R E P O R T R E S U M E S

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A PRE-TECHNICAL PROGRAM FOR GEORGIA'S AREA VOCATIONAL-TECHNICAL SCHOOLS, A REPORT ON A PILOT PROGRAM.
GEORGIA STATE DEPT. OF EDUCATION, ATLANTA

PUB DATE JUN 68

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DESCRIPTORS- *AREA VOCATIONAL SCHOOLS, PROGRAM EVALUATION, *REMEDIAL PROGRAMS, TECHNICAL EDUCATION, *POST SECONDARY SCHOOLS, REMEDIAL INSTRUCTION, VOCATIONAL EDUCATION, CURRICULUM GUIDES, COURSE CONTENT, READING, SCIENCES, MATHEMATICS, POST TESTING, PRETESTING, *PRETECHNOLOGY PROGRAMS, *PILOT PROJECTS, PROGRAM EFFECTIVENESS, PROGRAM ADMINISTRATION, GRADE EQUIVALENT SCALES, GEORGIA,

POST-HIGH SCHOOL VOCATIONAL-TECHNICAL STUDENTS WAS DEVELOPED, IMPLEMENTED, AND EVALUATED IN FIVE SCHOOLS IN TERMS OF ITS ABILITY TO PROVIDE DIRECTION IN ESTABLISHING PRE-TECHNICAL PROGRAMS. READING SKILLS, STUDY SKILLS, MATHEMATICS, AND SCIENCE WERE OFFERED AS LEVEL A FOR ENTERING TRADE STUDENTS AND LEVEL B FOR ENTERING TECHNICAL STUDENTS. TEACHERS MET ONE WEEK PRIOR TO THE BEGINNING OF THE PROGRAM TO BECOME ORIENTED AND TO DEVELOP A PROPOSED CURRICULUM GUIDE WITH ASSISTANCE FROM SUBJECT-MATTER SPECIALISTS AND CONSULTANTS. ALL INSTRUCTION WAS STUDENT ORIENTED. A T TEST OF PRE- AND POST-TEST MEAN SCORES ON FIVE ACHIEVEMENT TESTS WAS USED TO DETERMINE STUDENT LEARNING. ALTHOUGH NO CONTROL GROUP WAS AVAILABLE FOR THE TESTING, SIGNIFICANT GAINS AS REFLECTED BY THE TEST SCORES, WERE OBTAINED IN THE SUBJECT AREAS. DATA DID NOT SUPPORT INCLUDING SCIENCE IN THE PRE-TECHNICAL PROGRAM EXCEPT ON AN OPTIONAL BASIS. IT WAS RECOMMENDED THAT THE PRE-TECHNICAL PROGRAM BE IMPLEMENTED IN ALL POST-SECONDARY AREA VOCATIONAL-TECHNICAL SCHOOLS IN GEORGIA. INCLUDED ARE (1) GUIDELINES FOR REPLICATING THE PROGRAM (2) THE CURRICULUM OUTLINE, WHICH INDICATES MAJOR CONTENT UNITS, GOALS, SPECIFIC SKILLS TO BE DEVELOPED, AND SUGGESTED INSTRUCTIONAL MATERIALS, EQUIPMENT, AND PROCEDURES, (3) A STUDENT DATA SHEET, (4) A TEACHER RATING SHEET, AND (5) THE GRADING STANDARD. (DM)

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JACK P. NIX
STATE SUPERINTENDENT OF SCHOOLS

STATE DEPARTMENT OF EDUCATION · OFFICE OF INSTRUCTIONAL SERVICES · DIVISION OF VOCATIONAL EDUCATION

a pre-technical program for georgia's area vocational-technical schools

A REPORT ON A PILOT PROGRAM
1968

A PRE-TECHNICAL PROGRAM

for

GEORGIA'S AREA VOCATIONAL-TECHNICAL SCHOOLS

- a report on a pilot program -

June 1968

State Department of Education
Vocational Education Division
George W. Mulling,
Director
Atlanta, Georgia 30334

This study was conducted under the direction of

James E. Bottoms, Associate State Director
for Leadership Services - Guidance

with special assistance from

Bonham J. Bolt, Data Analyst
Mary Kay Murphy, Technical Writer
R. E. Bodenhamer, Associate State Director
for Area School Programs and members
of his staff

"Everyday in a Pre-Technical Program every student must have four experiences: a first to improve his self-image; a second to feel some form of success; a third to let him know that the Pre-Technical Program can make a positive difference in his preparation for the future; and a fourth to let him know that his Pre-Tech teacher cares about him."

...Virginia Faircloth
Pre-Technical Program
Orientation Teacher of
Reading Skills

June, 1967

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FOREWORD

Pilot programs in vocational education can do much to show us ways of utilizing faculty, students, and facilities to meet the needs of growing numbers of students who want to receive vocational and technical education.

A pilot program of particular significance to the development of vocational-technical education in Georgia was recently completed in five of Georgia's area vocational-technical schools. A summary of the results of that program follows in this report.

The significance of this pilot program lies in its definition of a problem, in its determination of means to solve this problem, and in its evaluation of the appropriateness of this means to solve the problem.

The problem treated by this report--development of a remedial program to prepare post-high school students for vocational and technical courses--is a problem experienced by most vocational-technical schools in Georgia.

This report's value will be determined by its ability to provide direction and assistance to those in Georgia who plan to develop Pre-Technical programs in their own area vocational-technical schools.

The success of this pilot program will lie in its ability to meet the needs of increasing numbers of Georgians as they pursue training to prepare them for vocational and technical occupations.

Atlanta
April, 1968

R. E. Bodenhamer
James E. Bottoms

INTRODUCTION

This report is meant to be used by two different audiences. For those interested in guidelines to develop a Pre-Technical program, Chapter Four has special meaning. These guidelines are based on recommendations which resulted from the pilot program outlined in Chapters One through Three.

For those interested in more specific research aspects of the Pre-Technical program, Chapters One, Two, and Three will have special meaning.

Certainly, all are encouraged to read the entire report. But for those with special interest in aspects of the Pre-Technical program, some chapters will be of more direct importance than others.

CHAPTER ONE

PROBLEM DESCRIPTION

Need for Pre-Technical Program

Vocational educators have for a long time felt that there are large numbers of students who could profit from vocational and technical training but who because they lack certain prerequisite courses or who have marginal high schools grades fail to qualify for entry into these programs.

Georgia has made great strides in developing programs of vocational and technical education to meet the needs of many students at the post-high school level. Still, large numbers of bright students in the state are unable to qualify for these programs because they have not mastered reading, study, mathematics, and science skills--all closely related to successful performance in vocational and technical programs.

Underdeveloped study and reading skills can keep a student from succeeding in any area of vocational or technical education. These skills are to the student as are tools to the craftsman. Underdeveloped mathematics and science skills can also keep a student from succeeding, especially in technical areas.

Research conducted in area schools has revealed that students who are admitted with limited education are among the first to drop out. If vocational-technical education is to serve all the students who could benefit from it, a program to provide students with remedial instruction in these areas is needed.

Such a program, a Pre-Technical program, would give marginal students, late developing students, and students not having prerequisite courses the opportunity to enter vocational and technical programs.

In addition, the curriculum for such a program would be developed to serve two different groups of students. First, a Pre-Technical program would be designed for students who enter vocational level course areas. Second, a Pre-Technical program would be designed for students who enter technical course areas. Although the subject matter for these two programs might overlap, the Pre-Technical curriculum is basically designed to meet the different needs of two different groups of students.

This program will help meet the demand of employers for vocational and technical education graduates. It will also provide opportunities for growing numbers of students with potential for success but with limited educational backgrounds to continue vocational and technical education beyond high school.

Objectives of the Program

In developing a Pre-Technical program for students entering post-secondary vocational and technical programs, there were five objectives:

1. To conduct an orientation program for Pre-Technical teachers during which time they were to develop curriculum guides for Pre-Technical students;

2. To develop an effective Pre-Technical vocational curriculum whose objective is providing students with skills and insights necessary to enter vocational courses;

3. To develop an effective Pre-Technical technological curriculum whose objective is providing students with skills and insights necessary to enter technical courses;

4. To determine if the Pre-Technical program can contribute to successful completion of vocational and technical programs;

5. To determine if student achievement in certain areas can be raised to an effective performance level during an intensive study period.

Background of the Program

Recognizing the need to develop remedial reading, mathematics, science, and study skills in growing numbers of students whose potential for success is high but whose preparation is limited, vocational-technical education leaders in Georgia set about designing a program to narrow this gap. The program was identified as the Pre-Technical program.

In December, 1966, a representative of the Georgia State Department of Education met with a committee of directors of five of Georgia's area vocational-technical schools. These directors had agreed to carry out a pilot program in their schools during the summer of 1967. The schools included Augusta Tech, DeKalb Tech, Coosa Valley Tech, Upson County Tech, and Valdosta Tech.

A representative of Region IV, U. S. Office of Education, attended the initial planning meeting in Atlanta for the purpose of reviewing the development of Pre-Technical programs in other areas of the country.

In addition, the director of Vocational Education, State Department of Education, met initially with the group to outline the State Department's role in support of the program. The associate state director of Georgia's area schools also met with the committee. In later meetings, student personnel specialists in the five pilot schools met with the committee to determine their role in data collection, test administration, and counseling and guidance related to the Pre-Technical program.

