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ABSTRACT

The achievement of the 44 Crockett high school students, in Austin, Texas, who participated in the Principles of Technology Program during the 1987-1988 school year was assessed, with the following findings; (1) 14 second-year students answered 30 percent more items correctly on the posttest than on the pretest; (2) the second-year students mastered the curriculum content; (3) on the science test and the mathematics test of the Tests of Achievement and Proficiency (TAP), student achievement gains were not significantly above or below the national norm; (4) the students who took the first-semester content of the first-year course in spring 1987 scored significantly better on the test than the students who took the same course in fall 1988; and (5) six students completed the first-year course and 19 completed the first semester of the second year. (Nine attachments are included: (1) enrollment history; (2) 1987-88 evaluation activities; (3) second-year test; (4) answers for second-year test; (5) scores on the second-year pretest; (6) first semester test results; (7) correlated t-test on pretest and posttest TAP science scores; (8) correlated t-test on pretest and posttest TAP mathematics scores; and (9) comparison of scores on the first-year test.) (NLA)

PRINCIPLES OF TECHNOLOGY

NO. 88420028

FINAL REPORT

AUSTIN INDEPENDENT SCHOOL DISTRICT

PRINCIPLES OF TECHNOLOGY

FINAL REPORT

NO. 8842028

DURING THE 1987-1988 SCHOOL YEAR, AISD CONTINUED THE OPERATION OF PRINCIPLES OF TECHNOLOGY, THE FIRST YEAR AND STARTED PRINCIPLES OF TECHNOLOGY THE SECOND YEAR. WE UTILIZED THE CURRICULUM MATERIALS DEVELOPED BY THE CENTER OF OCCUPATIONAL RESEARCH AND DEVELOPMENT IN WACO, TEXAS. EQUIPMENT WAS PURCHASED, USING THE RECOMMENDED EQUIPMENT LIST OBTAINED FROM CORD.

AN ADVISORY COMMITTEE WAS FORMED AND HELD SEVERAL MEETINGS. MEMBERS OF THE COMMITTEE ARE: SHEVAWN EISMAN, LOCKHEED; RALPH GOHRING, TRACOR; DAVID KERNWEIN, CROCKETT, PRINCIPAL; BERT MARCOM, ACC; HAL MEYER, MOTOROLA; JANICE WALKER, CROCKETT, COUNSELOR; ROGER WEEKLY, I.B.M.; LOUIS IGO, RON FOY, AND BEN BOTBOL ARE EXOFFICIO MEMBERS. THE ADVISORY COMMITTEE MET FOR AN ORIENTATION MEETING MARCH 10, 1988 AT CROCKETT HIGH SCHOOL WITH BEN BOTBOL, TEACHER MAKING THE PRESENTATION. THE COMMITTEE MET AGAIN AT CROCKETT ON APRIL 7 AND OBSERVED A CLASS OF PRINCIPLES OF TECHNOLOGY IN OPERATION. ANOTHER MEETING WAS HELD MAY 10 AT TRACOR. THE NEXT MEETING WILL BE JULY 7, PLACE TO BE ANNOUNCED.

An evaluation plan was designed and administered by the Office of Research and Evaluation of AISD. The results are attached.

An articulation agreement with ACC was approved. TSTI in Waco was approached for an articulation agreement. They are in the process of revising their catalog and some curriculum revision in many programs. We were encouraged that there should not be any problem with an articulation plan, however, it would have to come after the revision efforts they are now attempting. At this writing a plan has not been submitted.

Essential Elements for the second year of Principles of Technoloy were developed and they are enclosed. These essential elements point out how close this course follows essential elements of various science courses.

During the course of the year the teacher met several times with math and science teachers at Crockett. These sessions were helpful, informative meetings where exchange of theory, practice, and results were made. Science teachers feel that the program fills an important practical applications gap in science and technology.

MATH TEACHERS AGREE THAT THE PRACTICAL PRESENTATION OF MATHEMATICS CONCEPTS SUPPORTS THE MATH PROGRAM. THE TEACHER ALSO MADE PRESENTATIONS AT A STATE TECHNOLOGY INSERVICE AND AT A SECONDARY SCIENCE AND TECHNOLOGY PRE-SCHOOL INSERVICE. TEACHERS STATEWIDE SEEM TO BE INTERESTED IN THIS INNER-DISCIPLINARY COURSE.

IN AN INTERVIEW WITH THE TEACHER, THE TEACHER GAVE THESE RESPONSES TO THE LISTED QUESTIONS:

1. WHAT DO YOU CONSIDER THE STRENGTHS OF THE PRINCIPLES OF TECHNOLOGY PROGRAM?
"THE STRUCTURE OF THE PRESENTATIONS AND THE WAY SCIENTIFIC PRINCIPLES ARE GIVEN PRACTICAL APPLICATIONS."

2. WHAT DO THE STUDENTS SEEM TO ENJOY ABOUT THE COURSE?
"THE HANDS-ON EXPERIENCES OF PROVING OR INVESTIGATING SCIENTIFIC PRINCIPLES."

3. WHAT DO YOU CONSIDER THE WEAKNESS OF THE PROGRAM TO BE?
"HARDWARE. THE ITEMS OR APPARATUS THAT ARE USED NEED IMPROVEMENTS. HOWEVER, AS THE COURSE BECOMES MORE POPULAR AND COMPETITION BECOMES KEENER ON EQUIPMENT, QUALITY SHOULD IMPROVE."

4. Do you feel science credit could be justified for Principles of Technology?

"Yes, I feel the scientific principles studied, the lab method of investigating these principles and the math involved to support these principles, that the students receive a good practical science experience."

EFFECTIVENESS AND RECOMMENDATIONS:

The pre and post test seem to indicate the materials are effective in helping students to understand the principles of momentum, waves and vibrations, converters, transducers, radiation, optical systems and time constants. The advisory committee agrees that these are concepts that should be understood by anyone entering the work force as a technician.

The course, Principles of Technology, should be a state approved course to be offered to secondary students in the State of Texas. Students should be encouraged to take both years of the course, however, a student should get credit if only one year is taken.

E V A L U A T I O N

OFFICE OF RESEARCH AND EVALUATION
DEPARTMENT OF MANAGEMENT INFORMATION
AUSTIN INDEPENDENT SCHOOL DISTRICT

Assistant Director:
David A. Doss, Ph.D.

Evaluator:
L. David Wilkinson

Evaluation Associate:
Letticia Galindo, Ph.D.

