40 in. D) 96 in.

19. Which of the following has a perimeter equal in length to the perimeter of this example?

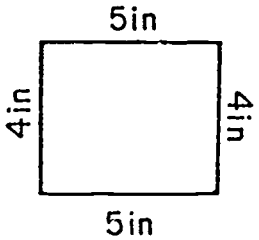




A



B



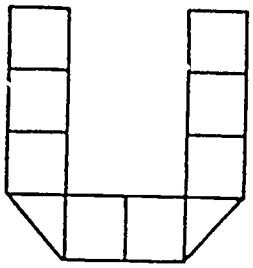
C

Area

20. What is the area of this figure in square centimeters?

A) 8 cm B) 9 cm

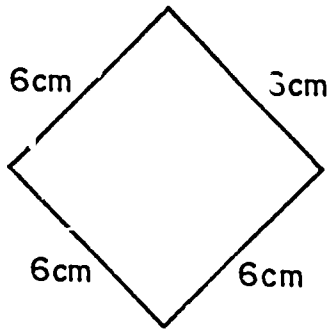
C) 10 cm D) 20 cm



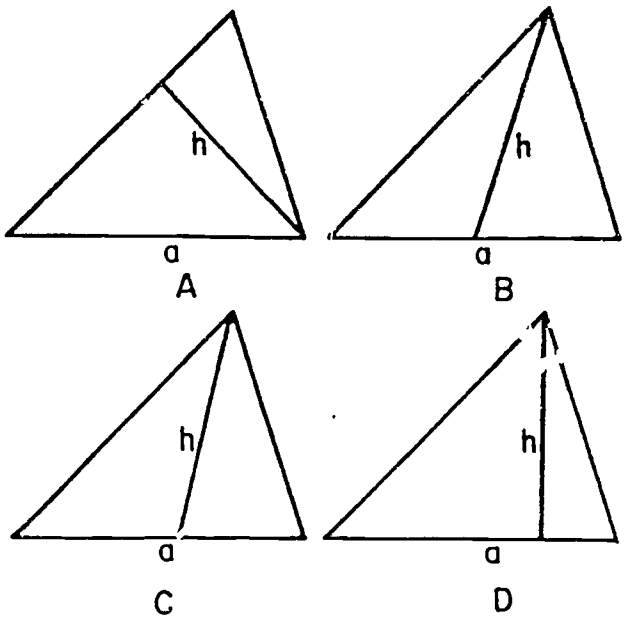
21. What is the area of the following square in square centimeters?

A) 6 cm B) 12 cm

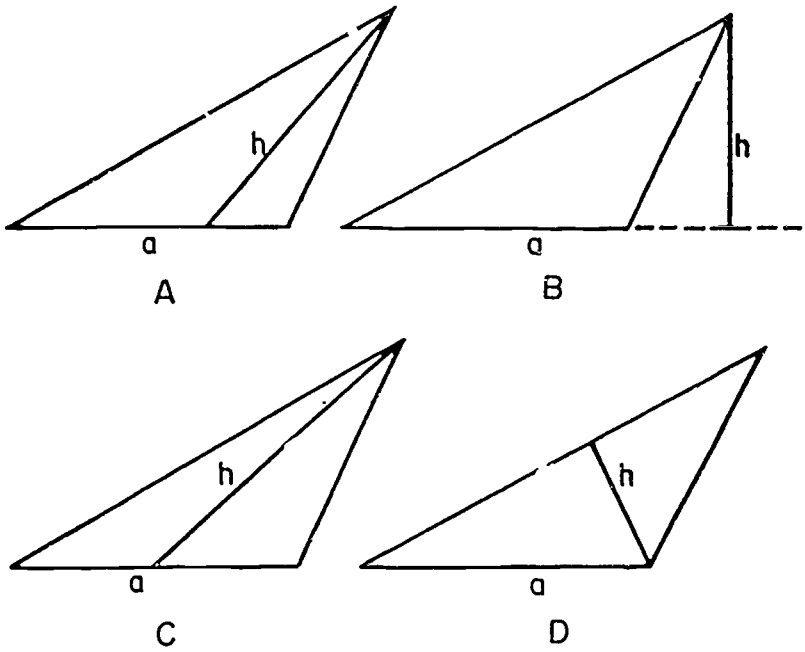
C) 24 cm D) 36 cm



22. The base of these triangles is side a. In which triangle is segment h the altitude of the triangle?



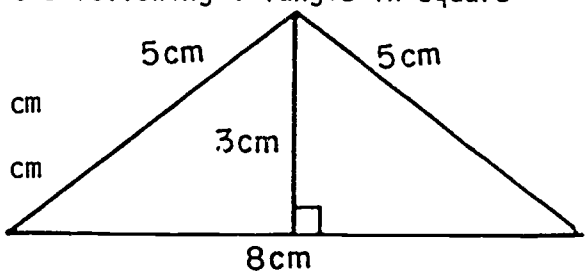
23. Side a is the base of each triangle. In which triangle is segment h the altitude of the triangle?



24. What is the area of the following triangle in square centimeters?

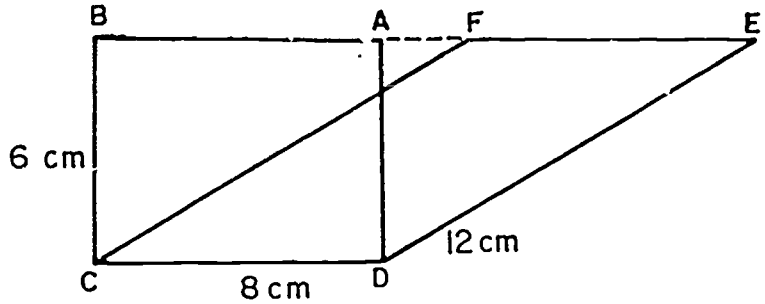
A) 12 cm B) 21 cm

C) 24 cm D) 20 cm

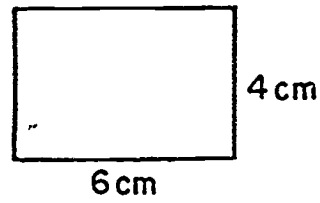


25. What is the area of the parallelogram FEDC in square centimeters? A) 96 cm B) 48 cm

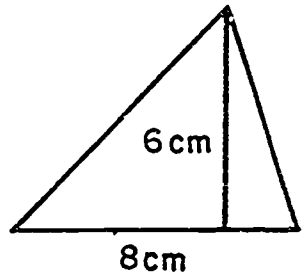
C) 40 cm D) 20 cm



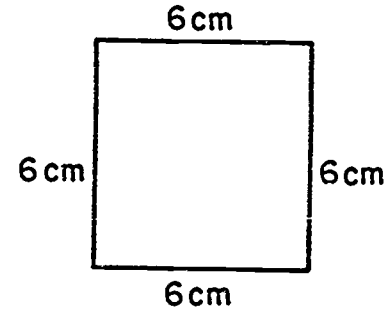
26. The area of this rectangle is 24 square centimeters.



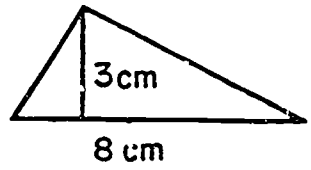
Which of the following figures has the same area?



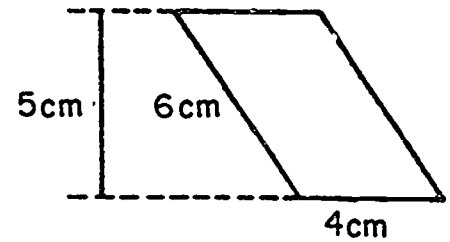
A



B



C



D

APPENDIX 7

Learning Environment Questionnaire Items*

1. Do you think learning mathematics is easy for most of the pupils in your class?
2. Do the pupils discuss mathematics problems in class?
3. Is your math teacher usually at the blackboard and explaining to the class?
4. Are most of the pupils satisfied with their math books?
5. Are most of the pupils able to finish their work in class?
6. Do you get worksheets to do in math class?
7. Do the pupils compete in math class?
8. Is the amount of work expected from them in math class clear to the pupils?
9. Do you work together in small groups in math class?
10. Are the demands made of the pupils in math too high for most of the class?
11. Do most of the pupils participate in classroom discussions in math class?
12. Do most of the pupils enjoy classroom activities in math class?
13. Is the pace too fast for most of the pupils in your math class?
14. Does your math teacher ever give explanations using transparencies?
15. Do some of the pupils try to do better than others?
16. Are the learning goals clear to the pupils in your math class?
17. Are strict behavior regulations enforced in math class?
18. Do the pupils learn only from their textbooks in class?

19. Do pupils suggest their own solutions to math problems?

20. Are most of the pupils happy with the pace of learning in math class?

21. Is learning mathematics difficult for most of the pupils in your class?

22. Is enough time given in class for pupils to complete their assignments?

23. Do the pupils compete to see who will do the best work?

24. Are math assignments clearly defined?

25. Are pupils able to act freely in math class?

26. Are most of the pupils in your class happy with their math studies?

27. Do you play math games in class?

28. Do the pupils discuss solutions to math problems in class?

29. Do you think that most pupils need more time in class to finish their assignments?

30. Is the material presented in class understood by most of the pupils?

31. Are the demands made on the pupils in math too low for most?

32. Are most of the pupils satisfied with the level of learning in math clas

33. Do the pupils rac o see who finishes first in your math class?

34. Do the pupils know wh teacher expects of them?

35. Do pupils work on their own in math class, while the teacher moves about the room helping them?

* The response scale presented to the pupil was:

(1) Never

(2) Rarely

(3) Usually

(4) Always

APENDIX 8-A

Attitude Questionnaire Items*

Level A and B

1. I think that knowing mathematics is important in every day life.
2. Studying mathematics is boring.
3. I feel at ease in my math class.
4. Knowing mathematics will help me to succeed in life.
5. I enjoy solving math problems.
6. When I have to solve a math problem, I suddenly forget everything I know.
7. It is important to me to do well in mathematics.
8. I feel more nervous before a math exam than before a test in any other subject.
9. I am managing alright with my math studies.
10. Studying mathematics is a waste of time in my opinion.
11. I feel confused in math class.
12. Today, in the age of computers, there is no need to learn a lot of mathematics.
13. I tense up when my math teacher addresses a question to me in class.
14. Interesting things are done in mathematics.
15. I feel a lack of self-confidence in math class.
16. I study mathematics only because I have no other choice.
17. I feel calm when I need to solve a math problem.
18. Mathematics is more important than other school subjects.
19. I like learning mathematics.