Another representative of the State Department of Education, a specialist in curriculum design for Manpower programs, met with the planning committee to outline curriculum directions and course materials and equipment needed to carry out the program.

Definition of Terms

To distinguish between the two different groups of students which the Pre-Technical program was designed to serve, two different curriculum levels were identified:

1. Pre-Technical--Level A. This terms refers to a curriculum planned to meet the remedial needs of students entering a vocational program at the post-high school level. Additionally, Level A denotes a planned curriculum designed to develop skills and insights in students planning to enter trade-oriented courses, business education courses, or health occupation courses.

2. Pre-Technical--Level B. This terms refers to a curriculum planned to meet the remedial needs of students entering a technical program at the post-high school level. Additionally, Level B denotes a planned curriculum to develop skills and insights in students planning to enter technical courses.

Additional Aims

In designing a curriculum to meet the remedial needs of two different groups of students, additional aims were a part of the program:

1. Development of remedial skills to increase students' potential for successful performance in vocational or technical courses;

2. Development of motivation in students by providing them with success experiences, by involving them in course work, and by exposing them to concrete learning experiences;

3. Development of student insight about job opportunities and openings related to the Pre-Technical program.

Summary

In summary, the Pre-Technical program dealt with two distinct programs in terms of students to be served. One, a Pre-Technical Level A program for students prior to their entry into vocational courses; two, a Pre-Technical Level B program for students prior to their entry into technical courses.

Although some subject matter in these two programs might have overlapped, these two programs were developed in terms of remedial needs of the two different groups of students.

CHAPTER TWO

METHODOLOGY

General Design of the Program

The general design of the Pre-Technical program included criteria for selecting students, tests, faculty, materials, and equipment.

Students selected for Pre-Technical program entry had performance and achievement records which indicated that they could profit from remedial instruction in reading, mathematics, and science. Students so identifed were enrolled in either Level A or Level B curriculum areas prior to the start of the summer session which began June, 1967.

Three kinds of data were collected by student personnel specialists to select students for the Pre-Technical program: (1) GATB*scores; (2) high school records; (3) evaluation of students by the pilot school director and student personnel specialist.

GATB cutoff scores in effect at the five pilot schools were used as local norms against which to determine a basis for accepting students into the Pre-Technical program.

For students enrolling in a Pre-Technical Level A curriculum two guidelines are recommended:

1. Students must have demonstrated an aptitude for successful pursuit of vocational curriculum as measured by GATB scores, high school record, and student interest preference;

*General Aptitude Test Battery

2. Students are to be enrolled in Pre-Technical Level A program if they score five points below local cutoff scores in effect at the pilot area schools on the GATB in the G, the mathematics, or the verbal sections of the test.

For students enrolling in a Pre-Technical Level B curriculum four guidelines are recommended:

1. Students must have demonstrated an aptitude for successful pursuit of the technical curriculum as measured by GATB scores, high school record, and student interest preferences;

2. Students with either no course experience or with only one course experience in high school algebra are to be enrolled in Pre-Technical Level B curriculum;

3. Students with no course experience in high school physics are to be enrolled in Pre-Technical Level B curriculum;

4. Students are to be enrolled in Pre-Technical Level B program if they score five points below the cutoff score in effect at the pilot area school on GATB in the G, the mathematics, or the verbal section of the test.

Based on the above guidelines, Pre-Technical students in both Level A and in Level B programs are to be enrolled in one or all of the Pre-Technical course offerings, depending on their performance on the GATB, on their high school record, and on their evaluation by the area school director and the student personnel specialist. Thus, depending on which program area they choose to enter, vocational or technical, and depending on the amount of remedial assistance they need to become proficient in reading skills, in science, and in mathematics, students are to be enrolled in one, two, or three courses in Level A or in Level B or Pre-Technical pilot program.

In addition to the general guidelines related to selecting students for Pre-Technical Level A or Level B programs, controls are to be identified for determining

the relationship between presenting the Pre-Technical program and students' later performance in vocational and technical programs.

These controls include identification of experimental and control groups chosen as follows:

1. Control groups were composed of area vocational-technical students enrolled in pilot schools in the fall of 1966. These control students would have qualified for Pre-Technical Level A or Level B programs on the basis of their GATB scores, their high school records, and their evaluation by the area school director and student personnel specialist. Student personnel specialists in each of these schools were responsible for having teachers of control students rate them before the end of the 1966-67 school year.

2. Experimental groups were composed of students actually enrolled in Pre-Technical Level A and Level B programs in the summer of 1967.

3. The control and experimental groups were matched on two variables:

   a. GATB scores;

   b. Occupational objectives.

Selection of Students

Students selected for enrollment in the Pre-Technical program were chosen according to guidelines listed in the last chapter of this manual.

Selection of Tests

To determine if the achievement in requisite skills areas could be raised adequately during a six-week period of intensive study, five standardized tests were administered to students before the Pre-Technical program began. In addition, alternate forms of these five tests were administered to students upon completion of the Pre-Technical program.

These tests included the following:

1. Metropolitan Achievement Tests High School Battery (Forms Am and Bm) were used to determine a basis for individual student remedial instruction, to evaluate students' skills, and to provide pertinent information for counseling purposes. Form Am was used for the pre-test while Form Bm was used for the post-test. The sub-tests administered were as follows:

   a. Mathematical computation and concepts;

   b. Mathematical analysis and problem solving;

   c. Scientific concepts and understandings;

   d. Science information.

2. Spitzer Study Skills Tests (Forms Am and Bm) were administered to measure important work-study skills, with Form Am being used for pre-test and with Form Bm being used for post-test. Areas for emphasis in this test included:

   a. Using an index;

   b. Using a dictionary;

   c. Knowledge of sources of information;

   d. Understanding of graphs, maps, and tables;

   e. Organization of facts in note-taking.

3. Stanford High School Science Test (Form X) was administered to determine student achievement in the area of content, generalizations, and applications of the physical sciences, earth science, and life science. Form X will be administered as both pre-test and post-test.

4. Kelley-Greene Reading Comprehension Tests (Forms Am and Bm) were administered as an overall measure of reading comprehension as related to three reading abilities: to comprehend information in paragraph form, to find answers to questions, and to retain what is read. Form Am was administered by the pre-test while Form Bm was administered at the post-test.

5. Madden-Peak Arithmetic Computation Tests (Form Am and Bm) were administered to measure the basic arithmetic computational skills of students in five areas: addition and subtraction; multiplication and division; common fractions; decimal fractions, mixed decimals, and percents; mental computation and estimation. Form Am was used for the pre-test while Form Bm was used for the post-test.

Specimen sets of each of these five tests were made available to student personnel specialists at the pilot area schools prior to the pre-testing of Pre-Technical students. Two days at the beginning of the program and two days at the end of the program were devoted to testing students. Each of the five pilot schools was responsible for purchasing its own tests, with $.50 per student per test being budgeted for testing costs.

Student personnel specialists in each of the five pilot schools were responsible for recording pre-test and post-test data on students. (See Appendix A.)

In addition, they were responsible for having Pre-Technical teachers rate their students according to personality traits to determine rate of improvement. (See Appendix B.) Teachers rated students twice--once at the end of the first week and once at the end of the program. A five point rating scale was used. Student personnel specialists collected teacher rating scales at the end of the first week and at the end of the last week of the program.

Further, student personnel specialists were responsible for collecting student retention rates based on student grades in each Pre-Technical course. (See Appendix C.)

Selection of Faculty

Teachers selected for employment in the Pre-Technical program were chosen according to guidelines listed in the last chapter of this manual.

Equipment Selection and Requisition

To standardize Pre-Technical program offerings in the five pilot area schools, the same kind of equipment--textbooks, filmstrips, laboratory equipment and materials--was purchased, almost without exception, for uniform administration of the Pre-Technical program. Equipment and materials suggested for use in Pre-Technical courses is listed in the last chapter of this guide.

A Manpower curriculum specialist assigned to the State Department of Education was responsible for determining the equipment and materials to be used in the three subject matter areas. Later, his selections were approved by the Pre-Technical planning committee and still later were evaluated as to appropriateness of program and remedial needs of students by the Pre-Technical teachers. A list of this equipment follows in Chapter Four.

Orientation Program for Pre-Technical Teachers

In accordance with Objective 1 of the Pre-Technical program, conducting an orientation program for teachers of the Pre-Technical program, the teachers employed to teach the remedial courses of the program met for a one-week period prior to the beginning of the program for two purposes. They wished to become oriented to the area school program, objectives, and environment in which they were to find themselves working and to develop a proposed curriculum guide in the areas of remedial reading, science, and mathematics as related to students vocational (Level A) and technical (Level B) interests.

During the one-week orientation program, the Pre-Technical teachers developed their curricula in light of the cornerstones of an effective Pre-Technical program:

1. Students should experience success in every Pre-Technical class--everyday;

2. Pre-Technical instruction should be presented in a concrete manner;

3. Pre-Technical instruction should be related to students' vocational and technical interests and to their need for remedial training.

Subject matter specialists and consultants were employed by the State Department of Education to provide assistance to Pre-Technical teachers in developing curricula guides. In addition, representatives of the manufacturers of equipment purchased for use in the Pre-Technical program demonstrated the use of this equipment during orientation week. Finally, vocational-technical leaders and planners from the State Department of Education and from the University of Georgia met with the Pre-Technical teachers to provide an overview of the purpose, the philosophy, and the histroy of vocational and technical education.