Programmer:
Lora Perkins

Secretary:
Nancy O'Brien

Principles of Technology Program,
1987-88

Publication Letter 87.C

August, 1988

THE COURSE SHOULD BE OPEN TO 10, 11, AND 12 GRADERS WITH PREFERENCE FOR GRADES 11 AND 12. A PREREQUISITE FOR THE FIRST COURSE IS NOT NECESSARY. HOWEVER, THE FIRST COURSE SHOULD BE A PREREQUISITE FOR THE SECOND COURSE.

THE COURSE SHOULD BE TAUGHT BY A PERSON WITH A STRONG PHYSICS/MATH BACKGROUND BUT NOT NECESSARILY A DEGREE IN SCIENCE OR MATH. THE TEACHER SHOULD HAVE PRACTICAL, MANIPULATIVE EXPERIENCES AS A DEGREED VOCATIONAL TEACHER OR AN INDUSTRIAL TECHNOLOGY TEACHER. THE COURSE SHOULD DEFINITELY BE A HANDS-ON, LAB TYPE COURSE.

THE RESULTS OF THE UTILIZATION OF THE PROGRAM WILL HAVE TREMENDOUS IMPACT ON VOCATIONAL/TECHNOLOGY EDUCATION. A POSITIVE, COOPERATIVE RELATIONSHIP CAN BE CREATED BY THE APPROPRIATE INTERFACE WITH MATH AND SCIENCE DEPARTMENTS. THE COURSE TEACHES APPLIED PHYSICS AND MATH PRINCIPLES THROUGH A UNIFIED SYSTEMS APPROACH PROVIDING THE STUDENTS WITH THE NECESSARY TECHNICAL, MATH, AND SCIENCE SKILLS TO PURSUE TECHNICAL CAREERS. IN THIS WAY THEY GAIN A BROAD KNOWLEDGE BASE OF THE PRINCIPLES THAT UNDERLIE MODERN TECHNICAL SYSTEMS. THIS APPROACH PROVIDES CAREER FLEXIBILITY AS MACHINES AND TECHNOLOGY ADVANCE. THE COURSE CAN PROVIDE STATE-WIDE IMPACT ON TECHNOLOGY EDUCATION IN TEXAS.

ATTACHMENT

E X E C U T I V E S U M M A R Y

ACHIEVEMENT RESULTS FOR
THE PRINCIPLES OF TECHNOLOGY PROGRAM
1986-87

EXECUTIVE SUMMARY

The achievement of the 25 Crockett High School students who participated in the Principles of Technology Program during the second semester of the 1986-87 school year was examined, with the following findings:

MAJOR FINDINGS

- The 21 students who were administered the curriculum-specific test both as a pretest and a posttest answered an average of 21 (37%) more items correctly on the posttest than they had on the pretest. This gain was statistically significant.

- If 70% of the items answered correctly were set as the criterion level for mastery as is commonly done (e.g., on the Texas Educational Assessment of Minimum Skills), the students in the class could not be said to have mastered the curriculum content. No one passed the pretest but two thirds passed the posttest.

- On the Science Test of the Tests of Achievement and Proficiency (TAP), student achievement gains were not significantly above or below the national norm.

87.C

THE PRINCIPLES OF TECHNOLOGY PROGRAM, 1987-88

EXECUTIVE SUMMARY

AUTHORS: David Wilkinson, Letticia Galindo

The achievement of the 44 Crockett High School students who participated in the Principles of Technology Program during the 1987-88 school year was examined, with the following findings:

MAJOR FINDINGS

- The 14 second-year students who were administered the curriculum-specific test both as a pretest and a posttest answered an average of 15 (30%) more items correctly on the posttest than they had on the pretest. This gain was statistically significant.

- If 70% of the items answered correctly were set as the criterion level for mastery as is commonly done (e.g., on the Texas Educational Assessment of Minimum Skills), as a class the second-year students could not be said to have mastered the curriculum content. Individually, one student passed the pretest, and 44% passed the posttest at the 70% level.

- On the Science Test and the Mathematics Test of the Tests of Achievement and Proficiency (TAP), student achievement gains were not significantly above or below the national norm.

- The students who took the first-semester content of the first-year Principles of Technology course in spring, 1987 scored significantly better on the curriculum-specific test than the students who took the same course in fall, 1988.

- At the conclusion of the 1987-88 school year, six students had completed the first-year curriculum content of the Principles of Technology course. Nineteen students, including five students who had completed the first-year content, completed the first semester of the second-year course. No student has taken the second semester of the second-year course.

TABLE OF CONTENTS

PROGRAM DESCRIPTION

BACKGROUND

- The Principles of Technology (PT) Program is a state-funded vocational education improvement project. In its second year in 1987-88, the objective of the program was to continue offering the first-year and begin implementing the second-year "Principles of Technology" course.
- The PT course is an experimental vocational education course offered to 10th-, 11th-, and 12th-grade students interested in pursuing a technical career. The course is designed to familiarize students with basic principles of technology, to provide them with opportunities to apply technical principles and concepts in a laboratory setting, and to improve their science and mathematics skills.
- The PT course utilizes curriculum materials developed by the Center for Occupational Research and Development (CORD) in Waco, Texas.
- The program cost $125,000, $100,000 of which was used to purchase the "Principles of Technology" printed and video materials from CORD. Remaining funds were to be used primarily for the purchase of supplies and materials necessary to implement the course.
- The course was taught by a vocational education teacher with the necessary mathematics and science background.
- A set of essential elements for the second year of the PT course was to be developed, as well as an articulation plan with postsecondary institutions offering technical education.

STUDENTS SERVED

In 1987-88, the PT Program served a total of 44 students, 34 of whom took the first semester of the first-year PT course. Nine students who had taken one or both semesters of the first-year course began the second-year course. These students were joined by ten students who had not previously taken any part of the first-year course. No student to date has taken the second semester of the second-year course. Attachment 1 depicts the enrollment history of the PT course.

The analyses and results which are presented in this report concern those students who took the first semester of the second-year PT course (designated Group III in Attachment 1). The second group of students who took the first semester of the first-year course (Group II in Attachment 1) is also of interest. These students are compared with the first group of students who took the course in the 1987-88 school year (Group I in Attachment 1).

ACHIEVEMENT RESULTS

The science achievement of the 19 Crockett High School students in the second-year Principles of Technology Program was assessed by two measures:

1. A curriculum-specific test administered as a pre- and posttest, and
2. The Science Test of the Tests of Achievement and Proficiency (TAP).

CURRICULUM-SPECIFIC TEST

Test Development

The evaluation design submitted to the Texas Education Agency (TEA) included among the responsibilites of the Project Coordinator the construction of a curriculum-specific test which would:

1. Be administered as a pre- and posttest,
2. Cover the objectives and content of the course, and
3. Serve as the equivalent of a final examination for the course.

The test was to be provided to the Office of Research and Evaluation (ORE) for review prior to its administration as a pretest.