20. It seems as if time passes very slowly when I am in math class.

21. I think they teach too much mathematics in school.

22. I think that I will be interested in mathematics in the future.

23. It is important to my parents that I do well in mathematics.

24. I feel confident in math class.

25. Too much importance is put on learning mathematics in school.

* The response scale presented to the pupil was:

(1) Strongly disagree

(2) Disagree

(3) Agree

(4) Strongly agree.

APPENDIX 8-B

Attitude Questionnaire

Grades 7-9 - Level C

1. Do you like to study mathematics?

   a. I like it very much

   b. I like it.

   c. I like it a little.

   d. I don't like it at all.

2. Do you have a hard time doing your math homework?

   a. I always have a hard time.

   b. I often have a hard time.

   c. I rarely have a hard time.

   d. I never have a hard time.

3. Do you feel at ease during math lessons?

   a. Yes, I always feel at ease.

   b. I often feel at ease.

   c. I rarely feel at ease.

   d. I never feel at ease.

4. Do you get assignments to be done individually in class?

   a. We always get individual assignments.

   b. We often get individual assignments.

   c. We rarely get individual assignments.

   d. We never get individual assignments.

5. Do you go through the material too fast?

   a. We always go through the material too fast.

   b. We often go through the material too fast.

   c. We rarely go through the material too fast.

   d. We never go through the material too fast.

6. Do you get mixed up when the math teacher asks you a question?

   a. I always get mixed up.

   b. I often get mixed up.

   c. I rarely get mixed up.

   d. I never get mixed up.

7. Do you find it easy to understand your math teacher's explanations?

   a. I always find it easy.

   b. I often find it easy.

   c. I rarely find it easy.

   d. I never find it easy.

8. Are you bored in math class?

   a. I am always bored in math class.

   b. I am often bored in math class.

   c. I am rarely bored in math class.

   d. I am never bored in math class.

9. If a lesson has to be cancelled, in which subject would you like it to be?

   a. Math b. Literature c. Bible

   d. Physical education e. Arts and crafts

10. Do you get group assignments in math class?

a. We always get group assignments.

b. We often get group assignments.

c. We rarely get group assignments.

d. We never get group assignments.

11. Before taking a math test, do you feel more nervous than before any other kind of test?

a. I always feel more nervous.

b. I often feel more nervous.

c. I rarely feel more nervous.

d. I never feel more nervous.

12. Do you ever play math games in class?

a. We always play math games in class.

b. We often play math games in class.

c. We rarely play math games in class.

d. We never play math games in class.

13. Do you find it more difficult studying mathematics than other subjects?

a. I always find it more difficult.

b. I often find it more difficult.

c. I rarely find it more difficult.

d. I never find it more difficult.

14. Would you like to learn at a faster pace in your math class?

a. Always.

b. Often.

c. Rarely.

d. Never.

15. Does your math teacher hand out worksheets?

a. Yes, in every lesson.

b. In many lessons.

c. In few lessons.

d. Never.

16. Do you have enough time to finish your assignments in math class?

a. I always have enough time.

b. I often have enough time.

c. I rarely have enough time.

d. I never have enough time.

APPENDIX 9-A

School HR - Summary of Classroom Evaluation Form per Teacher by Period of Observation

	Teacher (1)		Teacher (2)		Teacher (3)		Teacher (4)		Teacher (5)	
Period	1st	last	1st	last	1st	last	1st	last	1st	last
General evaluation of the lesson	2.2	2.7	3.8	3.9	2.4	2.3	3.5	3.5	3.0	3.0
1. Prepared the lesson	2.5	1.2	3.7	2.4	1.6	1.6	3.5	4.0	3.3	3.3
2. Material presented at the appropriate level	4.0	4.2	4.6	4.8	3.6	4.0	4.0	5.0	3.3	3.3
3. Use of teaching aids (worksheets, games, overhead projector, etc.)	1.2	1.2	3.6	1.4	1.8	2.6	3.0	2.7	2.7	2.7
4. Lesson was interesting	1.5	2.2	3.6	3.6	1.8	2.6	3.0	3.3	3.3	3.3
5. Mathematics was correct	4.5	4.8	5.0	5.0	5.0	5.0	3.0	4.3	4.3	4.3
6. Efficient use of time	1.7	2.2	3.6	4.2	1.8	2.8	3.5	3.3	3.3	3.3
7. Efficient checking of homework	2.0	1.7	3.5	2.8	1.0	2.0	1.0	5.0	2.0	2.0
8. Discipline	4.0	4.2	3.6	4.8	4.2	4.2	5.0	4.7	4.7	4.7
9. Class has good work habits	3.7	3.6	3.6	4.4	3.4	2.8	4.0	4.3	4.0	4.0
10. Students had done their homework	4.2	3.7	4.7	4.2	2.7	2.3	1.0	4.0	3.0	3.0
11. Class atmosphere	3.2	3.2	3.8	4.2	2.8	2.8	4.0	3.7	3.7	3.7
12. Class participation	4.2	3.8	4.4	4.2	3.4	3.8	4.0	3.3	4.7	4.7
13. Appropriate response to students' remarks	4.7	4.2	4.4	4.2	4.0	3.6	5.0	4.7	3.7	3.7
14. Awareness of students' difficulties	3.0	3.2	4.2	3.8	2.6	3.4	4.0	4.0	2.3	2.3
15. Assigned appropriate homework	3.0	3.7	4.8	4.4	3.2	4.0	2.0	4.5	3.3	3.3
16. Clear explanations	4.5	3.8	4.2	3.6	3.2	4.0	4.5	4.3	3.0	3.0
17. Varied teaching methods	1.2	1.2	3.4	1.6	1.6	2.6	3.0	2.7	2.3	2.3
18. Varied cognitive level of questioning	1.5	1.6	4.4	3.0	1.2	1.0	4.5	2.3	1.7	1.7

APPENDIX 9-B

School MKR - Summary of Classroom Evaluation Form per Teacher by Period of Observation

	Teacher (1)		Teacher (2)		Teacher (3)	
Period	1st	last	1st	last	1st	last
General evaluation of the lesson	3.0	3.57	3.0	3.0	3.2	3.6
1. Prepared the lesson	2.6	4.0	2.5	4.0	2.8	3.9
2. Material presented at the appropriate level	3.3	3.9	3.0	3.5	3.2	3.7
3. Use of teaching aids (worksheets, games, overhead projector, etc.)	1.0	2.0	1.0	1.0	1.0	2.2
4. Lesson was interesting	2.7	3.4	2.0	2.5	2.4	3.4
5. Mathematics was correct	3.6	3.4	4.0	3.5	4.0	4.0
6. Efficient use of time	3.0	3.9	2.0	2.0	2.7	2.7
7. Efficient checking of homework	2.0	3.0	3.0	2.0	2.7	3.3
8. Discipline	3.7	3.7	3.0	1.0	3.5	3.3
9. Class has good work habits	3.7	3.1	4.0	2.5	3.0	3.1
10. Students had done their homework	3.5	2.8	3.0	2.0	2.5	2.2
11. Class atmosphere	3.9	3.9	3.5	2.0	3.2	3.3
12. Class participation	2.9	3.0	3.5	3.0	3.2	3.2
13. Appropriate response to students' remarks	3.4	3.4	3.5	3.5	3.8	3.7
14. Awareness of students' difficulties	2.7	2.3	3.0	3.0	2.7	2.5
15. Assigned appropriate homework	3.0	2.3	-	-	2.6	3.2
16. Clear explanations	2.9	3.6	3.0	3.0	3.6	3.8
17. Varied teaching methods	1.0	3.0	1.0	1.0	1.0	2.2
18. Varied cognitive level of questioning	1.3	2.7	1.0	1.0	1.7	2.5

APPENDIX 9-C

School MKG - Summary of Classroom Evaluation Form per Teacher by Period of Observation

	Teacher (1)		Teacher (2)		Teacher (3)		Teacher (4)	
Period	1st	last	1st	last	1st	last	1st	last
General evaluation of the lesson	2.0	3.0	3.7	3.0	3.5	3.0	3.5	4.0
1. Prepared the lesson	2.7	3.7	4.0	3.5	4.3	4.0	4.0	4.5
2. Material presented at the appropriate level	3.7	4.0	4.0	4.0	4.3	3.7	3.0	3.5
3. Use of teaching aids (worksheets, games, overhead projector, etc.)	1.0	1.0	1.0	1.5	1.3	2.3	2.5	2.5
4. Lesson was interesting	1.7	3.0	3.5	3.0	3.7	3.0	3.3	3.5
5. Mathematics was correct	2.0	2.7	4.0	3.5	4.0	2.3	3.7	3.5
6. Efficient use of time	2.0	2.3	3.0	3.0	2.5	3.0	3.7	4.0
7. Efficient checking of homework	1.0	4.0	-	2.0	4.0	4.0	1.0	4.0
8. Discipline	2.3	3.0	4.0	3.5	3.7	4.0	4.0	3.5
9. Class has good work habits	3.0	3.3	3.5	2.0	3.0	4.0	3.7	4.0
10. Students has done their homework	2.5	3.5	-	2.0	2.0	3.3	3.0	2.5
11. Class atmosphere	3.0	3.3	4.0	3.5	4.0	3.7	3.7	4.0
12. Class participation	2.0	2.7	3.5	2.5	4.7	3.0	4.0	3.0
13. Appropriate response to students' remarks	2.0	2.7	3.5	4.0	4.3	3.7	3.0	4.0
14. Awareness of students' difficulties	3.0	2.0	3.0	2.0	4.0	2.0	2.3	2.0
15. Assigned appropriate homework	4.0	3.5	3.0	2.0	3.7	3 3	5.0	-
16. Clear explanations	2.3	2.3	4.0	2.5	4.3	3.3	3.7	3.5
17. Varied teaching methods	1.0	2.0	1.0	2.0	2.7	3.0	2.3	2.5
18. Varied cognitive level of questioning	1.0	1.7	2.0	1.5	2.3	1.7	2.0	3.0