CHAPTER THREE

TREATMENT OF THE DATA

In developing controls for evaluating a Pre-Technical program, Level A and Level B, two objectives were identified. The first objective was to determine if a planned Pre-Technical program can contribute to the successful completion of vocational and technical curricula by students participating in the program. The second objective was to determine if the achievement in requisite skill areas can be raised to an effective performance level during an intensive study period of six weeks in a summer session.

To measure these two objectives, the plan was to test associated hypotheses. The hypothesis related to the first objective is that a planned Pre-Technical program can contribute to successful completion of vocational and technical curricula. The hypothesis related to the second objective is that achievement in requisite skill areas can be raised to an effective performance level during an intensive six-weeks study period.

To test the first hypothesis, a plan was formulated to collect the following data: student background information; grades for the first two quarters; and retention rates for Pre-Technical students and control groups students.

To test the second hypothesis, a plan was formulated to collect pre-test and post-test scores on the five standardized tests included in the Pre-Technical test battery.

As of April, 1968, data have been collected and analyzed concerning achievement test scores, but the collection of the data to test the first hypothesis is still in progress.

Grades and Retention Rates

The collection of these data should be completed approximately by May, 1968, and results of the analysis will be made available after that date.

Achievement Test Scores

As has been stated, the hypothesis to be tested using pre-test and post-test scores on standardized tests is that achievement in requisite skill areas can be raised to an effective performance level during an intensive six weeks' study period. A t-test of pre-test and post-test means was used to determine gain scores of students in the Pre-Technical program as related to this hypothesis. The data were analyzed by pilot school and by technical or vocational course level.

The overall hypothesis was substantiated, although not evey school showed an increase on every test at both Levels A and B. The t values and the associated probability statements are presented in Tables I, II, and III, following. Those probabilities which are small enough to allow rejection of the null hypothesis (and thus acceptance of our hypothesis) are marked by an asterisk.

Since no control group was available for the testing, any gain in achievement score cannot be attributed to the Pre-Technical program, for it is possible that the students involved in the program would have shown a like increase after any six-week period in their lives.

It is known, however, that something occurred during this six-week period to cause the students to increase achievement in the subject areas as reflected by the test scores. It is suggested that this something was the Pre-Technical program.

TABLE I

Pre-Technical Program, t-Test Scores
Reported by Level A and Level B

	Pre Mean	Post Mean	N	t	Significance Level
All Schools-- Levels A & B					
Metropolitan	82.73	86.72	75	3.69	$p < .01$*
Stanford	36.60	40.32	50	4.37	$p < .01$*
Madden-Peak	36.72	44.88	105	7.15	$p < .01$*
Kelley-Greene	111.67	126.71	92	7.30	$p < .01$*
Spitzer	47.86	54.87	89	7.30	$p < .01$*
All Schools-- Level B					
Metropolitan	105.09	107.66	33	1.84	$p < .10$
Stanford	46.40	49.31	22	2.34	$p < .05$*
Madden-Peak	50.87	54.75	40	3.28	$p < .01$*
Kelley-Greene	136.00	146.00	39	3.32	$p < .01$*
Spitzer	60.24	67.81	33	2.06	$p < .05$*
All Schools-- Level A					
Metropolitan	65.67	69.59	37	2.30	$p < .05$*
Stanford	29.59	34.86	22	3.68	$p < .01$*
Madden-Peak	28.39	39.18	61	10.17	$p < .01$*
Kelley-Greene	97.04	114.34	47	3.73	$p < .01$*
Spitzer	40.87	48.20	49	4.91	$p < .01$*

Table I

It can be seen from Table I that taking all schools and both levels together, it was possible to accept our hypothesis in every case. Separating the levels, our hypothesis could not be accepted for the Metropolitan Mathematics and Science test at Level B. But our hypothesis could be accepted for every test at Level A.

TABLE II

Pre-Technical Program, t-Test Scores
Reported by Pilot Program School

	Mean	Mean	N	t	Significance Level
Metropolitan					
Augusta	72.38	79.15	13	2.16	$p < .10$
Coosa Valley	81.62	86.00	24	3.42	$p < .01$*
DeKalb	95.94	96.11	18	.07	$p > .90$
Upson	61.40	75.20	5	6.42	$p < .01$*
Valdosta	84.73	87.00	15	0.75	$p < .50$
Stanford					
Augusta	27.54	30.54	13	2.22	$p < .05$*
Coosa Valley	-	-	-	-	-
DeKalb	41.64	47.17	17	3.21	$p < .01$*
Upson	26.33	27.16	6	.63	$p < .60$
Valdosta	43.29	46.71	14	1.89	$p < .10$
Madden-Peak					
Augusta	41.93	50.07	15	4.24	$p < .01$*
Coosa Valley	40.78	42.53	32	1.67	$p < .20$
DeKalb	34.65	47.00	20	6.17	$p < .01$*
Upson	22.25	33.25	4	1.73	$p < .20$
Valdosta	33.53	44.94	34	8.45	$p < .01$*
Kelley-Greene					
Augusta	112.69	131.46	13	3.24	$p < .01$*
Coosa Valley	93.68	91.95	31	-1.32	$p < .20$
DeKalb	139.00	161.50	16	5.70	$p < .01$*
Upson	81.80	117.80	5	3.45	$p < .05$*
Valdosta	121.19	145.96	27	7.96	$p < .01$*
Spitzer					
Augusta	42.31	51.77	13	6.52	$p < .01$*
Coosa Valley	42.20	55.52	25	3.62	$p < .01$*
DeKalb	59.06	66.40	15	4.79	$p < .01$*
Upson	36.14	40.43	7	1.39	$p < .30$
Valdosta	45.65	53.24	29	3.43	$p < .01$*

Table II

Table II shows the test results by test and by school, taking both levels together.

It can be seen that four schools showed an increase sufficient to reject the null hypothesis on the Spitzer and the Kelley-Greene tests; three schools showed an increase sufficient to reject the null hypothesis on the Madden-Peak test; and two schools showed an increase sufficient to reject the null hypothesis on the Metropolitan and Stanford tests.

It should be mentioned here that the science section of the Metropolitan test and the Stanford Science test are general science tests including such topics as meteorology and biology. The science course in the Pre-Technical program was, however, directed exclusively toward physics. Thus the relatively poorer showing on these tests could easily be a consequence of a poor choice of tests for the area of science.

TABLE III

Pre-Technical Program, t-Test Scores
Reported by Levels A & B and by Pilot Program School

	Pre Mean	Post Mean	N	t	Significance Level
Metropolitan					
Level B					
Augusta	92.50	96.62	8	1.35	$p < .30$
Coosa Valley	109.45	114.45	11	2.31	$p < .05$*
DeKalb	120.67	121.83	6	.62	$p < .60$
Valdosta	100.00	98.75	8	- .35	$p < .80$
Level A					
Augusta	40.20	51.20	5	1.67	$p < .20$
Coosa Valley	58.07	61.92	13	2.50	$p < .05$*
DeKalb	83.58	83.25	12	-.001	$p < .90$
Valdosta	67.28	73.57	7	1.40	$p < .30$
Stanford					
Level B					
Augusta	34.37	39.62	8	3.86	$p < .01$*
Coosa Valley	-	-	-	-	-
DeKalb	55.83	58.00	6	0.67	$p < .60$
Valdosta	51.37	52.62	8	0.60	$p < .60$
Level A					
Augusta	16.60	16.00	5	0.24	$p < .90$
Coosa Valley	-	-	-	-	-
DeKalb	33.90	41.27	11	2.77	$p < .02$*
Valdosta	32.50	38.83	6	2.16	$p < .10$
Madden-Peak					
Level B					
Augusta	79.50	88.50	9	7.62	$p < .01$*
Coosa Valley	57.35	56.28	14	-0.67	$p < .60$
DeKalb	50.17	53.17	6	1.48	$p < .20$
Valdosta	44.00	50.18	11	2.31	$p < .05$*

	Pre Mean	Post Mean	N	t	Significance Level
Madden-Peak (Continued)					
Level A					
Augusta	25.33	36.67	6	2.73	$p < .05$*
Coosa Valley	27.88	31.83	18	3.16	$p < .01$*
DeKalb	28.00	44.35	14	8.65	$p < .01$*
Valdosta	29.82	42.43	23	2.63	$p < .02$*
Kelley-Greene					
Level B					
Augusta	145.00	160.00	8	.83	$p < .50$
Coosa Valley	105.71	100.78	14	-1.72	$p < .20$
DeKalb	173.83	185.33	6	3.51	$p < .02$*
Valdosta	147.36	172.00	11	5.39	$p < .01$*
Level A					
Augusta	61.00	85.80	5	2.94	$p < .05$*
Coosa Valley	83.76	83.76	17	-	-
DeKalb	131.22	163.55	9	7.29	$p < .01$*
Valdosta	103.18	128.06	16	5.74	$p < .01$*
Spitzer					
Level B					
Augusta	53.37	62.25	8	7.78	$p < .01$*
Coosa Valley	66.20	69.80	10	1.60	$p < .20$
DeKalb	71.33	78.17	6	2.69	$p < .05$*
Valdosta	52.33	63.67	9	4.20	$p < .01$*
Level A					
Augusta	24.60	34.80	5	2.88	$p < .05$*
Coosa Valley	37.86	46.00	15	3.33	$p < .01$*
DeKalb	50.88	58.55	9	3.75	$p < .01$*
Valdosta	42.70	48.55	20	1.98	$p < .10$

Table III

Table III shows the analysis by test, by school, and by level. Upson did not report its data by level and thus was not included in this analysis. The Coosa Valley data for the Stanford Science test were incomplete and could not be used.