Attachment 2 is a timeline of the evaluation activities conducted in connection with the Principles of Technology Program. As referenced in Attachment 2, on September 8, 1987, the Evaluator and the Project Coordinator discussed the timeline on which the project was proceeding and agreed that the curriculum-specific test should cover the content of the second year of the PT course. Because students would be beginning the second-year course content in the spring semester of 1988, a test would need to be developed prior to January, 1988.

On November 30, 1987, the Evaluator reminded the Coordinator of the need for a second-year curriculum-specific test. Ten days later, the Evaluator learned from the PT teacher that the Teacher would be developing the test, which was confirmed in a subsequent conversation with the Coordinator.

The Evaluator reviewed the draft test supplied by the Teacher and recorded some comments on January 13, 1988. Apart from questions about punctuation and wording of the items, the following were concerns:

1. There were only three answer choices on 10 of 50 test items (20%). ("None of the above" and "all of the above" were used as distractors on some items, but they were never the correct answer. Therefore, for those items, having these unused distractors amounted to the same thing as having only three answer choices.)

2. The correct answer choice was the longest response choice on five items (10%).

3. The distribution of correct answer choices according to letter, "A" through "D," was not approximately equal. Answer choice "D" was correct only 10% of the time.

4. No answer choices were included for one item.

The first three concerns touched on issues involving the test's reliability and validity. Having effectively one fifth of the test items with only three response choices would tend to inflate students' scores by virtue of their guessing, rather than reflecting their true knowledge of the subject. Likewise, unintended cues such as the correct response choice being the longest choice--a common feature of teacher-made tests--afford students the opportunity to better their scores artificially. An unequal distribution of response choices, long a common feature of teacher-made tests, had led to the too-often-correct prescription to the test-taker, "If you don't know the answer, choose 'B'." Again, an opportunity is afforded students to improve their scores without knowing the subject matter.

The Evaluator communicated these concerns to the Teacher on January 14. The Teacher promised to revise the test and have it for the Evaluator on January 20. The revised test rectified most of the problems discussed. The Evaluator and the Teacher clarified the correct answer choices for several items and reviewed the item choice distribution on January 26. ORE reproduced the final version of the test and administered it on January 27.

On the whole, the second-year test was an improvement over the first-year test. Because it was entirely in a multiple-choice response format, the test could be machine scored, thus eliminating the subjective element in having scoring done by the PT Teacher. The second-year test was shorter by six items, although the difference may belie a substantial difference in the difficulty of the two tests. The first-year test included a larger computational component which was deemphasized in the second year test.

Description of Test

The final version of the curriculum-specific test, titled "Pretest and Posttest for Second Year Principles of Technology Pilot Program at Crockett High School, 1987," contains 50 multiple-choice items. As previously related, the test was developed locally in the fall of 1987. Items were adapted from the end-of-unit exercises and material in unit texts. No normative data are available. There are presently no reliability of validity data on the test. A copy of the test is Attachment 3. The answer key is Attachment 4.

Test Administration

The Principles of Technology second-year test was administered as a pretest on January 27, 1988. The test was administered to 17 students in the students' classroom. The Evaluator administered the test; the teacher served as test proctor. The directions (modified from the directions for the first-year test) were read aloud, and students were requested not to begin working until time was called. Students marked their answers on machine-readable SCANTRON answer documents (Form 882). Fifty-five minutes were allotted for working time on the test. Most students, however, finished working on the test before time expired. No make-up testing was conducted.

After the testing, all tests were collected and accounted for. Scratch paper used by the students for calculation was collected after the test and was disposed of securely in ORE. Scoring was performed by passing the students' answer documents through a SCANTRON scanner which stamped the number of items each student answered correctly on the student's answer form. The Teacher recorded the number correct for each student and gave the answer documents to the Evaluator. A memo dated February 18, 1988 was transmitted to the teacher giving him the percentages of items answered correctly by students. See Attachment 5. The specific content of test items was not discussed with the students to protect the validity of the test for use as a posttest.

The same Principles of Technology second-year test was administered again to the same class of students on May 31, 1988. Fourteen students took the posttest. The posttest was administered under the same conditions as the pretest, with one exception. Because the posttest served as a final examination for the course, students were permitted the two hours allotted for final examinations. However, the students finished working on the test in approximately the same amount of time as had been available for the pretest. As with the pretest, scoring was done by machine and the student answer sheets were given to the Evaluator.

Analyses

Two types of analyses, one descriptive and one inferential, were performed on the results of the pre- and posttest administrations of the second-year curriculum-specific test.

The following descriptive statistics were calculated:

1. The number and percentage of items each student answered correctly for both pre- test and posttest administrations,
2. The change from pre- to posttest in the number and percentage of items answered correctly by each student.
3. The average number and percentage of items answered correctly, and
4. The average change from pre- to posttest in the number and percentage of items answered correctly.

A t test for correlated means was performed to determine if the average change from pre- to posttest was statistically significant. The analysis was carried out using the Statistical Analysis System (SAS) on AISD's IBM 4341 computer (program name: DW$PT3).

Results of these analyses are discussed in the following section.

Results

Attachment 6 presents the results of the descriptive analyses. As shown in the attachment, 17 students took the pretest, 16 took the posttest, and 14 took both. On the average, these 14 students answered 15 (30%) more items correctly on the posttest than they had on the pretest. The test of significance determined that the students' mean gain from pre- to posttest was highly significant ($t = 5.25585$, $df = 13$, $p < .0002$).

These results indicate that from the administration of the pretest at the end of January, 1988 to the administration of the posttest at the end of May, 1988, the students learned significantly more of the content of the Principles of Technology curriculum.

On the other hand, it can be noted that on neither the pretest nor the posttest did the average percent correct equal 70%. If 70% of the items answered correctly were set as the criterion level for mastery, as is commonly done (e.g., on the TEAMS), the students in the Principles of Technology class could not be said to have mastered the curriculum content.

TAP SCIENCE TEST

Description of the Test

The Tests of Achievement and Proficiency (TAP), Form T, is a standardized, multiple-choice achievement test battery. AISD uses the complete battery which contains six tests, among them a Science Test. There are four different levels of the TAP, levels 15-18. Level 15 is administered to students in grade 9, level 16 to students in grade 10, and so on. The TAP was developed by the University of Kansas and is published by the Riverside Publishing Company. The test was nationally normed in 1982. Normative data are provided in the Teacher's Guide and other materials available from the publisher. The Teacher's Guide provides empirical norms (grade equivalent, percentile, stanine) for the fall and spring. Reliability and validity data are also available from the publisher.