APPENDIX 9-D

School AY - Summary of Classroom Evaluation Form per Teacher by Period of Observation

	Teacher (1)		Teacher (2)		Teacher (3)		Teacher (4)		Teacher (5)	
Period	1st	last	1st	last	1st	last	1st	last	1st	last
General evaluation of the lesson	2.5	3.5	3.5	4.0	3.2	3.0	2.0	2.5	2.2	2.5
1. Prepared the lesson	2.5	4.0	3.5	4.0	3.0	3.7	1.5	4.0	2.0	3.0
2. Materials presented at the appropriate level	3.5	4.0	4.0	4.5	2.0	3.3	2.0	4.0	4.0	4.0
3. Use of teaching aids (worksheets, games, overhead projector, etc.)	1.0	3.0	2.5	4.0	2.7	2.7	5.0	1.0	1.0	3.0
4. Lesson was interesting	3.5	3.5	3.0	4.0	4.0	3.7	2.5	2.0	2.5	3.0
5. Mathematics was correct	4.0	4.0	2.0	4.5	2.0	2.0	4.0	4.0	2.5	2.7
6. Efficient use of time	1.0	3.0	4.0	4.0	4.0	3.3	2.0	2.0	1.5	2.3
7. Efficient checking of homework	4.0	5.0	4.0	-	-	-	2.0	-	3.0	-
8. Discipline	3.0	3.0	4.0	3.5	4.0	4.3	3.5	3.0	3.0	2.7
9. Class has good work habits	3.0	4.0	4.0	4.0	4.0	4.0	2.5	3.0	3.5	2.5
10. Students had done their homework	2.0	-	4.0	-	-	2.0	2.0	-	4.0	2.0
11. Class atmosphere	3.5	3.5	4.0	4.0	4.0	3.7	3.0	3.0	3.0	2.7
12. Class participation	4.0	4.0	3.5	4.0	4.5	4.0	3.0	4.0	3.5	2.7
13. Appropriate response to students' remarks	3.0	3.0	3.5	3.0	3.0	2.7	3.5	3.0	3.0	2.0
14. Awareness of students' difficulties	3.0	3.0	2.5	3.5	2.0	2.3	1.5	4.0	2.0	2.0
15. Assigned appropriate homework	2.5	2.0	4.0	5.0	1,0	-	2.5	5.0	-	3.5
16. Clear explanations	3.0	3.5	3.0	3.5	2.0	2.33	3.5	3.0	2.5	2.0
17. Varied teaching methods	1.5	2.0	2.5	3.0	3.5	3.0	2.5	1.0	1.5	2.7
18. Varied cognitive level of questioning	3.0	2.5	4.0	3.5	1.0	2.0	1.0	1.0	1.5	1.3

APPENDIX 10

A Summary of Mid-Year Interviews

1. The questions asked in the interview are listed below.

   A. Questions on the in-school activities.

      1. In general, do you feel the in-school activities have any effect?
      2. How do you feel about the personal guidance?
      3. What is your opinion of the observation form that the counsellor gives you after the lesson?
      4. What would you like to change in the project's in-school activities?

   B. Questions on the activities held in the Weizmann Institute.

      1. What is your opinion of the mathematics part of the weekly workshops?
      2. What is your opinion of the didactical part of the weekly workshops?
      3. What changes would you like to be made?

   C. A question on the overall project.

      1. In general, what do you expect of the project?

2. Summary of the Interviews

   Part A: In-school Activities

   Most of the teachers interviewed felt that the project helped them to get information about the updated books and to decide which topics to choose and what areas to emphasize. Inexperienced teachers seemed to benefit in these areas more than experienced

ones. Three teachers mentioned that they are covering more material this year than they did last year. Two others felt that they were already familiar with the Rehovct Program since they have been teaching it for many years.

Concerning the personal guidance, one teacher was extremely positive towards this aspect of the project. Indeed, she would like the observer to come into her class more often.

Two other teachers also expressed satisfaction and felt that the counsellor gave them helpful advice and good ideas. But still two others felt that the classroom visits were not necessary for them. Only one teacher was completely negative and expressed her objection to being observed and criticized by someone from outside the "official" school structure.

Regarding the observation form, most of the teachers felt that this form provided them with a true description of what was happening in their classroom, and that the remarks made by the counsellor were very helpful. Only one teacher felt threatened by it and said that she did not like the pressure it put her under. She also felt that she was accomplishing less in the classroom because of it.

When the teachers were asked to suggest changes to be made in the in-school activities, two of them suggested to have more demonstration lessons given either by the counsellor or by the teachers themselves. Others wished to increase the time devoted to the personnel guidance or to discussion after the observed lesson.

Part B: Workshops Activities

The teachers interviewed were asked to evaluate the two parts of the workshop - the mathematical part and the didactical activities. According to their responses it seems that there are two categories of opinions. The three veteran teachers with a deeper understanding of mathematics than the others, were very satisfied with the mathematical part of the workshops and saw it as a good opportunity for enrichment. They believed that they have a good grasp of the material that they teach daily in their classes and preferred hearing about other subjects, even though they did not see the relationship of this material to that which they teach. The three less experienced teachers said they would prefer to get direct instructions and ideas concerning the material they have to teach in class. Since they are not math teachers by training, there are topics and techniques in the curriculum which they find difficult to master themselves, let alone to teach. Two of them said that the level of the math lectures was too high for them, hence they could not follow the presentations.

When asked about the didactical part of the workshops, again two types of answers emerged. Teachers who were experienced with the Rehovot program, not necessarily the most veteran teachers, felt that they had met, on other occasions, some of the activities presented in the workshops (specific games, worksheets, etc.). So again the response was "It is nice, but I don't really need it". The other teachers, however, were very pleased with most of the activities presented. They singled out the workshop which dealt

with tests - how to build tests and how to grade them - as being particularly useful.

Part C: The overall activities of the project.

It was difficult for the teachers to express their specific expectations from the project. However, they expressed their personal needs according to their educational background and teaching experience. Those who had a somewhat better mathematical background wished to continue with strengthening their mathematical knowledge - envisioned it as enrichment; the others stressed the need to be engaged with the specific mathematical content of the junior high school curriculum. However, most of the teachers were pleased with the didactical activities and the in-school activities.

APPENDIX 11

Class Environment Subscales - Means and Differences for Students and Teachers.

(results from 28 classes)

Legend: Subscale

Difficulty - Dif.

Inquiry - Inq.

Satisfaction - Sat.

Speed - Sp.

Diversity - Div.

Competitiveness - Com.

Goal Direction - G.D.

Formality - For.

Transparencies - Tran.

Group Work - Gr.w.

Use of Board - Br.u.

Individual Work - Ind.w.

---------- SCHOOL=HR GRADE=7 LEVEL=B TEACHER=1 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.08	2.29	-0.21	2.00	2.25	-0.25	-0.08	-0.04
Inq.	3.33	3.24	0.10	2.33	2.50	-0.17	-1.00	-0.74
Sat.	3.63	3.49	0.15	3.00	3.00	0.00	-0.63	-0.49
Sp.	2.27	2.21	0.06	2.00	2.00	0.00	-0.27	-0.21
Div.	2.08	1.62	0.46	1.67	1.67	0.00	-0.41	0.05
Com.	3.10	3.04	0.07	3.50	4.00	-0.50	0.40	0.96
G.D.	3.48	3.21	0.27	3.00	3.00	0.00	-0.48	-0.21
For.	3.50	3.29	0.21	3.00	2.00	1.00	-0.50	-1.29
Tran.	1.00	1.21	-0.21	1.00	1.00	0.00	0.00	-0.21
Gr.W.	2.46	1.43	1.03	2.00	3.00	-1.00	-0.46	1.57
Br.U.	3.85	3.71	0.13	3.00	3.00	0.00	-0.85	-0.71
Ind.W.	3.62	3.43	0.19	3.00	3.00	0.00	-0.62	-0.43

---------- SCHOOL=HR GRADE=7 LEVEL=B TEACHER=1 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	1.79	1.95	-0.16	2.00	2.25	-0.25	0.21	0.30
Inq.	2.96	3.19	-0.23	2.67	1.67	1.00	-0.30	-1.53
Sat.	3.39	3.23	0.16	3.00	3.00	0.00	-0.39	-0.23
Sp.	1.90	2.04	-0.15	2.00	2.00	0.00	0.10	-0.04
Div.	2.01	1.50	0.51	1.67	1.00	0.67	-0.35	-0.50
Com.	1.56	2.18	-0.62	4.00	3.75	0.25	2.44	1.57
G.D.	3.46	3.40	0.06	3.00	3.00	0.00	-0.46	-0.40
For.	2.79	2.93	-0.15	3.00	2.00	1.00	0.21	-0.93
Tran.	1.07	1.00	0.07	1.00	1.00	0.00	-0.07	0.00
Gr.W.	1.59	1.33	0.26	2.00	3.00	-1.00	0.41	1.67
Br.U.	3.67	3.63	0.04	3.00	4.00	-1.00	-0.67	0.38
Ind.W.	3.59	3.00	0.59	2.00	3.00	-1.00	-1.59	0.00