It may be noted that in only two instances on a particular test does a school show an acceptable increase at Level B and not at Level A. However, in five instances a school shows an acceptable increase on a particular test at Level A and not at Level B. This could be a consequence of the fact that the Level A students had relatively greater room for improvement than did the Level B students.

Summary of Test Score Analysis

Overall, the results from the standardized tests used in the Prè-Technical program seem favorable. There is some question as to the relevancy of these standardized tests to the specific course content in the Pre-Technical program; however, these tests do measure achievement in these general subject matter areas.

In summary, it is felt that the test results of the Pre-Technical program provide evidence for recommending the Pre-Technical program for implementation in all post-secondary area vocational-technical schools in Georgia.

Subjective Analysis

In addition to the above mentioned data, plans have also been developed to collect from students a subjective evaluation of their reactions to the Pre-Technical program.

CHAPTER FOUR

GUIDELINES FOR REPLICATING THE PRE-TECHNICAL PROGRAM

General Summary

A remedial program in skills related to successful performance of post-high school vocational-technical students has been developed, implemented, and evaluated in terms of its ability to provide direction in establishing Pre-Technical programs.

Recommendations

For those involved in post-secondary vocational and technical education who are interested in replicating the Pre-Technical program, the following recommendations, based on a Pre-Technical pilot program are identified as guidelines:

1. Objectives

   The primary objective of the Pre-Technical program is to offer a program to develop remedial skills in the area of reading, study skills, and mathematics in students entering post-secondary vocational or technical courses.

2. Courses

   Resulting from the Pre-Technical pilot program offered in five Georgia area vocational-technical schools, only three areas for study are recommended to be included in the Pre-Technical program:

   a. Reading skills;

b. Study skills;

c. Mathematics.

If the Pre-Technical science program is offered, it will be offered on a local option basis by area vocational-technical schools.

3. Levels

The guidelines to identify levels for the Pre-Technical program are as follows:

a. Pre-Technical Mathematics is to be divided into two levels, Level A for entering trade students and Level B for entering technical students;

b. Pre-Technical Reading Skills and Study Skills are not to be divided into Levels A and B but taught as one course.

4. Selection of Students

Pre-Technical students are to be selected on the basis of the following:

a. For students enrolling in a Pre-Technical Level A curriculum, the following specific guidelines are to be observed:

(1) The student must demonstrate aptitude for being successful in the vocational curriculum;

(2) A Pre-Technical Level A student having scores within five points of the cutoff score on the GATB should study the Pre-Technical Level A curriculum. The score considered should be in the student's occupational area;

(3) A student scoring five points below the cutoff score on the GATB, mathematics, and verbal scores will be required to study the summer pre-technical curriculum.

b. For students enrolling in a Pre-Technical Level B curriculum, the following specific guidelines are observed:

(1) The student must demonstrate aptitude for being successful in the technology curriculum;

(2) If the Pre-Technical student has not had at least one course in high school algebra, he will be required to enroll in the summer Pre-Technical curriculum;

(3) If the Pre-Technical student has had one year of algebra, it will be recommended that he enroll in the summer Pre-Technical curriculum;

(4) If the Pre-Technical student has not had a course in physics, it will be recommended that he enroll in the summer Pre-Technical curriculum;

(5) If a Pre-Technical student is within the range of five points of the cutoff score on the GATB verbal, mathematics, and G scores, it will be recommended that he enroll in the Pre-Technical curriculum;

(6) If a Pre-Technical student is five points below the cutoff score recommended on the GATB for the occupational area he wishes to pursue, he will be required to enroll in the summer Pre-Technical curriculum.

Based on the above guidelines, some students will either be recommended or required to enroll in all of the Pre-Technical course offerings. Other students will be required to enroll in only specified courses. For example: The GATB cut-off scores for electronics are G-105, mathematics 105, and verbal 100, and the required high school prerequisite is at least one course in high school algebra. John Jones wants to enroll in electronics. John's GATB scores are as

follows: G-108, mathematics 103, verbal 90. John did not have any algebra in high school. An application of the guidelines would require John to take the pre-technical mathematics and communication skills courses.

5. Selection of Faculty

Selection of faculty members for the Pre-Technical program is to be based on the following criteria:

a. Teachers employed for the six-week period must have been professionally certified by the Georgia State Department of Education in the subject matter area in which they are employed to teach. In addition, they must have earned a college major in the subject matter area in which they are employed to teach.

b. High school teachers are preferred for employment in the area of mathematics, while teachers with training and experience in remedial reading are preferred for employment as teachers of the reading and study skills sections of the program.

c. Pre-Technical teachers must be willing to attend one week of orientation and pre-planning prior to the beginning of the Pre-Technical program.

d. Pre-Technical teachers are to be employed on a seven-week basis not to exceed pay on step three of the State Technical Salary Schedule. If a revised salary schedule is released after the summer of 1967, Pre-Technical teachers are to be paid according to the first step of that schedule, provided that the first step is equal to or higher than the third step of the rescinded salary schedule.

e. Pre-Technical teachers are to be employed to teach at least two two-hour classes each school day during the Pre-Technical

program. If only one class can be scheduled for a Pre-Technical teachers, the area school director is to arrange related responsibilities for that teacher.

f. Pre-Technical teachers are to have the responsibility of relating subject matter in their area to students' Level A or Level B occupational interests, needs, and goals.

6. Teaching Methods

Primary emphasis on teaching methods in the Pre-Technical program should include the following:

a. Emphasis on methods which provide success experiences for students;

b. Emphasis on methods which provide concrete experiences and activities related to vocational and technical courses rather than on abstract theoretical methods;

c. Emphasis on methods which provide individual instruction rather than on group instruction;

d. Emphasis on methods of active student involvement in learning experiences rather than on the lecture method by Pre-Technical teachers.

7. Testing Program

Pre-testing and post-testing are to be carried on for continued evaluation experiences in the Pre-Technical program. Data are to be collected by student personnel specialists in participating area vocational-technical schools and forwarded to Leadership Services Unit of the State Department of Education two weeks following completion of Pre-Technical program. Forms for collection of these data are included as Appendix A.

The tests orginally used in the Pre-Technical program are, as of April 1968, out-of-print. Discouraging as this circumstance is in regard to replicating the original program, it does not invalidate efforts of others to implement a Pre-Technical program.

The following revised list is to be considered as a guide for pre and post-testing. The same form of each suggested test is to be used for both pre and post-tests.

a. Reading and Comprehension Skills--Levels A and B

California Test of Basic Skills
(published by the California Test Bureau, a division of McGraw-Hill Book Company)

Test 1 - Reading Vocabulary
Test 2 - Reading Comprehension
Test 3 - Lanugage Mechanics
Test 4 - Language Expression
Test 5 - Language Spelling

b. Study Skills--Levels A and B

California Test of Basic Skills

Test 9 - Using Reference Materials
Test 10 - Using Graphic Materials

c. Mathematics Skills--Level A

California Test Basic Skills

Test 6 - Arithmetic Computation
Test 7 - Arithmetic Concepts
Test 8 - Arithmetic Applications

d. Mathematics Skills--Level B

Wide Range Achievement Test
(distributed by Psychological Corporation)

Arithmetic Test - Level 2 tests and norms.

e. Science Skills--Levels A and B

Every Student Science Test (General Science) (published by Ohio Scholarship Tests)

8. Orientation Program

All teachers employed in the Pre-Technical program will be required to attend a one-week orientation program.

9. Equipment

The following equipment is suggested for inclusion in the Pre-Technical program:

a. Reading and Study Skills:

FOR PURCHASE BY SCHOOL:

(1)	1	Controlled Reader Projector	$275.00
(2)	1	Tach-X Tachistoscope	200.00
(3)	1	V-789 Grade 7-9, Vocabulary Filmstrip, Correlated with Word Clue Books	42.00
(4)	1	V-1011 Grade 10-11, Vocabulary Filmstrip, Correlated with Word Clue Books	28.00
(5)	5	Flash X-Tachistoscope	36.00
(6)	1	Flash X Accuracy Building Set X-9 Advanced Set	3.60

(7)	2	X-27 and X-33 Flash X Vocabulary Sets for use with Word Clue Series Correlated with Word Clues	7.20
(8)	6	Study Skills Libraries Exercises on Reading Levels 3-9: 3 kits at each level-- $10.50 per kit	69.00
(9)	1	SRA Reading Laboratory Reading Levels 5.0-12.0	58.50
(10)	1	SRA Reading Laboratory Reading Levels 8.0-14.0	58.50
(11)	1	SRA Reading for Understanding Kit (General Education) Grades 5 through College	32.58
(12)	1	set of 50 Placement Tests to be used with Reading for Understanding	4.00 per package

FOR PURCHASE BY STUDENTS:

(1)	1	SRA Developing Your Vocabulary by Paul Witty and Edith Grochberg	2.00
(2)	1	SRA Student Record Book	.51
(3)	1	SRA Student Record Book	.27

b. Mathematics Skills--Levels A & B:

FOR PURCHASE BY SCHOOL:

(1)	1	set, Geometry, A Unified Course (45 prepared transparencies)	65.00

(2)	1	set, Algebra One, A Modern Course (40 prepared transparencies)	58.00
(3)	1	set, Algebra Two, A Modern Course (40 prepared transparencies)	58.00

FOR PURCHASE BY STUDENTS:

(1)	1	per student, SRA Student Record Book	..51
(2)	1	per student, Working With Numbers. Refresher course by James T. Shea	1.08
(3)	1	per student, Basic Mathematics, by M. W. Keller and J. H. Zant.	2.75

10. Curriculum Guide

In accordance with Objectives 2 and 3 of the Pre-Technical program, remedial curriculum guides were developed in the subject matter areas of reading, science, and mathematics, Level A and Level B.