Test Administration

The Crockett High School students who took the Principles of Technology course were administered the TAP Science Test as part of the annual achievement testing which AISD conducts each spring for all students in grades 9-12. The TAP Science Test was administered in spring, 1988 on the second of two days of testing, April 27. Testing time for the TAP Science Test is 40 minutes. A complete description of the TAP administration procedures is contained in several technical reports available from ORE.

Analyses

The spring, 1987 and spring, 1988 TAP Science Test scores of the students in the second-year Principles of Technology course during the second semester of 1987-88 were analyzed to determine the impact of the program on the students' science achievement. A programs utilizing the Statistical Analysis System (SAS) was run on AISD's IBM 4341 computer to obtain 1987 TAP Science scores (program name: SA$DP008); 1988 scores were obtained by hand.

Two types of analyses, one descriptive and one inferential, were performed on the TAP Science Test scores.

Each student's percentile score was converted to an NCE score by means of a set of conversion tables. The average NCE score was calculated for each of the two years. The average pretest NCE was subtracted from the average posttest NCE to obtain the average gain.

A _t_ test for correlated means was performed to determine if the average gain from pretest (spring, 1987) to posttest (spring, 1988) was statistically significant. The analysis was carried out by means of a SAS computer program (program name: DW$PT1). Results of these analyses are discussed in the following section.

Results

Attachment 7 displays the NCE scores of students in the Principles of Technology course on the spring, 1988 administration of the TAP Science Test, as well as their scores the previous spring. As shown in the attachment, the average NCE change from spring, 1987 to spring, 1988 was negative (-1.57). If the assumption is made that the students' achievement should have remained the same from pretest to posttest relative to the national norming group (i.e., that students would attain the same percentile rank in both years), the average NCE gain was less than zero (-1.57). However, as indicated by the t test for correlated means, the difference from zero in the performance of the 16 students who were tested with TAP in both years was not statistically significant ($t = -0.328$, $df = 15$) indicating that the students made average gains for students of their percentile rank.

TAP MATHEMATICS TEST

Description of the Test

See description under "TAP Science Test."

Test Administration

The Crockett High School students who took the Principles of Technology course were administered the TAP Math Test in spring, 1988 on the first of two days of testing, April 26. Testing time for the TAP Math Test is 40 minutes.

Analyses

The spring, 1987 and spring, 1988 TAP Math Test scores of the students in the second-year Principles of Technology course during the second semester of 1987-88 were analyzed to determine the impact of the program on the students' mathematics achievement. Scores were obtained by the same procedures employed for TAP Science Test scores.

The same two types of analyses were performed on the TAP Math Test scores as on the TAP Science Test scores. Results of these analyses are discussed in the following section.

Results

Attachment 8 displays the NCE scores of students in the Principles of Technology course on the spring, 1988 administration of the TAP Math Test, as well as their scores the previous spring. As shown in the attachment, the average NCE change from spring, 1987 to spring, 1988 was negative (-2.41). If the assumption is made that the students' achievement should have remained the same from pretest to posttest relative to the national norming group (i.e., that students would attain the same percentile rank in both years), the average NCE gain was less than zero (-2.41). However, as indicated by the *t* test for correlated means, the difference from zero in the performance of the 17 students who were tested with TAP in both years was not statistically significant ($t = -0.759$, $df = 16$) indicating that the students made average gains for students of their percentile rank.

COMPARISON WITH LAST YEAR'S STUDENTS

Analyses

Two types of analyses, one descriptive and one inferential, were performed on the results of the pre- and posttest administrations of the curriculum-specific test administered to students who took the first semester of the first-year PT course (Group I) in the spring of 1987 and to a second group of students who took the course in the fall of 1988 (Group II).

The following descriptive statistics were calculated for each group:

1. The number and percentage of items each student answered correctly for both pre- and posttest administrations,
2. The change from pre- to posttest in the number and percentage of items answered correctly by each student,
3. The average number and percentage of items answered correctly, and
4. The average change from pre- to posttest in the number and percentage of items answered correctly.

A *t* test for uncorrelated means was performed to determine if the difference between the posttest performances of the two groups was statistically significant. Because the groups' pretest means were unequal, an analysis of covariance was contemplated but set aside in favor of the *t* test because:

1. The pretests were administered at different points in the semester. As described in ORE Publication Letter 86.I, the pretest was not administered to the first group of students who took the first semester of the first-year PT course until March, some 10 weeks further into the semester than the test was administered to the second group of students taking the course.
2. Outcomes, not gains, are of interest in assessing whether the first or second group of students "did better" in the course.

The analysis was carried out using the Statistical Analysis System (SAS) on AISD's IBM 4341 computer (program name: DW$PT2).

Results of these analyses are discussed in the following section.

Results

Attachment 9 compares the scores on the first-year, curriculum-specific test by the students in Group I and II. As the attachment shows:

- Group I students answered 5.2% more items correctly on the pretest that did Group II students.
- Group I students answered 16.52% more items correctly on the posttest than Group II students.
- Results indicate a greater gain for Group I students on both the pretest and posttest than for Group II students.

As indicated by the *t* test, this difference was statistically significant, meaning that students who took the first semester of the first-year PT course in 1986-87 did better at the end of the semester than students who took the course in 1987-88. This finding is contrary to the expectation that the second group of students to take the course would do better because the teacher had the opportunity to practice and to improve his teaching. The difference appears to lie with the students rather than with the teacher. Because the size of the groups was so small--23 and 17 students in Group I and II, respectively--the means for the groups were strongly influenced by the scores of a few students. A few high-scoring students in Group I evidently elevated the group mean and were responsible for the difference between means.

COSTS

Over the two years in which the Principles of Technology Program has been implemented, AISD has received **$250,000** in grant funds from the State of Texas to purchase the materials and supplies necessary to operate the experimental PT course. Given the handful of students (see Attachment 1) who have participated in the course, the cost per student, if it were reasonable to calculate such a cost, would be astronomical. However, it is clear that such a cost representation would be misleading--unless the District were to abandon the program and not use the materials again. A more reasonable approach would be to parcel the costs over a longer time span--five years has been used previously--during which, it is presumed, the District will continue to utilize the materials. Even this approach, however, is a rather arbitrary and artificial way to represent costs.

It might be best, therefore, simply to state that the program cost the State $250,000, from which expenditure an experimental course was piloted which may have engendered a new science course in AISD and possibly in other districts. AISD costs wer negligible. The vocational teacher was already employed, as was the program evaluator. There were some indirect costs to the District in assigning these individuals' time, as well as that of the Program Coordinator, to the PT program, but no direct salary costs.