---------- SCHOOL=HR GRADE=8 LEVEL=A TEACHER=2 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.64	2.04	0.59	2.25	2.00	0.25	-0.39	-0.04
Inq.	2.94	3.18	-0.23	3.00	3.33	-0.33	0.06	0.16
Sat.	2.19	2.93	-0.74	2.60	3.00	-0.40	0.41	0.07
Sp.	2.49	2.00	0.49	2.00	2.00	0.00	-0.49	0.00
Div.	2.96	2.62	0.34	2.33	2.33	0.00	-0.63	-0.29
Com.	1.50	1.66	-0.16	2.75	2.75	0.00	1.25	1.09
G.D.	3.21	3.38	-0.17	3.00	3.50	-0.50	-0.21	0.12
For.	2.50	2.24	0.26	2.00	1.50	0.50	-0.50	-0.74
Tran.	1.00	1.00	0.00	1.00	1.00	0.00	0.00	0.00
Gr.W.	2.83	3.38	-0.54	2.00	3.00	-1.00	-0.83	-0.38
Br.U.	3.78	3.76	0.01	3.00	2.00	1.00	-0.78	-1.76
Ind.W.	3.28	3.47	-0.19	3.00	3.00	0.00	-0.28	-0.47

---------- SCHOOL=HR GRADE=8 LEVEL=B TEACHER=1 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.11	2.00	0.11	2.25	1.75	0.50	0.14	-0.25
Inq	2.73	2.48	0.24	2.33	1.67	0.67	-0.39	-0.82
Sat.	3.02	2.89	0.13	3.00	3.00	0.00	-0.02	0.11
Sp.	2.06	2.10	-0.04	2.00	2.00	0.00	-0.06	-0.10
Div.	2.00	1.38	0.62	2.00	1.67	0.33	0.00	0.28
Com.	2.81	3.20	-0.39	3.00	3.75	-0.75	0.19	0.55
G.D.	3.22	3.17	0.04	3.00	3.25	-0.25	-0.22	0.08
For.	3.29	3.22	0.07	2.50	2.00	0.50	-0.79	-1.22
Tran.	1.06	1.20	-0.14	1.00	1.00	0.00	-0.06	-0.20
Gr.W.	1.65	1.40	0.25	2.00	3.00	-1.00	0.35	1.60
Br.U.	3.76	3.80	-0.04	4.00	4.00	0.00	0.24	0.20
Ind.W.	3.41	3.05	0.36	3.00	3.00	0.00	-0.41	-0.05

---------- SCHOOL=HR GRADE=8 LEVEL=B TEACHER=3 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.81	2.80	0.01	3.00	2.75	0.25	0.19	-0.05
Inq.	2.95	3.18	-0.23	3.00	3.00	0.00	0.05	-0.18
Sat.	2.30	2.15	0.15	2.20	2.40	-0.20	-0.10	0.25
Sp.	2.44	2.39	0.05	3.00	2.75	0.25	0.56	0.36
Div.	2.36	1.94	0.42	2.00	2.00	0.00	-0.36	0.06
Com.	1.65	1.89	-0.24	2.75	2.75	0.00	1.10	0.86
G.D.	2.92	2.86	0.06	2.25	3.00	-0.75	-0.67	0.14
For.	2.46	2.41	0.05	2.00	1.50	0.50	-0.46	-0.91
Tran.	2.54	1.18	1.36	2.00	1.00	1.00	-0.54	-0.18
G.W.	2.62	2.91	-0.29	3.00	4.00	-1.00	0.38	1.09
Br.U.	3.08	3.27	-0.20	3.00	2.00	1.00	-0.08	-1.27
Ind.W.	2.54	3.00	-0.46	3.00	3.00	0.00	0.46	0.00

---------- SCHOOL=HR GRADE=9 LEVEL=A TEACHER=2 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.29	2.47	-0.18	3.00	2.50	0.50	0.71	0.03
Inq.	3.05	3.32	-0.26	3.00	3.00	0.00	-0.05	-0.32
Sat.	2.62	2.79	-0.17	2.00	2.00	0.00	-0.62	0.79
Sp.	2.21	2.30	-0.09	2.00	1.75	0.25	-0.21	-0.55
Div.	2.16	1.93	0.23	2.33	2.00	0.33	0.17	0.07
Com.	1.81	1.89	-0.08	2.50	2.75	-0.25	0.69	0.86
G.D.	3.33	3.24	0.09	3.00	3.25	-0.25	-0.33	0.01
For.	2.04	2.16	-0.12	2.50	1.50	1.00	0.46	-0.66
Tran.	2.96	2.13	0.83	3.00	2.00	1.00	0.04	-0.13
Gr.W.	2.04	1.45	0.59	2.00	3.00	-1.00	-0.04	1.55
Br.U.	3.52	3.68	-0.16	3.00	3.00	0.00	-0.52	-0.68
Ind.W.	3.40	3.43	-0.03	3.00	3.00	0.00	-0.40	-0.43

---------- SCHOOL=HR GRADE=9 LEVEL=B TEACHER=3 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.52	2.80	-0.28	3.00	3.00	0.00	0.48	0.20
Inq.	2.41	2.79	-0.38	2.67	3.00	-0.33	0.26	0.21
Sat.	2.66	2.64	0.02	2.00	2.20	-0.20	-0.66	-0.44
Sp.	2.67	2.22	0.45	3.00	3.25	-0.25	0.33	1.03
Div.	1.69	1.75	-0.06	2.00	1.33	0.67	0.31	-0.42
Com.	3.21	3.33	-0.12	2.75	4.00	-1.25	-0.46	0.67
G.D.	2.80	3.17	-0.37	2.00	3.25	-1.25	-0.80	0.08
For.	2.75	2.85	-0.10	2.00	1.50	0.50	-0.75	-1.35
Tran.	2.14	1.00	1.14	2.00	1.00	1.00	-0.14	0.00
Gr.W.	2.21	2.06	0.16	3.00	3.00	0.00	0.79	0.94
Br.U.	2.57	3.71	-1.13	3.00	3.00	0.00	0.43	-0.71
Ind.W.	2.71	3.13	-0.41	3.00	3.00	0.00	0.29	-0.13

---------- SCHOOL=MKR GRADE=7 LEVEL=A TEACHER=2 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.30	2.55	-0.25	2.25	2.25	0.00	-0.05	-0.30
Inq.	2.93	3.03	-0.10	3.00	3.00	0.00	0.07	-0.03
Sat.	2.71	2.90	-0.19	3.00	3.00	0.00	0.29	0.10
Sp.	2.72	2.69	0.03	1.75	2.00	-0.25	-0.97	-0.69
Div.	1.40	1.71	-0.31	2.00	2.00	0.00	0.60	0.29
Com.	1.96	2.05	-0.09	3.00	3.25	-0.25	1.04	1.20
G.D.	3.41	3.37	0.04	3.00	3.25	-0.25	-0.41	-0.12
For.	1.83	2.38	-0.54	2.00	2.00	0.00	0.17	-0.38
Tran.	1.00	1.07	-0.07	1.00	1.00	0.00	0.00	-0.07
G.W.	2.88	1.96	0.91	2.00	3.00	-1.00	-0.88	1.04
Br.U.	3.75	3.89	-0.14	4.00	3.00	1.00	0.25	-0.89
Ind.W.	3.00	3.48	-0.48	3.00	3.00	0.00	0.00	-0.48

---------- SCHOOL=MKR GRADE=7 LEVEL=B TEACHER=1 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.18	2.09	0.10	2.00	2.25	-0.25	-0.18	0.16
Inq	3.19	2.91	0.28	2.33	2.33	0.00	-0.85	-0.57
Sat.	3.09	3.35	-0.25	3.00	2.80	0.20	-0.09	-0.55
Sp.	2.42	2.13	0.29	2.00	2.00	0.00	-0.42	-0.13
Div.	2.21	2.90	-0.69	2.33	2.33	0.00	0.12	-0.56
Com.	2.60	2.55	0.05	3.00	3.00	0.00	0.40	0.45
G.D.	3.36	3.54	-0.18	3.00	3.00	0.00	-0.36	-0.54
For.	2.85	2.79	0.06	2.00	2.00	0.00	-0.85	-0.79
Tran.	1.04	1.00	0.04	1.00	2.00	-1.00	-0.04	1.00
Gr.W.	2.81	2.96	-0.15	3.00	3.00	0.00	0.19	0.04
Br.U.	3.78	3.85	-0.07	3.00	3.00	0.00	-0.78	-0.85
Ind.W.	3.63	3.73	-0.10	3.00	4.00	-1.00	-0.63	0.27

---------- SCHOOL=MKR GRADE=8 LEVEL=A TEACHER=1 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.42	2.27	0.15	2.25	2.25	0.00	-0.17	-0.02
Inq.	2.50	2.67	-0.17	2.33	2.33	0.00	-0.17	-0.33
Sat.	2.31	2.89	-0.59	2.40	2.80	-0.40	0.09	-0.09
Sp.	2.38	2.28	0.09	2.50	2.00	0.50	0.13	-0.28
Div.	1.60	1.64	-0.05	2.00	2.00	0.00	0.40	0.36
Com.	1.96	2.09	-0.13	2.25	2.50	-0.25	0.29	0.41
G.D.	2.83	3.09	-0.26	3.00	3.00	0.00	0.17	-0.09
For.	2.11	2.22	-0.11	2.00	2.50	-0.50	-0.11	0.28
Tran.	1.00	1.31	-0.31	2.00	2.00	0.00	1.00	0.69
Gr.W.	2.70	2.38	0.32	3.00	3.00	0.00	0.30	0.63
Br.U.	3.60	3.50	0.10	3.00	3.00	0.00	-0.60	-0.50
Ind.W.	3.00	2.88	0.13	3.00	4.00	-1.00	0.00	1.13