Although some subject matter in the Pre-Technical Level A and Level B curricula might have overlapped, the Pre-Technical program was carried out in terms of curricula to meet the needs of two distinct groups of students--one, a Pre-Technical Level A student prior to his entry into trade courses; two, a Pre-Technical Level B program for a student prior to his entry into technical courses.

a. Introductory Pre-Technical Reading and Study Skills, Level A and Level B

Because reading and study skills are basic tools of the student, Level A and Level B

students were combined into one group and exposed to the same subject matter, classroom experiences, and concept and skills analysis, depending on individual student reading level and study skills performance.

Each Pre-Technical teacher determined a timed schedule for relating concepts and skills to the individual student's level of development and to his need for remedial reading and study skills instruction.

Although reading skills represented a vital core of the Pre-Technical program, other language arts areas such as listening, speaking, and writing were also included in the program. Reading and study skills were considered the central skills to be developed, with other language arts areas also being emphasized.

The outline which follows indicates major units of curriculum content, instructional goals, and specific skills to be developed. Further, it outlines instructional materials and equipment to be as well as suggested teaching procedures. The form of this outline represents the revised curriculum agreed to by Pre-Technical reading and study skills teachers.

TABLE IV

CURRICULUM AREA - INTRODUCTORY PRE-TECHNICAL READ

Major Units	Time	Instructional Goals	Specific Skills to be Developed	
I. Reading (See Teaching Comprehension Skills, Georgia State Department of Education, 1964, outline developed by I. A. Aaron. Also see Developing Reading Abilities, Grades 7-12, Georgia State Department of Education, 1964)	as needed	1. Comprehension in Basal Reading a. Developing Reading Readiness b. Directed silent reading c. Comprehension check and skill building d. Word recognition skill building e. Purposeful rereading	1. Comprehension Skills a. Associating meaning with words b. Interpreting punctuation c. Interpreting subheadings, etc. d. Reading by thought units e. Interpreting and appreciating figurative language f. Reading to find answers to specific questions g. Reading for details h. Reading to follow directions i. Reading to follow sequence to events j. Reading to get main idea k. Reading to locate information l. Reading to enjoy and to appreciate m. Reading to interpret illustative materials such as maps, globes, tables, graphs, pictures	1. Tac 2. SRA 3. EDI rea 4. Mul 5. Dep mar

TABLE IV

ECHNICAL READING & STUDY SKILLS - LEVEL A & B

to	Instructional Materials & Equipment to Be Used		Suggested Teaching Procedures
	Basic	Supplementary	
Skills mean- rds g punc- g sub- tc. thought g and g figu- uage find estions follow follow events get locate enjoy eciate inter- ative uch as , hs,	1. Tach X 2. SRA material 3. EDL controlled reader 4. Multilined EDL 5. Departmental reading manuals	1. Tape recorder 2. Newspaper 3. Catalogues 4. Technical magazines 5. Dictionary 6. Indexes 7. Booklets 8. Brochures	1. Adequate time in class to teach reading skills as related to occupational subjects a. Specialized vocabulary b. Background for understanding occupational material c. Special symbols of subject d. Charts, maps, graphs of subject 2. Comprehension taught in material students can read

TABLE IV
(Continued)

Major Units	Time	Instructional Goals	Specific Skills to be Developed	B
I. Reading (Continued)			n. Reading to get depth for detailed remembering o. Reading to draw conclusions, to generalize, to get implied meanings 2. Word recognition 3. Speeded comprehension of paragraphs 4. Speeded comprehension of small units 5. Speeded comprehension of connected text	
II. Study Skills (See Pre-Technical Post High School Programs, U. S. Department of HEW, Office of Education 1967)		1. Scheduling time & working effectively	1. Setting up work schedule: a. when to study b. allocating study time c. fitting schedules to individual routine d. study environment	
		2. Using textbooks effectively	2. Different types of reading: a. skimming & scanning b. reviewing	
		3. Taking & organizing notes	3. Type of notes: a. verbatim b. outline notes c. skeleton outlines	

IV
nued)

	Instructional Materials & Equipment to be Used		Suggested Teaching Procedures
	Basic	Supplementary	
ed et on on on s t s			

TABLE IV
(Continued)

Major Units	Time	Instrucational Goals	Specific Skills to Be Developed	
II. Study Skills (Continued)		4. Outlining a. standard outline b. abbreviating 5. Improving concentration and memory 6. Developing effective exam skills	4. Interpretive listening: a. accenting important points b. adjusting to different types of lectures 5. Making notes on reading assignment 6. Preparing for exams a. reviewing b. organizing material c. taking objective-type exams d. taking essay-type exams	
III. Listening	as needed	1. Comprehension 2. Ability to follow oral directions 3. Ability to summarize directions	1. Vocabulary (Key Words) 2. Increase attention span 3. Increase concentration	1. SRA mate 2. Tape 3. Tape
IV. Speaking	as needed	1. Usage in job setting 2. Language levels 3. Types of usage for specific situations	1. Tone placement 2. Enunciation 3. Rhythm	1. Teac dril 2. Gray dril

ABLE IV
ontinued)

s to	Instructional Materials & Equipment to Be Used		Suggested Teaching Procedures
	Basic	Supplementary	
mpor- o ypes n ment exams			
ctive- y-type			
y tion ntra-	1. SRA listening materials 2. Tape recorder 3. Taped instruction	1. Prepared teacher-student tapes and stories	1. SRA suggested procedure 2. Map reading 3. Word bingo 4. Wordo 5. Job interviews 6. Discussion directions
	1. Teacher creative drills 2. Gray's oral reading drill and usage	1. Creative student material 2. Professional and commercial materials 3. Oral drill 4. Discussion groups 5. Other related materials	1. Oral drills 2. Job interviews 3. Role playing situation 4. Dialogue-scripts 5. Prepared note speeches 6. Incorporating good listening procedure procedures

TABLE IV
(Continued)

Major Units	Time	Instructional Goals	Specific Materials to Be Developed	Bas
V. Writing	as needed	1. Legible letter formation 2. Correct spelling in the technical vocabulary 3. Simple research 4. Advertisement writing 5. Resume writing	1. Command of vocational terminology 2. Note and outline formulation	1. Convent materia 2. Tape re

to	Instructional Materials & Equipment to Be Used		Suggested Teaching Procedures
	Basic	Supplementary	
onal	1. Conventional materials 2. Tape recorder	1. FM radio 2. Writing charts 3. Application forms 4. Tax, employment bank, sales 5. Schedules	1. Note taking based on trade and technical content 2. Writing based on trade and technical materials 3. (supplementary) 3. Developing music into rhythms 4. Metronome techniques

b. Introductory Pre-Technical Mathematics Skills, Level A

In this curriculum area, a study of the fundamental skills of arithmetic is to be made, with special emphasis being placed on using whole numbers and computing common fractions and decimal fractions as related to vocational interests and topics. Special topics in elementary mathematics are to be introduced as needed, related to students' level of development and need for remedial instruction.

Time schedules, though suggested in hours in the outline which follows, are flexible and directly related to the individual Pre-Technical teacher's appraisal and assessment of individual strengths and weaknesses on the part of the Pre-Technical student.

The outline which follows indicates major units of curriculum consideration, instructional goals, specific skills to be developed, instructional materials and equipment to be used, and suggested teaching procedures. The form of this outline represents the revised curriculum agreed to by Pre-Technical mathematics teachers.