Future costs of the PT Program, if it is continued, will depend on whether the program will be expanded to other high schools and on the cost of duplicating or purchasing the printed and video materials used in the PT course. If the cost of materials is the same as has already been provided by the State, AISD costs to operate the program would be considerable. If the materials can be acquired or duplicated at a lesser cost, the program might be reasonably inexpensive to implement.

Attachment 1

ENROLLMENT HISTORY OF AISD STUDENTS IN PRINCIPLES OF TECHNOLOGY COURSES

Program Year	School Year	Semester	Year of Course Content	Semester of Course Content	Course Number	Number of Students	Group
1	1986-87	Spring	1st	1st	7811	24	I
2	1987-88	Fall	1st	2nd	7812	6	I
2	1987-88	Fall	1st	1st	7811	19	II
2	1987-88	Spring	2nd	1st	7821	19*	III*
2	1987-88	Spring	1st	1st	7811	15	IV

* Includes five students from Group I and four students from Group II.

Attachment 2

1987-88 PRINCIPLES OF TECHNOLOGY EVALUATION ACTIVITIES

Date	Activity
September 8, 1987	Talked with Coordinator. Informed by Coordinator that second-year course would not start until January, 1988. Pretest for second-year content to be given at start of second semester. Funds for the second year of project not in yet.
September 18	Tested 18 students at Crockett with the first-semester test for the first-year content.
September 18	Talked with PT Teacher. Teacher has two classes together, one with seven students taking the second-semester, first-year content, and another with 20 students beginning the first-semester, first-year content. Gave Teacher a copy of 1986-87 ORE report (Pub. Letter 86.I). Promised to send copy to CORD representative.
October 5	Programmer generated printout of students in the PT courses.
October 20	Talked with PT Teacher about second-year course. Saw no problem with students beginning second year without first having two semesters.
November 30	Talked with Coordinator and reminded him of the need for a second-year curriculum specific test.
December 10	Received message from PT Teacher that the second-year test would be mailed the next week.
December 18	Talked with PT Teacher. Informed by Teacher that there would be 60 students the coming semester, 30 of whom would take the second-year content. January 27 set as date of administration for the pretest of the second-year content.
January 13, 1988	Reviewed curriculum-specific test for second-year content.
January 14	Received message from PT Teacher that the final examination for the first-year content would be January 20.
January 14	Talked with PT Teacher about revising the curriculum specific test for second-year content. Teacher said he would have the revision ready on January 20 when the first-year posttest would be administered.

Attachment 2
(Continued, page 2 of 2)

Date	Activity
January 20	Curriculum-specific test of first-year, first-semester content administered.
January 26	Talked with PT teacher. Asked about correct response choices for three items. Arranged to reproduce the curriculum-specific test of the second-year, first-semester content to be administered on January 27.
January 27	Tested 15 students with the curriculum-specific test for the second-year content.
April 7	Clarified that there is not a test for the first-year, second-semester content, nor was one administered as a pretest in fall, 1987.

Pretest and Posttest for Second Year Principles of Technology Pilot Program at Crockett High School, 1987

by Ben Botbol, Instructor

---

1 Momentum is ______________

a. a scalar quantity.
b. a vector quantity.
c. both vector and scalar.
d. Neither vector nor scalar.

2. In mechanical systems, a large reduction in momentum is accomplished without damage to the machinery by:

a. applying a large stopping force for a short time.
b. reducing the momentum to zero in the largest possible time.
c. slowing down the machinery in the shortest possible time.
d. reducing the momentum to zero in the shortest possible time

3. The law of conservation of momentum tells us that in an isolated system:

a. the total momentum before an interaction equals the total interaction after the interaction.
b. the velocity before an interaction equals the velocity after the interaction.
c. the kinetic energy before an interaction equals the kinetic energy after the interaction.
d. the total momentum before an interaction equals the total momentum after the interaction.

4. An object's momentum tells us mostly about:

a. the potential energy the object has.
b. the amount of motion the object has.
c. the physical size of the object.
d. the specific gravity of the object.

5. A 50-kg. girl stands in a rowboat near a river bank. The boat and the girl are initially at rest. The girl jumps from the boat to the bank with a speed of 2 m/sec. Conservation of momentum tells us that:

a. the boat remains perfectly still.
b. the boat moves in the same direction as the girl.
c. the boat moves in the opposite direction to the girl with a momentum of 100 mxkg/sec.
d. the boat moves in the oppisite direction to the girl with a momentum of 25 m x kg/sec.

6. L_{mom} = ______________

a. $I \times \omega$
b. $m \times I$
c. $m \div I$
d. mr^2

7. Which of the following will give you full and correct information about a rotating object's angular momentum?

a. mass and angular velocity.
b. moment of inertia and angular velocity.
c. mass and radius.
d. linear momentum and specific gravity.

8. English units for linear momentum are:

a. kg x m/sec.
b. slug x ft.x sec.
c. ft. lbs/sec.
d. slug x ft/sec.

9. A hydraulic cylinder piston rod of mass 0.25 slug moves out at a rate of 1.2 feet/sec to push boxes across a conveyor belt onto a table. The linear momentum of the rod is:

a. 0.3 slug x ft/sec.
b. 3.0 slug x ft/sec.
c. 6.6 slug x ft/sec.
d. 9.6 slug x ft/sec.

10. A wheel balance machine applying torque (T) to the rim of a wheel for a time (Δt) best describes:

a. change in linear momentum.
b. linear impulse.
c. change in angular momentum.
d. angular impulse.

11. When balancing an automobile wheel that is mounted on the automobile, a 30 pound tangential force is applied to the tread of the tire for 15 seconds. The tire and wheel have a radius of 1.5 feet. The angular impulse of the wheel (ang imp = T x Δt where T = F x r) is

a. 3 (lb x ft) x sec
b. 300 (lb x ft) x sec
c. 450 (lb x ft) x sec
d. 675 (lb x ft) x sec

12. A steam turbine has a 0.6 meter radius with steam striking the turbine blades with a force of 1600 N. If the steam is directed onto the turbine for 60 seconds, what is the angular impulse on the turbine?

a. 16 (N x m) x sec
b. 960 (N x m) x sec
c. 57,600 (N x m) x sec
d. 159,960 (N x m) x sec

13. A linear impulse of a 10 lb. force acting on an object for 5 seconds is____________ a linear impulse of 5 lb. force acting on the same object for 10 seconds.

a. greater than
b. less than
c. equal to
d. of no relation to

14. A 1500-lb force brings a truck to a stop in 30 seconds on a straight road. The truck experiences a change in velocity of 80 ft/sec during the time the force is applied. Find the mass of the truck. (Hint: Use the relationship F(Δt) = m(Δv).)

a. 562.5 kg.
b. 562.5 slugs.
c. 3,600,000 kg.
d. 3,600,000 slugs.