---------- SCHOOL=MKR GRADE=8 LEVEL=B TEACHER=2 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.30	2.07	0.23	3.00	3.00	0.00	0.70	0.93
Inq.	2.06	1.79	0.27	3.00	2.33	0.67	0.94	0.55
Sat.	2.70	3.00	-0.30	2.60	2.80	-0.20	-0.10	-0.20
Sp.	2.86	2.25	0.61	2.00	2.00	0.00	-0.86	-0.25
Div.	2.31	1.89	0.42	2.00	2.33	-0.33	-0.31	0.44
Com.	2.91	3.00	-0.09	3.50	3.00	0.50	0.59	0.00
G.D.	3.02	3.08	-0.06	3.00	3.00	0.00	-0.02	-0.08
For.	2.00	2.35	-0.35	2.00	2.50	-0.50	0.00	0.15
Tran.	1.00	1.00	0.00	1.00	1.00	0.00	0.00	0.00
Gr.W.	1.92	2.06	-0.14	3.00	2.00	1.00	1.08	-0.06
Br.U.	3.33	3.44	-0.10	3.00	3.00	0.00	-0.33	-0.44
Ind.W.	2.75	2.75	0.00	4.00	4.00	0.00	1.25	1.25

---------- SCHOOL=MKR GRADE=9 LEVEL=A TEACHER=2 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.39	2.07	0.32	2.25	2.25	0.00	-0.14	0.18
Inq.	3.48	2.81	0.67	3.00	3.67	-0.67	-0.48	0.86
Sat.	2.84	3.31	-0.47	3.00	3.00	0.00	0.16	-0.31
Sp.	2.39	2.11	0.28	1.75	2.00	-0.25	-0.64	-0.11
Div.	1.41	1.67	-0.26	2.00	2.33	-0.33	0.59	0.67
Com.	2.06	2.04	0.02	3.00	4.00	-1.00	0.94	1.96
G.D.	3.11	3.50	-0.39	3.00	3.25	-0.25	-0.11	-0.25
For.	1.94	2.11	-0.17	2.00	2.00	0.00	0.06	-0.11
Tran.	1.00	1.00	0.00	1.00	1.00	0.00	0.00	0.00
Gr.W.	2.44	2.89	-0.44	3.00	2.00	1.00	0.56	-0.89
Br.U.	3.67	3.56	0.11	4.00	3.00	1.00	0.33	-0.56
Ind.W.	2.11	3.29	-1.17	4.00	3.00	1.00	1.89	-0.29

---------- SCHOOL=MKR GRADE=9 LEVEL=B TEACHER=3 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.18	1.94	0.23	2.50	2.00	0.50	0.32	0.06
Inq.	2.76	2.52	0.24	3.00	2.33	0.67	0.24	-0.19
Sat.	2.84	2.85	-0.01	2.20	2.80	-0.60	-0.64	-0.05
Sp.	2.00	2.34	-0.34	2.00	1.75	0.25	0.00	-0.59
Div.	1.14	1.22	-0.08	1.00	1.33	-0.33	-0.14	0.11
Com.	2.04	2.56	-0.52	2.25	3.00	-0.75	0.21	0.44
G.D.	3.50	3.33	0.17	3.00	3.00	0.00	-0.50	-0.33
For.	3.00	3.29	-0.29	4.00	3.50	0.50	1.00	0.21
Tran.	1.00	1.00	0.00	1.00	1.00	0.00	0.00	0.00
Gr.W.	1.03	2.58	-0.75	3.00	2.00	1.00	1.17	-0.58
Br.U.	3.43	3.83	-0.40	4.00	3.00	1.00	0.57	-0.83
Ind.W.	4.00	3.11	0.89	4.00	4.00	0.00	0.00	0.89

---------- SCHOOL=MKG GRADE=7 LEVEL=A TEACHER=1 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.67	2.14	0.53	2.25	2.00	0.25	-0.42	-0.14
Inq.	3.04	3.21	-0.17	3.00	3.00	0.00	-0.04	-0.21
Sat.	2.64	3.35	-0.71	3.20	3.60	-0.40	0.56	0.25
Sp.	2.78	2.40	0.38	2.50	2.00	0.50	-0.28	-0.40
Div.	1.44	1.66	-0.21	1.67	2.00	-0.33	0.23	0.34
Com.	2.09	2.40	-0.31	2.50	2.00	0.50	0.41	-0.40
G.D.	2.98	3.39	-0.41	3.25	3.00	0.25	0.27	-0.39
For.	3.26	2.87	0.40	2.50	2.50	0.00	-0.76	-0.37
Tran.	1.00	1.00	0.00	1.00	1.00	0.00	0.00	0.00
Gr.W.	2.02	2.70	-0.68	3.00	3.00	0.00	0.98	0.30
Br.U.	3.72	3.90	-0.18	3.00	3.00	0.00	-0.72	-0.90
Ind.W.	2.75	3.70	-0.95	3.00	3.00	0.00	0.25	-0.70

---------- SCHOOL=MKG GRADE=7 LEVEL=B TEACHER=2 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.18	1.97	0.21	1.75	2.00	-0.25	-0.43	0.03
Inq.	3.10	3.01	0.08	3.33	3.33	0.00	0.24	0.32
Sat.	3.15	3.43	-0.28	3.20	3.40	-0.20	0.05	-0.03
Sp.	2.12	2.13	-0.01	1.50	2.00	-0.50	-0.62	-0.13
Div.	1.57	1.46	0.11	1.67	1.33	0.33	0.10	-0.13
Com.	2.05	2.00	0.05	4.00	3.75	0.25	1.95	1.75
G.D.	3.35	3.55	-0.20	3.25	3.50	-0.25	-0.10	-0.05
For.	3.11	3.45	-0.34	3.00	3.00	0.00	-0.11	-0.45
Tran.	1.00	1.10	-0.10	1.00	1.00	0.00	0.00	-0.10
Gr.W.	2.10	2.20	-0.10	4.00	3.00	1.00	1.90	0.80
Br.U.	3.82	3.90	-0.08	4.00	3.00	1.00	0.18	-0.90
Ind.W.	3.77	3.58	0.19	4.00	3.00	1.00	0.23	-0.58

---------- SCHOOL=MKG GRADE=8 LEVEL=A TEACHER=3 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.41	2.25	0.16	2.00	2.50	-0.50	-0.41	0.25
Inq.	3.43	3.36	0.08	3.67	3.67	0.00	0.23	0.31
Sat.	3.10	3.17	-0.07	3.40	3.20	0.20	0.30	0.03
Sp.	2.14	2.11	0.03	2.00	2.00	0.00	-0.14	-0.11
Div.	2.76	2.80	-0.04	2.67	2.33	0.33	-0.09	-0.47
Com.	2.08	2.73	-0.65	2.25	3.00	-0.75	0.17	0.27
G.D.	3.59	3.42	0.17	3.75	4.00	-0.25	0.16	0.58
For.	3.05	2.53	0.52	2.50	2.50	0.00	-0.55	-0.03
Tran.	1.07	1.03	0.04	1.00	1.00	0.00	-0.07	-0.03
Gr.W.	2.27	2.27	0.00	2.00	2.00	0.00	-0.27	-0.27
Br.U.	3.93	3.80	0.13	3.00	3.00	0.00	-0.93	-0.80
Ind.W.	3.13	3.17	-0.03	2.00	3.00	-1.00	-1.13	-0.17

---------- SCHOOL=MKG GRADE=8 LEVEL=B TEACHER=4 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.14	2.31	-0.17	2.50	2.25	0.25	0.36	-0.06
Inq.	3.15	2.94	0.21	3.00	3.00	0.00	-0.15	0.06
Sat.	2.95	2.73	0.23	2.00	2.20	-0.20	-0.95	-0.53
Sp.	1.96	2.24	-0.28	2.00	2.00	0.00	0.04	-0.24
Div.	2.21	2.16	0.05	2.33	2.33	0.00	0.13	0.17
Com.	2.19	2.17	0.02	2.00	2.00	0.00	-0.19	-0.17
G.D.	3.17	3.23	-0.06	3.25	3.25	0.00	0.08	0.02
For.	2.52	2.52	0.00	3.50	2.50	1.00	0.98	-0.02
Tran.	1.43	1.00	0.43	1.00	1.00	0.00	-0.43	0.00
Gr.W.	1.90	1.96	-0.06	2.00	1.00	1.00	0.10	-0.96
Br.U.	3.71	3.91	-0.20	3.00	3.00	0.00	-0.71	-0.91
Ind.W.	3.67	3.52	0.14	3.00	3.00	0.00	-0.67	-0.52

---------- SCHOOL=MKG GRADE=9 LEVEL=A TEACHER=5 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.38	2.41	-0.04	2.25	2.00	0.25	-0.13	-0.41
Inq.	3.10	3.08	0.03	2.67	3.33	-0.67	-0.44	0.26
Sat.	2.70	2.90	-0.19	3.00	3.00	0.00	0.30	0.10
Sp.	2.22	2.09	0.13	2.25	2.00	0.25	0.03	-0.09
Div.	1.82	1.77	0.06	1.67	1.67	0.00	-0.15	-0.10
Com.	2.20	2.18	0.02	1.50	3.00	-1.50	-0.70	0.82
G.D.	3.29	3.28	0.01	3.00	3.75	-0.75	-0.29	0.47
For.	2.92	3.19	-0.27	3.00	4.00	-1.00	0.08	-0.81
Tran.	1.00	1.00	0.00	1.00	1.00	0.00	0.00	0.00
Gr.W.	2.27	2.50	-0.23	2.00	3.00	-1.00	-0.27	0.50
Br.U.	3.92	3.85	0.08	3.00	3.00	0.00	-0.92	-0.85
Ind.W.	3.23	3.42	-0.19	3.00	3.00	0.00	-0.23	-0.42