TABLE V

CURRICULUM AREA - INTRODUCTORY PRE-TECHNICAL

Major Units	Time	Instructional Goals	Specific Skills to Be Developed	
I. Whole Numbers	4	1. Student develops understanding, accuracy and speed in use of whole numbers	1. Technique, accuracy, speed	Textbook textbook
II. Common and Mixed Fractions	8	1. Student develops understanding, skill, accuracy and speed in using common fractions 2. Student develops some understanding of how these skills relate to occupational area	1. Read and write common fractions 2. Four operations in common fractions	Textbook textbook
III. Decimals	8	1. Student develops understanding and skill in use of decimal fractions 2. Student develops some understanding of how these skills relate to their occupational area	1. Read and write decimals 2. Use decimal fractions in the four basic operations 3. Conversion from common fraction to decimal and from decimal to common fraction	Textbook textbook
IV. Percent	4	1. Student develops understanding, skill, accuracy and speed in the use of percentage as related to concrete occupational	1. Conversion 2. Read and write percent 3. Relationships between decimals, fractions and percent	Textbook possible)

LE V

RE-TECHNICAL MATHEMATICS - LEVEL A

	Instructional Materials & Equipment to Be Used		Suggested Teaching Procedures
	Basic	Supplementary	
y,	Textbook (Programmed textbook is preferred)	Visual aids	1. Oral work 2. Written work 3. Time drills 4. Group work
	Textbook (Programmed textbook is preferred)	1. Occupationally related equipment a. ruler b. scale c. gauges d. wrenches	1. Definite problems from occupational area 2. Demonstrate use of equipment from occupational area in reading fractions
ons	Textbook (Programmed textbook is preferred)	1. Machine tools in the shop	1. Visit machine shop 2. Demonstrate the use of fractions on gauge blocks 3. Make shaft and convert from decimal readings to common fractions
een s	Textbook (Programmed if possible)	1. Visual aids 2. Machine tools	1. Use examples like percentage of income tax, Social Security and similar deductions from the paycheck

TABLE V
(Continued)

Major Units	Time	Instructional Goals	Specific Skills to Be Developed	
V. Units of Measurement and Formulas	12	1. Student is able to identify units of measure 2. Student is able to use formulas to find area of triangles and rectangles 3. Student solves for unknown in simple equations 4. Student is able to take square root 5. Student understands measurement in degrees	1. Learn the unit of measurement for a. Liquid b. Dry c. Linear d. Weight e. Time	Textbo possib
VI. Solving Equations for Unknown Number	12	1. Student understands the basic operations of linear equations	1. Identify types of linear equations 2. Use of signed numbers 3. Solve equations	Textbo possib
VII. Ratios and Proportion	12	1. Student knows the meaning and uses of ratio and proportion	1. Set up ratio and proportion 2. Solve for the unknown in proportions	Textbo possib

TABLE V
(Continued)

ls to d	Instructional Materials & Equipment to Be Used		Suggested Teaching Procedures
	Basic	Supplementary	
it of for	Textbook (Programmed if possible)	1. Geometric shapes	1. Relate unit of measure and formulas to occupational area
pes of tions ed ions	Textbook (Programmed if possible)	1. Visual aids	1. Find out from trade instructors different uses of equations in trade areas 2. Determine how to balance an equation
o and he	Textbook (Programmed if possible)	1. Visual aids	1. Find out from trade instructors how ratio & proportions are used in trade area

c. Introductory Pre-Technical Mathematics Skills, Level B

In this curriculum area, a study of the fundamental skills of algebra, with special emphasis on solving equations and applying algebraic skills to the solution of technically-related problems is to be stressed. Specialized concepts in mathematics are to be introduced as related to the students' interests and needs.

Time schedules, though suggested in hours in the outline which follows, are flexible and directly related to the individual Pre-Technical teacher's appraisal and assessment of individual strengths and weaknesses.

The outline which follows indicates instructional goals, specific skills to be developed, instructional materials and equipment to be used, and suggested teaching procedures. The form of this outline represents the revised curriculum agreed to by Pre-Technical mathematics teachers.

TABLE VI

INTRODUCTORY PRE-TECHNICAL MATH -

Major Units	Time	Instrucational Goals	Specific Skills to Be Developed	
	2	1. To insure that each student understands the operations listed	1. Operations with whole numbers a. addition b. subtraction c. multiplication d. division	
	4	1. To instill in each student the need for accuracy and speed in operations listed	2. Operations with fractions and mixed numbers a. addition b. subtraction c. multiplication d. division 3. Operations with decimal numbers a. addition b. subtraction c. multiplication d. division	
	4	1. Present the most common geometric relationships by using practical examples of the shapes studied	1. Area of common figures a. rectanble b. circle c. triangle d. cylinder e. cube	

ABLE VI

TECHNICAL MATH - LEVEL B

to	Instructional Materials & Equipment to be Used		Suggested Teaching Procedures
	Basic	Supplementary	
whole on ixed on on			1. Use the timed test on page 2. Exercises 3. Cooke, Nelson M. Basic Mathematics for Electronics McGraw-Hill: New York, 1960
		Collection of geometric surfaces and solids	After presenting formulas for standard shapes use objects from technologies for practice calculations i.e., area of circular semi-conducting materials

TABLE VI
(Continued)

Major Units	Time	Instructional Goals	Specific Skills to Be Developed
	10	2. Using the literal equations from 1 and 2, introduce techniques of solving equations for any unknown by using the fundamental laws of algebra	2. Volume of common solids a. cube b. sphere c. cone d. cylinder
	2		3. Fundamental laws of algebra a. associative b. commutative c. distributive d. laws of signs
	10	3. Emphasize balancing of units as part of algebraic manipulation of an equation	4. Algebraic expressions a. terms b. factors
	4		5. Laws of exponents a. addition b. multiplication c. division d. 0^{th} power
	10		6. Basic Geometric Theorems a. angle elements b. relationship among lines c. regular areas i. circles ii. polygons iii. triangles

TABLE VI
(Continued)

s to	Instructional Materials & Equipment to be Used		Suggested Teaching Procedures
	Basic	Supplementary	
mmon			Volume of oil held in rectangular reservoir
laws of ve ve ive igns			Use examples from applied mathematics to illustrate each law
			Using geometry formulas, solve for dimensions of object with known area or volume
nents ation			Additional theorems & problems can be formed Technical Mathematics: Rice, H. S. and R. M. Knight. McGraw-Hill: New York, 1966
ric			6.b. When a straight line is cut by a transversal, the opposite angles form formed are equal. When parallel lines are cut by a transversal, the alternate interior angles are equal.
ments nip es reas s ons ngles			

TABLE
(Contin

Major Units	Time	Instructional Goals	Specific Materials t Be Developed
			7. Numbers: a. positive and negative b. rational and irrational c. real number syste d. points on a line e. absolute value f. literal symbols 8. Problem solving methods

TABLE VI
(Continued)

aterials to oped	Instructional Materials & Equipment to be used		Suggested Teaching Procedures
	Basic	Supplementary	
e and e 1 and nal mber system on a line e value symbols lving			When parallel lines are cut by a transversal, the interior exterior angles are equal The radius of a circle forms a perpendicular with a tangent to the circle. A center line of two intersecting circles will transverse their common cord perpendicularly. A center line of two circles tangent to one another will pass through the point of intersection. 6.c.i. Two tangents to a circle which pass through the same point in space will form equal angles with a line drawn from that same point to the center of the circle. 6.c.ii. The sum of the interior angles of a polygon equals $(n-2)(180^{o})$; n=number of sides. An interior angle of a regular polygon is equal to $\frac{(n-2)}{(n)}180^{o}$ The sum of the angles of a triangle equals 180^{o} The sum of the two acute angles of a right triangle equals 90^{o} In an isosceles triangle the angles opposite the equal sides are qual In a right triangle the sum of the squares of the two sides adjacent to the right angle is equal to the square of the side opposite the right angle.

d. Introductory Pre-Technical Science Skills, Level A

In this curriculum area, a study of the important principles of physical sciences as these apply to trade education course concepts is the major topic for concentration. It is to be remembered, however, that the science guide which follows is included for information purposes only and that Introductory Pre-Technical Science Skills, Level A, is not recommended for inclusion in the Pre-Technical program.

Time schedules, though suggested in hours in the outline which follows, are flexible and directly related to the individual Pre-Technical teacher's appraisal and assessment of individual strengths and weaknesses on the part of the Pre-Technical student.

The outline which follows indicates major units of curriculum consideration, instructional goals, specific skills to be developed, instructional materials and equipment to be used, and suggested teaching procedures. The form of this outline represents the revised curriculum agreed to by Pre-Technical science teachers.

TABLE VII

CURRICULUM AREA - INTRODUCTORY PR

Major Units	Time	Instructional Goals	Specific Skills to Be Developed
I. Introduction	2	To develop motivation for learning science related to trade areas.	
II. Temperature and Measurement	5	To develop skills and knowledges in science related to trade areas	1. Measure temperature in Centigrade and Fahrenheit 2. Measure dimensions with meter stick, vernier calipers, and micrometers in both the English and metric systems 3. Calculate areas and volumes of simple geometric solids and planes
III. Heat and Expansion	5		1. Determine the effects of heat on liquids and solids 2. Determine the effects of pressure temperature and volume on gases
IV. Heat Transfer	1		1. Applications of conduction in heating cooling and insulating problems. 2. Convection as heat, transfer in heating and cooling 3. Radiation as energy from natural sources and all bodies

ABLE VII

UCTORY PRE-TECHNICAL - LEVEL A

to	Instructional Materials & Equipment to Be Used		Suggested Teaching Procedures
	Basic	Supplementary	
ature and ions ck, rs, and both d s and ple ds and		1. Air Conditioned Lab 2. Thermometers 3. Measuring instrument 4. Geometric areas and solids	1. Demonstration with thermometer 2. Use of instrument 3. Demonstrate conversion from English to Metric by letting students measure same object with both scales and compare.
effects uids effects mper- me on		1. Bi-metal strip 2. Ring and ball 3. Balloon and candle	1. Demonstration by use of supplementary equipment.
f con- ting sulat- heat, ating nergy ources			1. Demonstration of convection with candle and tube 2. Tour of heating lab with emphasis on examples of heat transfer