15. When a hydraulic cylinder is activated for 5 seconds, the piston applies a force of 80 newtons to the rod during that time period. The change in linear momentum of the fluid moved is:[change in momentum (Δmv) = FΔt]

a. 16 kg x m/sec
b. 64 kg x m/sec
c. 85 kg x m/sec
d. 400 kg x m/sec

16. When a golf ball is hit, the linear impulse involved is the product of the force applied by the club to the ball and

a. the distance the golf ball moves.
b. the mass of the golf club.
c. the mass of the golf ball.
d. the time the club is in contact with the ball.

17. An electric motor shaft and rotor turning at 1750 rpm (183 rad/sec) has a moment of inertia of 0.14 kg m^2. The angular momentum of the motor shaft is ________. (Hint: Use the equation $L_{mom} = I \times \omega$)

a. 2.56 kg x m^2/sec
b. 25.62 kg x m^2/sec
c. 130.7 kg x m^2/sec
d. 183.14 kg x m^2 /sec

18. A mechanical energy convertor changes:

a. mechanical energy to mechanical power.
b. mechanical energy to a different form of mechanical energy.
c. mechanical energy to thermal, electrical, or fluid energy.
d. fluid, electrical, or thermal energy to mechanical energy.

19. In an alternator, mechanical energy of the rotating rotor is converted to electrical energy. An alternator is____

a. a mechanical energy convertor.
b. a fluid energy convertor.
c. an electrical energy convertor.
d. a thermal energy convertor.

20. The wind pushes against the blades of a windmill. The shape of the blades produces a side thrust on the blades as the wind strikes them. This thrust causes the blades to spin. The sequence of events just described is a example of converting__________

a. fluid energy to mechanical energy.
b. fluid energy to electrical energy.
c. fluid energy to another form of fluid energy.
d. mechanical energy to fluid energy.

21. The common unit of thermal energy in the SI system is the ___________

a. calorie
b. watt x second
c. newton
d. newton x meter

22. An inertia welder uses friction to weld metals together. This process converts __________ energy to thermal energy.

a. mechanical
b. fluid
c. electrical
d. heat

23. A bimetallic strip bends because:

a. The two different types of metals are bonded together and expand at the same rate.
b. The outer metal is exposed to higher temperature, and the metal bends at a faster rate.
c. The two different types of metals are not exposed to the same temperature.
d. The two different types of metals are bonded together and expand at different rates.

24. The efficiency of an energy conversion process can be calculated if both energy-in (E_{in}) and energy-out (E_{out}) are known. The correct formula is:

a. Eff(%) = $E_{in} \div E_{out}$ x 100 %
b. Eff(%) = (E_{in} x E_{out}) x 100%
c. Eff(%) = $E_{out} \div E_{in}$ x 100%
d. Eff(%) = (E_{out} x E_{in}) x 100%

25. A vane type water pump uses rotating vanes to pull water through the pump and force it out at higher pressure. The water pump is an example of a___________.

a. mechanical-to-fluid energy convertor
b. fluid-to-mechanical energy convertor
c. fluid-to-electrical energy convertor
d. mechanical-to-electrical energy convertor

26. Which of the devices identified below is a thermal energy convertor?

a. electric motor
b. heart pacemaker
c. water pump
d. inertia welder

27. A turbine converts:

a. electrical to thermal energy
b. fluid energy to electrical energy
c. fluid energy to rotational mechanical energy
d. electrical energy to fluid energy

28. Which of the devices below converts electrical energy to thermal energy?

a. automobile alternator
b. soldering iron
c. turbine
d. windmill generator

29. Ten kilowatt-seconds of electrical energy is the same as__________joules of electrical energy.
(Remember: 1 watt•second = 1 joule.)

a. 10
b. 100
c. 1000
d. 10,000

30. A solenoid that is 60% efficient requires 60 joules of electrical energy to move the solenoid plunger. The mechanical output of this solenoid device is equal to _____.

a. 36 J/sec
b. 72 J/sec
c. 36 N x m
d. 72 N x m

31. A calrod unit (an electrical heating element) is used in a small steam engine to heat water and produce steam. The steam in turn drives a piston that produces rotating mechanical energy. The sequence of energy conversion--from input to final output--is________________.

a. electrical to mechanical to thermal
b. electrical to thermal to fluid to mechanical
c. thermal to electrical to thermal
d. thermal to electrical to fluid to mechanical

32. The revolving blades of a ventilator fan pull air through the fan and push air away on the other side. The fan blades are a ______________________.

a. mechanical-to-thermal energy convertor
b. fluid-to-mechanical energy convertor
c. electrical-to-fluid energy convertor
d. mechanical-to-fluid energy convertor

33. A 0.5 hp electric motor delivers 373 watts of output mechanical power. The motor is 93.2 % efficient. The amount of input electrical power needed to run the motor is ______.

a. 200 watts
b. 378 watts
c. 400 watts
d. 578 watts

34. The percent efficiency of mechanical-to-electrical energy convertor that has a rotating shaft input of 60 N x m of energy and a generating output of 45 J is __________.

a. 25 %
b. 50 %
c. 75 %
d. 90 %

35. The conversion of electrical energy into thermal energy in a heating element is most likely to be __________.

a. near 10 %
b. near 50 %
c. near 90 %
d. near 150 %

36. An MHD generator is provided with 50,000 joules of fluid kinetic energy to move an ionized liquid metal in a magnetic field. The MHD generator produces 20 kilowatt•seconds of electrical energy. The MHD generator is __________efficient.

a. 20 %
b. 40 %
c. 60 %
d. 70 %

37. The portion of the electromagnetic spectrum technically referred to as "light" is composed of________________.

a. only radiation between 4000 A and 6000 A
b. only visible and television radiation
c. only visible, ultraviolet, and infrared radiation
d. only visible, and all other electromagneic radiation

38. Three important characteristics of laser light are (1) its purity of color, (2) its ability to travel along a single path or direction, and (3) ______________________________.

a. its ability to multiply its output power to many times its input power.
b. its low-power output beam
c. its harmless effects on all targets
d. its coherent or in-step phase relatioship

39. When a light ray traveling in a medium strikes the surface of another medium and is turned back into the original medium, the process is called "______________."

a. refraction
b. reflection
c. diffraction
d. either a or b

40. When a light source shines on an object that has sharp, distinct edges, and the resulting shadow is fuzzy and poorly defined, the light producing the shadow is being __________.

a. reflected
b. refracted
c. diffracted
d. both a and c.