---------- SCHOOL=MKG GRADE=9 LEVEL=B TEACHER=2 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.64	2.50	0.14	3.00	2.50	0.50	0.36	0.00
Inq.	2.53	2.79	-0.26	3.00	3.67	-0.67	0.47	0.88
Sat.	2.56	2.72	-0.16	2.60	3.00	-0.40	0.04	0.28
Sp.	2.58	2.38	0.21	2.00	2.25	-0.25	-0.58	-0.13
Div.	1.35	1.33	0.01	1.33	1.33	0.00	-0.01	0.00
Com.	1.85	1.92	-0.07	2.00	3.75	-1.75	0.15	1.83
G.D.	2.95	2.99	-0.04	3.25	3.25	0.00	0.30	0.26
For.	2.81	2.89	-0.07	3.50	2.50	1.00	0.69	-0.39
Tran.	1.00	1.27	-0.27	1.00	1.00	0.00	0.00	-0.27
Gr.W.	2.42	1.77	0.64	3.00	2.00	1.00	0.58	0.23
Br.U.	3.88	3.95	-0.08	4.00	4.00	0.00	0.13	0.05
Ind.W.	3.46	2.86	0.59	3.00	3.00	0.00	-0.46	0.14

---------- SCHOOL=AY GRADE=7 LEVEL=A TEACHER=1----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.10	1.84	0.25	3.25	1.75	1.50	1.15	-0.09
Inq.	2.86	2.86	0.00	3.67	3.67	0.00	0.80	0.81
Sat.	2.88	3.34	-0.45	1.80	3.40	-1.60	-1.08	0.06
Sp.	2.34	1.84	0.50	2.25	1.25	1.00	-0.09	-0.59
Div.	1.47	1.31	0.16	1.67	1.33	0.33	0.20	0.03
Com.	2.36	2.39	-0.02	3.50	3.50	0.00	1.14	1.11
G.D.	3.24	3.45	-0.21	3.00	3.25	-0.25	-0.24	-0.20
For.	2.95	2.96	-0.00	3.00	3.50	-0.50	0.05	0.54
Tran.	1.00	1.00	0.00	1.00	1.00	0.00	0.00	0.00
Gr.W.	1.77	2.50	-0.73	1.00	3.00	-2.00	-0.77	0.50
Br.U.	3.77	3.79	-0.02	3.00	3.00	0.00	-0.77	-0.79
Ind.W.	2.82	3.21	-0.39	4.00	3.00	1.00	1.18	-0.21

---------- SCHOOL=AY GRADE=7 LEVEL=A TEACHER=2----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.25	2.06	0.19	2.25	2.00	0.25	0.00	-0.06
Inq.	2.96	2.87	0.09	2.67	2.67	0.00	-0.29	-0.21
Sat.	2.91	3.29	-0.38	2.00	3.00	-1.00	-0.91	-0.29
Sp.	2.31	2.19	0.13	2.00	2.25	-0.25	-0.31	0.06
Div.	1.81	1.59	0.22	1.67	1.67	0.00	-0.15	0.08
Com.	2.82	2.44	0.37	2.50	2.75	-0.25	-0.32	0.31
G.D.	2.93	3.48	-0.55	2.50	2.75	-0.25	-0.43	-0.73
For.	2.47	2.67	-0.20	2.50	1.00	1.50	0.03	-1.67
Tran.	1.00	1.00	0.00	1.00	1.00	0.00	0.00	0.00
Gr.W.	2.31	2.54	-0.23	3.00	3.00	0.00	0.69	0.46
Br.U.	3.81	3.92	-0.11	3.00	3.00	0.00	-0.81	-0.92
Ind.W.	3.25	3.69	-0.44	3.00	3.00	0.00	-0.25	-0.69

---------- SCHOOL=AY GRADE=7 LEVEL=B TEACHER=3 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.23	2.22	0.01	3.00	2.50	0.50	0.77	0.28
Inq.	2.84	3.17	-0.33	3.33	3.00	0.33	0.49	-0.17
Sat.	2.90	3.50	-0.60	2.60	2.80	-0.20	-0.30	-0.70
Sp.	2.17	2.20	-0.03	2.25	3.00	-0.75	0.08	0.80
Div.	2.12	2.22	-0.10	2.67	2.00	0.67	0.55	-0.22
Com.	2.75	2.79	-0.04	2.00	2.50	-0.50	-0.75	-0.29
G.D.	3.14	3.43	-0.29	2.25	2.50	-0.25	-0.89	-0.93
For.	3.00	2.86	0.14	3.00	2.50	0.50	0.00	-0.36
Tran.	1.00	1.00	0.00	1.00	1.00	0.00	0.00	0.00
Gr.W.	2.83	2.57	0.26	3.00	3.00	0.00	0.17	0.43
Br.U.	3.82	3.74	0.08	4.00	4.00	0.00	0.18	0.26
Ind.W.	3.30	3.26	0.04	4.00	4.00	0.00	0.70	0.74

---------- SCHOOL=AY GRADE=8 LEVEL=A TEACHER=1----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.38	2.18	0.20	3.25	2.75	0.50	0.87	0.57
Inq.	3.04	3.39	-0.36	3.00	3.67	-0.67	-0.04	0.27
Sat.	2.81	3.22	-0.41	0.60	2.60	-2.00	-2.21	-0.62
Sp.	2.25	1.98	0.27	2.25	1.25	1.00	0.00	-0.73
Div.	1.70	1.67	0.04	2.00	1.67	0.33	0.30	0.00
Com.	2.63	3.07	-0.44	1.25	2.75	-1.50	-1.38	-0.32
G.D.	3.03	3.26	-0.23	3.00	3.25	-0.25	-0.03	-0.01
For.	2.95	2.91	0.04	3.00	3.00	0.00	0.05	0.09
Tran.	1.00	1.05	-0.05	1.00	1.00	0.00	0.00	-0.05
Gr.W.	2.42	2.29	0.14	1.00	2.00	-1.00	-1.42	-0.29
Br.U.	3.79	3.86	-0.07	3.00	3.00	0.00	-0.79	-0.86
Ind.W.	3.53	3.82	-0.29	3.00	2.00	1.00	-0.53	-1.82

---------- SCHOOL=AY GRADE=8 LEVEL=A TEACHER=2----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.14	2.01	0.13	2.75	3.00	-0.25	0.61	0.99
Inq.	3.32	3.43	-0.12	2.67	2.67	0.00	-0.65	-0.77
Sat.	3.10	3.22	-0.12	2.40	2.20	0.20	-0.70	-1.02
Sp.	2.04	2.20	-0.16	3.00	2.50	0.50	0.96	0.30
Div.	2.01	2.16	-0.15	1.67	2.00	-0.33	-0.35	-0.16
Com.	2.59	2.65	-0.06	3.00	3.00	0.00	0.41	0.35
G.D.	3.34	3.48	-0.13	3.00	3.00	0.00	-0.34	-0.48
For.	2.28	2.15	0.13	2.50	2.00	0.50	0.22	-0.15
Tran.	1.80	1.00	0.80	2.00	1.00	1.00	0.20	0.00
Gr.W.	2.56	2.30	0.26	3.00	3.00	0.00	0.44	0.70
Br.U.	3.76	3.91	-0.15	3.00	3.00	0.00	-0.76	-0.91
Ind.W.	3.00	3.17	-0.17	3.00	3.00	0.00	0.00	-0.17

---------- SCHOOL=AY GRADE=8 LEVEL=B TEACHER=3 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.47	2.12	0.35	2.75	2.75	0.00	0.28	0.63
Inq.	2.70	3.18	-0.47	3.00	3.33	-0.33	0.30	0.16
Sat.	2.83	3.05	-0.21	2.20	2.20	0.00	-0.63	-0.85
Sp.	2.29	2.34	-0.05	2.75	2.75	0.00	0.46	0.41
Div.	2.11	2.08	0.03	2.33	2.00	0.33	0.22	-0.08
Com.	2.67	2.63	0.04	2.00	2.75	-0.75	-0.67	0.12
G.D.	3.22	3.34	-0.12	2.50	2.75	-0.25	-0.72	-0.59
For.	2.61	2.75	-0.14	2.50	3.00	-0.50	-0.11	0.25
Tran.	1.11	1.00	0.11	1.00	1.00	0.00	-0.11	0.00
Gr.W.	2.58	3.00	-0.42	3.00	3.00	0.00	0.42	0.00
Br.U.	3.63	3.76	-0.13	3.00	3.00	0.00	-0.63	-0.76
Ind.W.	3.58	3.35	0.23	4.00	4.00	0.00	0.42	0.65

---------- SCHOOL=AY GRADE=9 LEVEL=A TEACHER=2 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.55	2.58	-0.04	2.25	2.75	-0.50	-0.30	0.17
Inq.	2.79	3.05	-0.26	3.00	2.67	0.33	0.21	-0.38
Sat.	2.39	2.75	-0.36	2.80	2.00	0.80	0.41	-0.75
Sp.	2.71	2.79	-0.07	2.50	3.00	-0.50	-0.21	0.21
Div.	1.92	1.97	-0.04	2.00	2.00	0.00	0.08	0.03
Com.	2.36	2.46	-0.10	2.75	3.00	-0.25	0.39	0.54
G.D.	3.12	3.31	-0.19	3.00	2.75	0.25	-0.12	-0.56
For.	2.32	2.21	0.10	3.00	2.50	0.50	0.68	0.29
Tran.	2.00	1.43	0.57	2.00	1.00	1.00	0.00	-0.43
Gr.W.	2.55	2.52	0.02	3.00	3.00	0.00	0.45	0.48
Br.U.	3.59	3.86	-0.27	3.00	3.00	0.00	-0.59	-0.86
Ind.W.	2.64	3.29	-0.65	3.00	3.00	0.00	0.36	-0.29

---------- SCHOOL=AY GRADE=9 LEVEL=A TEACHER=4 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	2.37	2.26	0.11	2.75	2.50	0.25	0.38	0.24
Inq.	2.94	3.09	-0.15	2.67	2.67	0.00	-0.27	-0.42
Sat.	2.67	2.87	-0.20	3.00	2.80	0.20	0.33	-0.07
Sp.	2.30	2.14	0.15	2.25	2.75	-0.50	-0.05	0.61
Div.	2.17	2.14	0.03	2.00	2.33	-0.33	-0.17	0.19
Com.	2.01	2.14	-0.13	3.00	3.50	-0.50	0.99	1.36
G.D.	3.24	3.24	0.00	3.50	3.50	0.00	0.26	0.26
For.	2.74	2.60	0.14	3.50	3.50	0.00	0.76	0.90
Tran.	1.10	1.25	-0.15	1.00	1.00	0.00	-0.10	-0.25
Gr.W.	2.76	2.75	0.01	3.00	2.00	1.00	0.24	-0.75
Br.U.	3.62	3.65	-0.03	2.00	3.00	-1.00	-1.52	-0.65
Ind.W.	3.19	3.50	-0.31	3.00	2.00	1.00	-0.19	-1.50