TABLE VII
(Continued)

Major Units	Time	Instructional Goals	Specific Skills to Be Developed	
V. Change of State			1. Heat without a change of temperature always accompanies a change of phase 2. Effect of temperature on change of phase 3. Effect of pressure on change of phase	
VI. Humidity	1		1. Absolute humidity vs. relative humidity 2. Control of humidity important to human comfort	
VII. Thermometer	1		1. Heat energy converted to mechanical energy through a thermodynamics cycle.	
VIII. Forces	4		1. Forces with magnitude and direction 2. Forces composed of components 3. Forces added by special means 4. Addition of forces graphically	

II
ed)

Instructional Materials & Equipment to Be Used		Suggested Teaching Procedures
Basic	Supplementary	
	1. Block of ice with weighted wire and various metal samples	
	1. Wet and dry bulb thermometer	
	1. Transparencies	
	1. Force Board	

TABLE VII
(Continued)

Major Units	Time	Instructional Goals	Specific Skills To Be Developed
IX. Mechanics of Liquids	8		1. Pressure depending on depth and weight of fluids 2. Pressure as transferred undiminished throughout fluids 3. Transmission of force by change of area 4. Hydraulics as used in brake systems, valve lifters, power equipment 5. Archimedes' principle 6. Hydrometer
X. Applications of Atmospheric Pressure	5		1. Atmospheric pressure due to weight of overhead air 2. Barometer 3. Energy is conserved from point to point in any fluid system 4. Syphon 5. Lift pumps and other applications of atmospheric pressure
XI. Engineering Properties of Materials	2		1. Materials properties defined by a. Tensile b. Shear c. Compression d. Hardness

TABLE VII
(Continued)

ills To ped	Instructional Materials & Equipment to Be Used		Suggested Teaching Procedures
	Basic	Supplementary	
epending nd weight s trans- iminished fluids on of hange of as used ystems, ers, power ' principle c pressure ght of ir conserved to point id system and other ns of c pressure properties sion s		1. Automotive lab and machine shop Syphon	

TABLE VII
(Continued)

Major Units	Time	Instructional Goals	Specific Skills to Be Developed	B
XII. Newton's Laws	4		1. All objects as attracted to one another 2. Objects falling through the atmosphere with the same acceleration 3. Objects to be acted on externally to change their motion 4. Acceleration as proportional to F and and WT	
XIII. Motion	5		1. Speed = distance/time 2. Acceleration = velocity change/time 3. Torque = force x moment arm RPM, cycles, period, frequency 4. Simple problems in motion 5. Rotational motion as accompanied by a force toward center of orbit	

Instructional Materials & Equipment to be Used		Suggested Teaching Procedures
Basic	Supplementary	

e. Introductory Pre-Technical Science Skills, Level B

In this curriculum area, a study of important principles of physics as they apply to technical areas is to be the major commitment of the course. Chemistry is offered as needed for students entering specified technological course areas where concepts of this course are required for mastery and proficiency in the technological curriculum.

It is to be remembered, however, that the science guide which follows is included for information purposes only and that Introductory Pre-Technical Science Skills Level B is not recommended for inclusion in the Pre-Technical program.

Time schedules, though suggested in hours in the outline which follows, are flexible and directly related to the individual Pre-Technical teachers' appraisal and assessment of individual strengths and weaknesses on the part of the Pre-Technical student.

The outline which follows indicates major units of curriculum consideration, instructional goals, specific skills to be developed, instructional materials and equipment to be used, and suggested teaching procedures. Pre-Technical science teachers approved this curriculum.

TABLE VIII

CURRICULUM AREA - INTRODUCTORY PRE-TECHNICAL

Major Units	Time	Instructional Goals	Specific Skills to Be Developed	
I. Introduction	2	To teach the methods of learning physics by using certain skills of learning		1. Meter 2. Microm 3. Vernie 4. Pendul 5. Stop W 6. Balanc
II. Mechanics	2	1. Definitions--to study the basic terms necessary for understanding physics principles	1. Length-distance 2. Time 3. Velocity 4. Acceleration $s = vt$ $a = (v_2 - v_1)/t$	
	6	2. Equations--to be able to manipulate equations in order to solve for any variable		
	6	3. Units--to teach students that a. answers must be in proper units b. units can be manipulated the same as numbers	1. Units to be learned a. distance--ft., in., meters, cm. b. time-hours, seconds c. velocity--Mph, ft/sec., m/sec. d. acceleration-ft/sec^2, M/sec^2, cm/sec^2 2. Conversions a. Mph to ft/sec b. M/sec to ft/sec	

II

-TECHNICAL - SCIENCE LEVEL B

Instructional Materials & Equipment to be Used		Suggested Teaching Procedures
Basic	Supplementary	
1. Meter stick 2. Micrometer 3. Vernier caliper 4. Pendulum 5. Stop Watch 6. Balance	References (books, manuals, etc.) 1. Duplicated materials a. Problems b. Vocabulary c. Graphs 2. Transparencies 3. Charts 4. Filmstrips	

TABLE VIII
(Continued)

Major Units	Time	Instructional Goals	Specific Skills to Be Developed
	6	4. Scientific Notation--to study use of scientific notation in writing data and recognize numbers in scientific notation	3. Skills a. write numbers in powers of ten b. convert from powers of ten to decimal form c. multiply and divide using power of ten (Examples in mechanics millimeters, kilometers)
	4	5. Graphs--to learn how to read and use graphs	1. Cartesian Coordinate system a. a point on a graph represents a value from an equation b. points are determined from the relationship between constants and variables 2. Equations to be used graphs a. $s = vt$ b. $a = (v_2 - v_1)/t$
	6	1. Problem solving--to develop logical approaches to solution of physics problems	1. Steps in logical problem solving 2. Transferring word problems into equations

E VIII
inued)

o	Instructional Materials & Equipment to be Used		Suggested Teaching Procedures
	Basic	Supplementary	
in to owe es ate raph			Students plot graphs from given data and are asked to find values which were not in original data
m ip nts sed t			

TABLE VIII
(Continued)

Major Units	Time	Instructional Goals	Specific Skills to Be Developed	Ba
III. Gas Laws		1. Instructional goals will be the same as in similar sections in Unit II		1. Thermome 2. Manomete 3. Baromete 4. Linear m instrume
	2	2. Definitions	1. Force 2. Area 3. Pressure 4. Volume 5. Temperature	
	3	3. Equations	1. PV = KT 2. F = 9/5C + 32	
	3	4. Units	1. Force 2. Newton, Lbs. 3. Areas 4. Ft^2, In^2, $meters^2$, cm^2 5. Volumes 6. Ft^3, in^3, m^3, cc, liter 7. Areas are in square units 8. Volumes are in cubic units	1. Variable 2. Multimet 3. Variable
	1	5. Scientific Notation	1. Using powers of ten in areas, volumes, and other gas law conversions and computation	

VIII
nued)

	Instructional Materials & Equipment to be Used		Suggested Teaching Procedures
	Basic	Supplementary	
	1. Thermometer 2. Manometer 3. Barometer 4. Linear measuring instruments	1. Transparencies 2. Duplicated materials a. problems b. vocabulary c. graphs	Trip to air-conditioning and heating lab
e ic n	1. Variable D.C. 2. Multimeter 3. Variable resistor	1. Power supply 2. Transparencies 3. Charts 4. Duplicated a. problems b. vocabulary c. graphs	1. Demonstrations 2. Trip to electrical lab to see principles as applied to instruments and machines

TABLE VIII
(Continued)

Major Units	Time	Instructional Goals	Specific Skills to be Developed
III. Gas Laws (Continued)	2	6. Graphs	1. Equations to be used for graphs a. F = 9/5C + 32 b. P = K/V
	3	7. Problem Solving	1. Problems involving PV = KT 2. Problems involving conversion from C to F and F to C
IV. Electricity (Ohm's Law)	2	1. Definitions Equations and terms in parentheses are to be used if time is available	1. Current 2. Resistance 3. Voltage (power)
	3.	2. Equations	1. E = IR (P = EI) 2. Derive supplementary equations from E = IR and P = EI
	3	3. Units	1. Amp, milliamp, microamp 2. Volt, millivolt, kilovolt 3. Ohm, kilohm, megohm (Watt, kilowatt, megawatt)
	1	4. Scientific Notation	1. Milli, micro, kilo, mega use on units in E = IR

E VIII
inued)

o	Instructional Materials & Equipment to be Used		Suggested Teaching Procedures
	Basic	Supplementary	
used 2 ing ing C to ntary EI , gohm , ilo, ts			

TABLE VIII
(Continued)

Major Units	Time	Instructional Goals	Specific Skills to Be Developed
IV. Electricity (Ohm's Law) (Continued)	2	5. Graphs	1. I vs. E constant R 2. I vs. R constant E ($P = I^2R$ constant R) 3. Ohm's Law problems (Problems involving cost of power in KWH)
	3	6. Problem Solving	
V. Work and Friction	7		1. Work = force x distance moved 2. Energy as coming from motion and/or position 3. Energy neither created nor destroyed 4. Power rate of doing work 5. Simple problems in work and energy 6. Fraction as a loss of energy from system
VI. Simple Machines			1. Incline plane 2. Screw 3. Lever 4. Pulley 5. Input, output 6. Efficiency 7. Simple problems in M.A. and efficiency