41. When light waves overlap on a screen, the resulting pattern of bright and dark lines on the screen is called "__________"

a. the "zebra" effect
b. a universal bar code
c. geometrical shadows
d. interference fringes

42. "Collimated" light is light that travels with minimum beam spread. This is best achieved by using____________.

a. light from a flashlight
b. incoherent light and lenses to expand the beam
c. coherent light and lenses to expand the beam
d. both a and c

43. Power density and irradiance refer to the same quantity. Whichever name is used, they both are a measure of______.

a. energy per unit area
b. power per unit area
c. energy per unit time
d. power per unit volume

44. For a nearsighted person (without glasses) the image of objects is formed ______________________.

a. in front of the retina
b. on the retina
c. behind the retina
d. on the retina, but much smaller than with normal vision

45. The focal length of a spherical mirror (concave or convex) equals____________________.

a. four times the radius of curvature of the mirror
b. two times the radius of curvature of the mirror
c. the radius of curvature of the mirror
d. one-half the radius of curvature of the spherical mirror

46. When two light waves overlap, the resultant wave where the two wave peaks meet is stronger than either individual wave. This is an example of__________________.

a. constructive interference
b. destructive interference
c. refraction
d. diffraction

47. The bending of light rays as they pass from one transparent medium to another is called "__________."

a. refraction
b. reflection
c. diffraction
d. diffusion

48. When light travels from one medium to another, the indices of refraction of the two media affect__________.

a. the angle of refraction of light at the boundary
b. the angle of reflection of light at the boundary
c. the direction of the normal at the boundary
d. the direction of the light at the boundary

49. The rim-to-rim size of a lens determines its ability to ____________.

a. bend light rays
b. diffract light rays
c. change the color of light
d. collect and pass light

50. The focal length of a lens is determined by__________.

a. the rim-to-rim diameter of the lens
b. the index of refraction of the lens material and the shape of the front and back surfaces
c. the angle of incidence of the light on the lens
d. both a and c.

Attachment 4

IMPORTANT

- USE #2 PENCIL
- EXAMPLE: A B ● D E
- ERASE *COMPLETELY* TO CHANGE

NAME *PRINCIPLES OF TECHNOLOGY*

SUBJECT *KEY – 2nd YEAR FINAL*

DATE *AND PRE-TEST* HOUR

SCAN-TRON® FORM 882

TEST RECORD	
PART 1	
PART 2	
TOTAL	

STW-4984-998

1 B	2 B	3 A	4 B	5 C	6 A	7 B	8 B	9 A	10 D
11 D	12 C	13 C	14 B	15 D	16 B	17 B	18 C	19 A	20 A
21 A	22 A	23 B	24 C	25 A	26 B	27 C	28 B	29 D	30 C
31 B	32 D	33 C	34 C	35 C	36 B	37 C	38 A	39 B	40 C
41 A	42 C	43 B	44 A	45 A	46 A	47 A	48 A	49 B	50 B

← FEED THIS DIRECTION ←

25

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AUSTIN INDEPENDENT SCHOOL DISTRICT
Department of Management Information
Office of Research and Evaluation

February 18, 1988

TO: Ben Botbol, Teacher, Crockett High School

FROM: David Wilkinson DW

SUBJECT: Principals of Technology Test Scores

Thank you for your help and cooperation in the administration and scoring of the Principles of Technology Second Year, First Semester Test which was given as a pretest on January 27, 1988. Attached is a list of the students (including the two you recently sent me) with the number and percent of items each student answered correctly.

If you have any questions about this information, please call me at 458-1227.

DW:nco
Attachments

cc: David Kernwein, Principal
Ron Foy

Approved: ____________________
Assistant Director
Management Information

AUSTIN INDEPENDENT SCHOOL DISTRICT
Department of Management Information
Office of Research and Evaluation

PRINCIPLES OF TECHNOLOGY PRETEST
(SECOND YEAR, FIRST SEMESTER)--January 27, 1988

	Student ID	Student Name	Number Correct	Percent Correct
1.	0490351	Basham, Monica	11	22%
2.	0537371	Beck, Terry	20	40%
3.	0542451	Becker, Chris	26	52%
4.	0893152	Briones, Gabriel	13	26%
5.	9054104	Carranza, Juan	15	30%
6.	2872903	Gomez, Darren	23	46%
7.	2953701	Govea, James	9	18%
8.	3072404	Guerra, Cindy	19	38%
9.	3761351	Hubbard, Stetson	16	32%
10.	4309351	Klaehn, Martin	18	36%
11.	4435603	Lambeth, Jacky	19	38%
12.	5985582	Palmer, Tim	25	50%
13.	9008306	Payeur, Steve	38	76%
14.	6761391	Roberts, Zac	11	22%
15.	7031452	Salinas, Michael	12	24%
16.	7193104	Schultz, Michael	9	18%
17.	8533001	Wendler, Kevin	12	24%

Attachment 6

RESULTS OF THE PRINCIPLES OF TECHNOLOGY
SECOND-YEAR, FIRST-SEMESTER TEST, 1987-88

ID#	Student	NUMBER CORRECT Pretest	Posttest	Change	PERCENT CORRECT Pretest	Posttest	Change
0490351	Basham, Monica	11	19	+ 8	22%	38%	+16%
0537371	Beck, Terry	20	26	+ 6	40%	52%	+12%
0542451	Becker, Chris	26	43	+17	52%	86%	+34%
0893152	Briones, Gabriel	13	22	+ 9	26%	44%	+18%
9054104	Carranza, Juan	15	--	--	30%	--	--
2872903	Gomez, Darren	23	14	- 9	46%	28%	-18%
2953701	Govea, James	9	--	--	18%	--	--
3072404	Guerra, Cindy	19	39	+20	38%	78%	+40%
3761351	Hubbard, Stetson	16	41	+25	32%	82%	+50%
4309351	Klaehn, Martin	18	35	+17	36%	70%	+34%
4435603	Lambeth, Jacky	19	34	+15	38%	68%	+30%
5985582	Palmer, Tim	25	--	--	50%	--	--
9008306	Payeur, Steve	38	47	+ 9	76%	94%	+18%
6479304	Ramos, Robert	--	28	--	--	56%	--
6761391	Roberts, Zac	11	32	+21	22%	64%	+42%
6791303	Robinson, Samuel	--	32	--	--	64%	--
7031452	Salinas, Michael	12	21	+ 9	24%	42%	+18%
7193104	Schultz, Michael	9	37	+28	18%	74%	+56%
8533001	Wendler, Kevin	12	44	+32	24%	88%	+64%

-- = Test not taken; calculation of change not possible

Average percent correct			Range	
Pretest	34.82%	(N=17)	Pretest	18% - 76%
Posttest	64.25%	(N=16)	Posttest	28% - 94%
Average change	+29.57%	(N=14)	Change	-18% - +64%