---------- SCHOOL=AY GRADE=9 LEVEL=B TEACHER=4 ----------

SUBSCALE	STUDENTS			TEACHERS			DIF.TEACH.STUD.	
	POST	PRE	DIF.	POST	PRE	DIF.	POST	PRE
Dif.	1.87	2.26	-0.40	2.25	2.50	-0.25	0.38	0.24
Inq.	3.14	2.75	0.40	2.67	3.00	-0.33	-0.48	0.25
Sat.	3.28	2.80	0.48	2.60	2.20	0.40	-0.68	-0.60
Sp.	1.83	2.18	-0.35	2.00	2.00	0.00	0.17	-0.18
Div.	1.83	1.65	0.19	1.67	1.67	0.00	-0.17	0.02
Com.	2.02	2.25	-0.23	2.25	2.75	-0.50	0.23	0.50
G.D.	3.41	2.98	0.43	3.50	3.66	-0.16	0.09	0.68
For.	2.40	2.66	-0.26	2.00	2.00	0.00	-0.40	-0.66
Tran.	1.47	1.00	0.47	2.00	1.00	1.00	0.53	0.00
Gr.W.	3.07	3.12	-0.05	2.00	2.00	0.00	-1.07	-1.12
Br.U.	3.93	3.88	0.05	3.00	4.00	-1.00	-0.93	0.12
Ind.W.	3.36	3.29	0.06	4.00	3.00	1.00	0.64	-0.29

APPENDIX 12-A

School HR: Total and Sub-test Mean Scores in Percentages on Curriculum-Based Achievement Test, by Grade, by Level* - Pre (June 1986)

Item #		1 - 20		1-6	7-12, 20	13-15	16-17	18-19					21-23	24-26	2,3,13,17
7th Grade	N	Total Test $\bar{x}$	S.D.	Signed numbers	Expressions	Equations	Percentages	Graphs					Common Fractions	Decimals	Anchor items
Level A (girls)	33	42	20	39	36	37	47	68					29	52	45
Level A (boys)	16	25	12	20	24	21	22	56					23	21	17
Level B (girls)	10	26	11	33	16	13	20	70					30	33	27
Level B (boys)	13	8	6	8	8	3	4	19					3	8	8
Item #		1-20		1-2	3-4	5-6	7-8	9-10	11-13	14-16	17-18	19-20	21-23	24-26	1,3,5,11
8th Grade	N	Total Test $\bar{x}$	S.D.	Signed numbers	Expressions	Percentages	Powers	Sets	Word Problems	Algebraic techniques	Equations & inequality	Equations (open items)	Common Fractions	Decimals	Anchor items
Level A (girls)	26	45	21	48	59	59	4	41	54	16	46	66	38	62	60
Level B (girls)	7	12	8	14	14	36	0	7	29	14	0	0	33	29	39
Level B (boys)	20	18	10	25	50	40	10	12	32	5	17	0	20	30	31
Item #		7-26		11-14	15-21	22-26							1-3	4-6	7-10
9th Grade	N	Total Test $\bar{x}$	S.D.	Algebraic Technique	Functions	Elementary Geometry							Common Fractions	Decimals	Anchor items
Level A (boys)	10	28	12	15	14	32							57	40	62
Level B (girls)	17	13	9	9	10	20							22	61	15
Level B (boys)	12	18	8	4	7	20							75	47	50

* In this particular religious school, the boys study separately from the girls

APPENDIX 12-B

School MKR: Total and Sub-test Mean Scores in Percentages on Curriculum-Based Achievement Test, by Grade, by Level - Pre (June 1986)

Item		1-20		1-6	7-12, 20	13-15	16-17	18-19					21-23	24-26	2,3,13,17
7th Grade	N	Total Test $\bar{x}$	S.D.	Signed numbers	Expressions	Equations	Percentages	Graphs					Common Fractions	Decimals	Anchor items
Level A	20	36	17	41	36	32	25	42					30	32	34
Level B	21	16	10	15	12	14	14	40					17	22	19
Item #		1-20		1-2	3-4	5-6	7-8	9-10	11-13	14-16	17-18	19-20	21-23	24-26	1,3,5,11
8th Grade	N	Total Test $\bar{x}$	S.D.	Signed numbers	Expressions	Percentages	Powers	Sets	Word Problems	Algebraic techniques	Equations & inequality	Equations (open items)	Common Fractions	Decimals	Anchor items
Level A	12	35	19	54	37	79	8	12	64	6	29	32	53	42	65
Level B	20	12	8	20	7	22	7	17	25	5	7	20	20	20	26
Item #		7-26		11-14	15-21	22-26							1-3	4-6	7-10
9th Grade	N	Total Test $\bar{x}$	S.D.	Algebraic techniques	Functions	Elementary Geometry							Common Fractions	Decimals	Anchor items
Level A	13	35	13	15	48	40							38	54	33
Level B	16	12	9	12	5	6							40	44	31

APPENDIX 12-C

School MKG: Total and Sub-test Mean Scores in Percentages on Curriculum-Based Achievement Test, by Grade, by Level - Pre (June 1986)

Item #		1-20		1-6	7-12, 20	13-15	16-17	18-19					21-23	24-26	2,3,13,17
7th Grade	N	Total Test $\bar{x}$	S.D.	Signed numbers	Expressions	Equations	Percentages	Graphs					Common Fractions	Decimals	Anchor items
Level A	30	67	19	67	65	60	67	82					51	61	64
Level B	23	43	13	47	34	32	43	74					41	19	47
Item #		1-20		1-2	3-4	5-6	7-8	9-10	11-13	14-16	17-18	19-20	21-23	24-26	1,3,5,11
8th Grade	N	Total Test $\bar{x}$	S.D.	Signed numbers	Expressions	Percentages	Powers	Sets	Word Problems	Algebraic techniques	Equations & inequality	Equations (open items)	Common Fractions	Decimals	Anchor items
Level A	17	39	16	47	65	74	9	38	49	12	56	26	53	27	56
Level B	23	34	14	56	31	44	12	52	56	15	44	13	18	11	55
Item #		7-26		11-14	15-21	22-26							1-3	4-6	7-10
9th Grade	N	Total Test $\bar{x}$	S.D.	Algebraic Technique	Functions	Elementary Geometry							Common Fractions	Decimals	Anchor items
Level A	26	51	22	41	52	45							55	50	68

APPENDIX 12-D

School AY: Total and Sub-test Mean Scores in Percentages on Curriculum-Based Achievement Test, by Grade, by Level - Pre (June 1986)

Item #		1-20		1-6	7-12, 20	13-15	16-17	18-19					21-23	24-26	2,3,13,17
7th Grade	N	Total Test $\bar{x}$	S.D.	Signed numbers	Expressions	Equations	Percentages	Graphs					Common Fractions	Decimals	Anchor items
Level A	29	72	16	72	74	70	64	78					52	67	70
Level B1	17	37	13	35	35	39	29	50					33	31	37
Level B2	19	32	15	36	28	28	21	50					33	23	38
Item #		1-20		1-2	3-4	5-6	7-8	9-10	11-13	14-16	17-18	19-20	21-23	24-26	1,3,5,11
8th Grade	N	Total Test $\bar{x}$	S.D.	Signed numbers	Expressions	Percentages	Powers	Sets	Word Problems	Algebraic techniques	Equations & inequality	Equations (open items)	Common Fractions	Decimals	Anchor items
Level A1	22	79	12	84	82	86	80	73	73	77	57	88	85	76	78
Level B1	17	38	18	59	68	32	12	32	37	14	26	53	27	43	53
Level B2	22	15	6	27	25	36	0	7	18	9	20	6	32	29	26
Item #		7-26		11-14	15-21	22-26							1-3	4-6	7-10
9th Grade	N	Total Test $\bar{x}$	S.D.	Algebraic techniques	Functions	Elementary Geometry							Common Fractions	Decimals	Anchor items
Level A1	15	55	21	50	42	59							91	82	77
Level B1	18	28	10	33	2	34							70	57	62
Level B2	10	16	6	15	1	28							40	43	27

APPENDIX 13-A

Total and Sub-test Mean Scores in Percentages of 8th Grade Students on 7th Grade Curriculum-Based Achievement Test, by School, Level C - Pre (September 1986)

Item #		1-25		1-3	4,5	6,7	8,9	10,11	12,13	15-20	22,23	14,21 24,25	1-5,8-13, 15,16
School	N	Total Test $\bar{X}$	S.D.	Natural Numbers	Common Fractions	Decimals	Order of Operations	Signed Numbers	Percentages	Expressions	Roots	Geometry	Anchor Items
HR													
Boys	11	41	10	85	59	18	50	73	59	23	27	18	51
Girls	10	51	15	100	75	75	55	70	55	40	15	10	67
MKR	10	32	5	77	20	15	35	45	25	23	25	22	41
MKG	12	31	6	86	37	8	42	54	50	10	0	21	49
AY	17	35	9	65	41	18	53	62	32	24	29	16	46
	16	37	10	79	53	19	47	72	50	21	6	20	55

APPENDIX 13-B

Total and Sub-test Mean Scores in Percentages of 9th Grade Students on 8th Grade Curriculum-Based Achievement Test, by School, Level C - Pre (September 1986)