ABLE VIII
ontinued)

s to	Instructional Materials & Equipment to be Used		Suggested Teaching Procedures
	Basic	Supplementary	
nt R nt E ant R) lems lving in t dis- ng d/or doing s in y loss s in iency		1. Pulley 2. Incline 3. Level	Demonstration of equations to be plotted. Students take data and plot on graphs Use of simple machines to demonstrate M.S. and efficiency

TABLE VIII
(Continued)

Major Units	Time	Instructional Goals	Specific Skills to Be Developed
VI. Ohm's Law (Continue (Continued)	5		1. Voltage as a measure of electrical force or pressure 2. Current as a measure of the flow of charges 3. Resistance as a measure of resistance to flow of electrical charge 4. Current as directly proportional to resistance 5. P = EI

TABLE VIII
(Continued)

: Skills to veloped	Instructional Materials & Equipment to be Used		Suggested Teaching Procedures
	Basic	Supplementary	
e as a measure ctrical force ssure t as a measure flow of s ance as a e of ance to flow ctrical charge t as directly tional to ance		Variable resistance, voltage, and meters	1. Use of simple circuit with variable voltage with students taking data off E vs. R 2. Same as above but with constant E and variable R 3. Plot graphs of above data

11. Time Schedule

One Week Prior to the Program

a. Conduct pre-test battery.

b. Score pre-tests and record scores on standardized form. (See Appendix A.) Student personnel specialists send copies of pre-test raw scores to Leadership Services Section, State Department of Education, at the end of the first week of the program.

c. Conduct an orientation program and planning session for Pre-Technical teachers.

Six Weeks During the Program

a. Conduct the Pre-Technical program.

b. Student personnel specialists collect teacher ratings of Pre-Technical students at end of the first week and at the end of last week of the program. (See Appendix B.) Student personnel specialists send copies of these rating sheets to Leadership Services Section at the end of the first week and at the end of the last week of the program.

c. Designate two days at the end of the program for post-testing.

d. Evaluate students in each Pre-Technical course. (See Appendix C.)

e. Counsel with students to determine their plans for entry into vocational and technical courses.

One Week Following the Program

a. Conduct an evaluation session for Pre-Technical teachers.

b. Score post-tests and record scores on standardized form. (See Appendix A.) Student personnel specialists send copies of post-test raw scores to Leadership Services Section, State Department of Education, one week after program ends. (Note to student personnel specialists: This report is to have both pre and post-test raw scores recorded for each Pre-Technical student on each test he took.)

Conclusions

A remedial program designed to increase the potential for students to successfully pursue post-secondary trade and technical courses has been developed, implemented, and evaluated.

Resulting from evaluation of this program, minor revisions to the original design of the Pre-Technical program have been made. Among these revisions is offering a program to develop remedial skills in three areas only rather than in the original four--reading, study skills, and mathematics. Science is not recommended for inclusion in the Pre-Technical program, for the data from control tests do not support inclusion of this course.

Another revision in the Pre-Technical design is the selection of different tests for use in the Pre-Technical program. The revised list of standardized tests is outlined on pages 26 and 27.

Finally, courses in the Pre-Technical program are to be offered on a remedial basis, related to students' occupational interests and objectives. Although the course content of these programs might overlap, Pre-Technical courses are to be offered on two levels--Level A for entering trade students and Level B for entering technical students.

# # # #

APPENDICES

APPENDIX

CONTROL DATA
for
STUDENTS ENTERING PRE-TE
(current prog

NAME OF SCHOOL _____ CITY

DATE REPORT PREPARED _____ BY W

LEVEL OF PROGRAM ____A____B NUMBER OF STUDENTS

Student	GATB			Reading and Comprehension									
				California Test Basic Skills									
	Gen-eral	Ver-bal	Math	Test 1		Test 2		Test 3		Test 4		Test	
				Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Pos

PENDIX A

L DATA SHEET
for
PRE-TECHNOLOGY PROGRAM
at program date)

CITY_____

BY WHOM_____

UDENTS REPORTED ON IN THIS LEVEL_____

	Study Skills						Mathematics								Science	
	California Test Basic Skills						California Test Basic Skills						Wide Range		Every Student	
Test 5		Test 9		Test 10			Test 6		Test 7		Test 8					
Pre	Post	Pre	Post	Pre	Post		Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post

CONTROL DA
(Conti

KEY: REASON F

1. Involuntary withdrawal: Academic
2. Involuntary withdrawal: Disciplinary
3. Entered military service
4. Withdrew while failing
5. Withdrew to marry
6. Stated desire to seek employment
7. Stated financial difficulty
8. Stated health problems

CONTROL DATA SHEET
(Continued)

EY: REASON FOR WITHDRAWAL

c

inary

9. Stated family hardship

10. Confirmed employment in field of stated preference

11. Confirmed employment in related field

12. Confirmed employment in unrelated field

13. Deceased

14. Other: Specify

15. Unknown

APPENDIX B

TEACHER RATING OF PRE-TECHNICAL STUDENT

PERSONAL TRAITS OBSERVATION REPORT

STUDENT'S NAME _____ AGE _____ CURRICULUM _____ DATE OF REPORT _____ INSTRUCTO

Instructions: Put a check (✓) in the box with the most descriptive phrase.

	1*	2*	3*	
1. INDUSTRY, ENERGY Consider application to school duties day by day.	Usually indifferent	Sometimes indifferent	Average in industriousness	
2. RELATIONS WITH OTHERS Consider helpfulness and cooperativeness with associates and superiors in manner and act.	Troublesome indifferent	Sometimes difficult to work with	Usually tactful and obliging	
3. EMOTIONAL STABILITY Consider ability to control emotions.	Loses his head easily	Unresponsive	Usually well controlled	
4. LEADERSHIP Consider ability to get others to cooperate.	Unable to lead	Not usually a leader	Sometimes displays leadership	
5. APPEARANCE Consider such factors as cleanliness of clothing and person	Untidy, carelessly dressed	Clean, but careless of appearance and grooming	Average in grooming and dress	
6. ABILITY TO LEARN Consider quickness in learning new methods, adapting to new situations, tasks.	Unable to learn material in this curriculum	Learns slowly	Average rate of adaptation	
7. DEPENDABILITY Consider faithfulness in carrying out assignments. Bears full share of responsibility	Needs constant supervision	Sometimes unreliable	Responsible but needs some directions	
8. PUNCTUALITY Consider his practices of being on time	Always tardy	Seldom on time	On time most of the time	
9. JUDGMENT Consider ability to reach sound decisions and handle unusual situations.	Quick to become frustrated in new situations	Slow in meeting new situations and decisions	Usually displays ability to handle unusual situation	
10. QUALITY Consider quality of work	Not capable of quality work	Seldom turns out quality work	Average in producing quality work	
11. INITIATIVE Consider resourcefulness and ability to see things to do.	Seems to shy away from seeing things to do	Slow to be resourceful and create activities	Usually shows initiative in his job	
12. QUANTITY Consider amount of work accomplished and speed of doint it.	Very slow in production	Little work accomplished; slow	Average in production	
13. PRIDE Consider pride in work	Passive in attitude toward work	Takes little interest in being proud of his work	Usually displays pride in work	
14.				
15.				

IN YOUR OWN OPINION, WHAT ARE:

(1) The student's strong points _____

(2) The student's weak points _____

COMMENTS _____

*Please check box choices and add totals column in last column.

IT

REPORT _____ INSTRUCTOR'S SIGNATURE _____

	3*	4*	5*	Total
rent	Average in industrious-ness	Willing to do more than assigned	Exceptionally diligent	
it to	Usually tactful and obliging	Always congenial and cooperative	Inspires cooperation	
	Usually well controlled	Balance of respon-siveness and control	Unusual control of emotions	
der	Sometimes displays leadership	Leads well under most circumstances	Displays marked ability to make things go	
ss	Average in grooming and dress	Well groomed	Outstanding in taste and care	
	Average rate of Adaptation	Above average in capacity	Outstanding in mental ability and alertness	
	Responsible but needs some directions	Very dependable	Thoroughly depend-able, trustworthy	
	On time most of the time	Seldom tardy	Always on time	
d	Usually displays ability to handle unusual situation	Willing to meet new situation	Exceptional and quick to handle new situa-tions and decisions	
	Average in producing quality work	Careful and thorough work	Outstanding in pro-ducing quality work	
rceful ties	Usually shows initiative in his job	Shows constant ability to see things to do	Always shows initia-tive; except in being creative	
plish-	Average in production	Speed of doing a job is good; accomplishes job	Always completes a job at a fast rate of speed	
erest f his	Usually displays pride in work	Shows pride in his work constantly	Very thorough in his work; always shows pride in work	

APPENDIX C

GRADING STANDARD
FOR
PRE-TECHNICAL STUDENTS

All grades should be converted to numerical scores for use in the Pre-Technical program. The following grading standard should be considered a guideline for interpreting Pre-Technical student grades:

LEGEND

A - Excellent
(93-100)

B - Good
(85-92)

C - Average
(77-84)

D - Below Average
(70-76)

F - Failing
(Below 70)

I - Incomplete