Item #			1-26	1-3	4-6	7-9	10-13	15-18	19-23	14	24-26	1-5,7,8,10, 12,15,17,19, 22
School	N	Total Test $\bar{X}$	S.D.	Natural Numbers	Common Fractions	Order of Operations	Signed Numbers	Percentages	Expressions	Graphs	Geometry	Anchor items
HR												
Boys	13	48	14	72	44	74	58	35	43	23	28	51
Girls	14	43	15	69	62	71	55	23	14	57	26	43
MKR	11	33	15	79	39	39	20	36	20	27	15	43
MKG												
	15	24	12	51	16	31	37	25	8	20	9	36
	23	42	13	68	51	68	42	42	23	26	19	48
AY												
	15	41	15	76	51	7t	45	25	20	27	18	51
	9	24	11	41	18	26	25	28	18	11	22	29

APPENDIX 14-A

School HR: Total and Sub-test Mean Scores in Percentages on Curriculum-Based Achievement Test, by Grade, by Level - Post (June 1987)

Item #		1-20		1-6	7-12, 20	13-15	16-17	18-19					21-23	24-26	2, 3 13,17
7th Grade	N	Total Test $\bar{X}$	SD	Signed Numbers	Expressions	Equations	Percentages	Graphs					Common Fractions	Decimals	Anchor Items
Level B (boys)	17	37	21	32	29	43	68	38					35	33	44
Level B (girls)	29	45	22	45	38	46	64	48					36	47	44
Item #		1-20		1-2	3-4	5-6	7-8	9-10	11-13	14-16	17-18	19-20	21-23	24-26	1, 3 5,11
8th Grade	N	Total Test $\bar{X}$	SD	Signed Numbers	Expressions	Percentages	Powers	Sets	Word Problems	Algebraic Techniques	Equations & Inequality	Equations (open items)	Common Fractions	Decimals	Anchor Items
Level A (girls)	18	68	13	86	86	61	58	67	78	35	75	73	72	94	82
Level B (boys)	18	45	18	58	42	53	8	47	46	37	42	57	31	37	43
Level B (girls)	12	28	19	29	37	50	12	54	33	22	12	17	50	64	40
Item #		7-26		11-14	15-21	22-26							1-3	4-6	7-10
9th Grade	N	Total Test $\bar{X}$	SD	Algebraic Techniques	Functions	Elementary Geometry							Common Fractions	Decimals	Anchor Items
Level B (girls)	29	42	13	32	24	50							77	68	73
Level B (boys)	16	31	11	30	0	44							48	62	72

APPENDIX 14-B

School MKR: Total and Sub-test Mean Scores in Percentages on Curriculum-Based Achievement Test, by Grade, by Level - Post (June 1987)

Item #		1-20		1-6	7-12,20	13-15	16-17	18,19					21-33	24-26	2, 3 13,17
7th Grade	N	Total Test $\bar{X}$	SD	Signed Numbers	Expressions	Equations	Percentages	Graphs					Common Fractions	Decimals	Anchor Items
Level A	25	47	13	45	50	44	20	72					47	72	28
Level B	28	57	14	40	60	58	73	82					51	49	52
Item #		1-20		1-2	3-4	5-6	7-8	9-10	11-13	14-16	17-18	19-20	21-23	24-26	1, 3 5,11
8th Grade	N	Total Test $\bar{X}$	SD	Signed Numbers	Expressions	Percentages	Powers	Sets	Word Problems	Algebraic Techniques	Equations & Inequality	Equations (open items)	Common Fractions	Decimals	Anchor Items
Level A	18	49	20	56	72	72	42	44	70	30	58	26	67	74	79
Level B	12	22	11	37	75	67	21	33	3	11	0	0	53	39	48
Item #		7-26		11-14	15-21	22-26							1-3	4-6	7-10
9th Grade	N	Total Test $\bar{X}$	SD	Algebraic Techniques	Functions	Elementary Geometry							Common Fractions	Decimals	Anchor Items
Level A	9	76	10	67	76	73							89	89	86

APPENDIX 14-C

School MKG: Total and Sub-test Mean Scores in Percentages on Curriculum-Based Achievement Test, by Grade, by Level - Post (June 1987)

Item #		1-20		1-6	7-12,20	13-15	16-17	18-19					21-23	24-26	2, 3 13,17
7th Grade	N	Total Test $\bar{X}$	SD	Signed Numbers	Expressions	Equations	Percentages	Graphs					Common Fractions	Decimals	Anchor Items
Level A	39	57	18	66	58	19	64	81					64	62	47
Level B	30	26	10	28	23	28	12	45					29	28	16
Item #		1-20		1-2	3-4	5-6	7-8	9-10	11-13	14-16	17-18	19-20	21-23	24-26	1, 3 5,11
8th Grade	N	Total Test $\bar{X}$	SD	Signed Numbers	Expressions	Percentages	Powers	Sets	Word Problems	Algebraic Techniques	Equations & Inequality	Equations (open items)	Common Fractions	Decimals	Anchor Items
Level A	31	67	18	76	89	84	64	64	66	33	64	74	60	76	76
Level B	21	13	5	12	33	29	2	21	25	2	17	0	19	24	31
Item #		7-26		11-14	15-21	22-26							1-3	4-6	7-10
9th Grade	N	Total Test $\bar{X}$	SD	Algebraic Techniques	Functions	Elementary Geometry							Common Fractions	Decimals	Anchor Items
Level A	25	44	13	38	29	45							59	59	78
Level B	21	21	9	13	13	17							35	62	48

APPENDIX 14-D

School AY: Total and Sub-test Mean Scores in Percentages on Curriculum-Based Achievement Test, by Grade, by Level - Post (June 1987)

Item #		1-20		1-6	7-12, 20	13-15	16-17	18-19							21-23	24-26	2, 3 13,17
7th Grade	N	Total Test $\bar{X}$	SD	Signed Numbers	Expressions	Equations	Percentages	Graphs							Common Fractions	Decimals	Anchor Items
Level A	24	69	11	84	64	47	60	81							51	78	68
Level B1	17	47	18	54	51	14	26	79							37	45	31
Level B2	21	32	11	46	31	25	12	21							37	14	36
Item #		1-20		1-2	3-4	5-6	7-8	9-10	11-13	14-16	17-18	19-20			21-23	24-26	1, 3 5,11
8th Grade	N	Total Test $\bar{X}$	SD	Signed Numbers	Expressions	Percentages	Powers	Sets	Word Problems	Algebraic Techniques	Equations & Inequality	Equations (open items)			Common Fractions	Decimals	Anchor Items
Level A	26	78	16	81	96	81	69	69	72	72	75	84			82	90	77
Level B1	19	37	14	68	68	58	39	26	46	17	16	29			35	53	59
Level B2	20	29	11	60	45	60	37	32	38	12	25	0			25	32	50
Item #		7-26		11-14	15-21	22-26									1-3	4-6	7-10
9th Grade	N	Total Test $\bar{X}$	SD	Algebraic Techniques	Functions	Elementary Geometry									Common Fractions	Decimals	Anchor Items
Level A	21	70	13	75	60	69									90	78	87
Level B1	22	33	14	33	8	36									50	65	72
Level B2	10	22	8	15	14	24									47	37	42

APPENDIX 15-A

Total and Sub-test Mean Scores in Percentages of 7th Grade Students on Curriculum-Based Achievement Test, by School, Level C - Post (June 1987)

Item #		1 - 26		1 - 3	4 - 6	7 - 9	11-13	15-18	19-23	14	24-26	1-5,7,8, 10,12,15, 17,19,22
School	N	Total Test $\bar{X}$	SD	Natural Numbers	Common Fractions	Order of Operations	Signed Numbers	Percentages	Expressions	Graphs	Geometry	Anchor Items
HR												
Boys	9	41	13	59	52	74	44	28	27	11	26	50
Girls	17	42	15	69	57	71	41	24	24	24	33	48
MKR	17	42	13	69	33	71	50	25	32	35	25	47
MKG	22	38	8	77	56	73	47	6	13	36	24	47
	11	26	6	70	36	39	27	18	5	9	9	31
AY	18	34	10	57	35	61	32	28	23	22	19	41

APPENDIX 15-B

Total and Sub-test Mean Scores in Percentages of 8th Grade Students on Curriculum-Based Achievement Test, by School, Level C - Post (June 1987)

Item #		1 - 25		1 - 3	4 - 5	6 - 7	8 - 9	10,11	12,13	15-20	22,23	14,21 24,25	1-5,8-13 15,16
School	N	Total Test $\bar{X}$	SD	Natural Numbers	Common Fractions	Decimals	Order of Operations	Signed Numbers	Percentages	Expressions	Roots	Geometry	Anchor Items
HR													
Boys	12	55	17	89	58	21	71	54	83	54	50	29	70
Girls	13	45	12	69	50	12	50	73	81	40	8	35	61
MKR	7	49	8	71	64	50	71	57	57	36	57	18	62
MKG	13	27	10	54	31	35	54	27	54	13	0	10	38
	23	46	13	72	41	35	76	57	37	36	46	33	53
AY	12	41	9	64	33	25	79	75	42	32	21	25	57
	8	39	16	83	75	31	38	56	44	21	31	16	54

APPENDIX 15-C

Total and Sub-test Mean Scores in Percentages of 9th Grade Students on Curriculum-Based Achievement Test, by School, Level C - Post (June 1987)

Item #		1 - 25		1 - 3	4, 5	6, 7	8, 9	10, 11	12, 13	14,15,20	16 - 18	22 - 25	1,5 8-15
School	N	Total $\bar{X}$	Test SD	Natural Numbers	Common Fractions	Decimals	Operations	Signed Numbers	Percentages	Expressions	Equations	Geometry	Anchor Items
HR													
Boys	12	56	13	75	75	29	63	83	79	31	33	35	69
Girls	7	49	20	86	50	36	57	64	64	29	24	43	60
MKR	9	50	23	81	67	56	78	67	44	37	37	25	64
	11	43	15	73	27	18	59	82	50	9	33	34	52
MKG	16	60	18	96	59	63	84	81	69	37	33	56	74
	10	42	8	70	60	30	60	60	45	33	30	42	54
AY	13	51	12	92	54	31	58	81	50	36	41	46	62
	11	42	11	79	23	23	64	68	64	24	36	25	56