Average number correct		Range	
Pretest	17	Pretest	9 - 38
Posttest	32	Posttest	14 - 47
Average Change	+15	Change	-9 - +32

Attachment 7

CORRELATED T TEST ON PRE- AND POSTTEST TAP SCIENCE SCORES
FOR STUDENTS IN SECOND-YEAR PRINCIPLES OF TECHNOLOGY - 1987-88

ID#	STUDENT	PRE	POST	GAIN
0490351	Basham, Monica	58.7	50.5	- 8.2
0537371	Beck, Terry	64.9	56.4	- 8.5
0542451	Becker, Chris	56.4	70.1	13.7
0893152	Briones, Gabriel	40.1	15.4	-24.7
9054104	Carranza, Juan	53.7	--	--
2872903	Gomez, Darren	48.4	59.3	10.9
2953701	Govea, James	29.9	--	--
3072404	Guerra, Cindy	77.0	61.0	-16.0
3761351	Hubbard, Stetson	39.6	72.8	33.2
4309351	Klaehn, Martin	84.6	34.4	-50.2
4435603	Lambeth, Jacky	54.8	55.3	0.5
5985532	Palmer, Tim	46.3	--	--
9008306	Payeur, Steve	84.6	93.3	8.7
6479304	Ramos, Robert	48.4	54.8	6.4
6761391	Roberts, Zachariah	64.9	65.5	0.7
6791303	Robinson, Samuel	51.6	61.0	9.4
7031452	Salinas, Michael	44.7	39.6	- 5.1
7193104	Schultz, Michael	6.7	21.8	15.1
8533001	Wendler, Kevin	68.5	57.5	-11.0
	N	19	16	16
	Mean*	53.88	54.30	- 1.57

t = -0.328, df = 15 NS

* Calculated on students with both pre- and posttest scores.

Program: SA-DW$PT1

Attachment 8

CORRELATED T TEST ON PRE- AND POSTTEST TAP MATHEMATICS SCORES
FOR STUDENTS IN SECOND-YEAR PRINCIPLES OF TECHNOLOGY - 1987-88

ID#	STUDENT	PRE	POST	GAIN
0490351	Basham, Monica	20.4	40.7	20.3
0537371	Beck, Terry	64.2	47.4	-16.8
0542451	Becker, Chris	79.6	75.8	- 3.8
0893152	Briones, Gabriel	39.0	39.6	0.6
9054104	Carranza, Juan	34.4	--	--
2872903	Gomez, Darren	57.5	53.2	- 4.3
2953701	Govea, James	40.7	--	--
3072404	Guerra, Cindy	65.6	60.4	- 5.2
3761351	Hubbard, Stetson	53.7	40.7	-13.0
4309351	Klaehn, Martin	78.2	45.8	-32.4
4435603	Lambeth, Jacky	55.9	51.6	- 4.3
5985532	Palmer, Tim	55.9	61.7	5.8
9008306	Payeur, Steve	86.9	89.6	2.7
6479304	Ramos, Robert	65.6	58.7	- 6.9
6761391	Roberts, Zachariah	82.7	67.7	-15.0
6791303	Robinson, Samuel	64.2	78.2	14.0
7031452	Salinas, Michael	49.5	67.7	18.2
7193104	Schultz, Michael	47.4	48.9	1.5
8533001	Wendler, Kevin	70.1	67.7	- 2.4
	N	19	17	17
	Mean*	58.50	58.55	- 2.41

$t = -0.759$, $df = 16$ NS

* Calculated on students with both pre- and posttest scores.

Program: SA-DW$PT1

Attachment 9

COMPARISON OF SCORES ON THE FIRST-YEAR (FIRST-SEMESTER) PRINCIPLES OF TECHNOLOGY TEST

Group*	Year/ Semester of Enrollment	AVERAGE PERCENT CORRECT Pretest	Posttest	Gain
I	Spring, 1987	29.14% (N=22)	67.87% (N=23)	+38.73% (N=20)
II	Fall, 1988	23.94% (N=18)	51.35% (N=17)	+27.41% (N=16)

$t = 2.4473$, $df = 38$, $p < .02$

* See Attachment 1.

ADDENDUM
TO
EVALUATION SUMMARY

Two year summary:

First Year:

- The students taking both the pre and post curriculum-specific test made a significant gain (37%) on questions answered correctly.
- Two-thirds of the class could be said to have mastered the essential elements on the 70% or above level of the post test.

Second Year:

- 30% more items were answered correctly on the post test than on the pretest. This is a significant gain.
- 44% of the students could be said to have mastered the essential elements at or above the 70% level.
- First year students taking the course in the spring of 1987 scored significantly better than the students taking the course in the fall of 1987.

The student most likely to succeed and profit from this course should have the following characteristics:

(A) The student should be a junior or senior, have had one year of algebra. Some of these students were sophomores, some had not had algebra. The content and method of presentation helped these students understand and work with math concepts. However, those students with one more year of maturity and with one year of algebra tended to be more successful. However, this probably could be said of any class with students of this caliber. A student who has a hard time with math and/or physics skills and concepts will have problems with this course also. However, the method of teaching and the related, practical content enables these less gifted students to understand math concepts easier than in abstract classes.

(B) The student should have an aptitude for mechanical phenomena. The content is based on applied physics. How and why things work interest the student.

(C) Neither race nor sex seemed to be a determiner of success in the course. Students of all ethnic origins and of both sexes did equally well.

PRINCIPLES OF TECHNOLOGY
ADVISORY COMMITTEE

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DAVID KERNWEIN CROCKETT HIGH SCHOOL 5601 MANCHACA ROAD AUSTIN, TEXAS 78745	AISD 444-5737
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HAL MEYER MOTOROLA MOTOROLA INC. 3501 ED BLUESTEIN BLVD. AUSTIN, TEXAS 78721	928-6332
JANICE WALKER CROCKETT HIGH SCHOOL 5601 MANCHACA ROAD AUSTIN, TEXAS 78745	AISD 444-5737
ROGER WEEKLY IBM 1110 TOWNSHIP COVE AUSTIN, TEXAS 78759	IBM 823-4957

ESSENTIAL ELEMENTS

ESSENTIAL ELEMENTS
PRINCIPLES OF TECHNOLOGY I

Principles of Technology I (1/2-1 Unit). Principles of Technology is a laboratory oriented course that shall include the following essential elements.

(1) Manipulative laboratory skills; the student will be provided opportunities to demonstrate safe use of laboratory equipment, and use data acquisition skills. The student will be provided opportunities to:

(A) to observe the phenomena present in force, work, rate, resistance, energy, power and force transformation.

(B) define and describe the processes of mechanical, fluid, electrical and thermal systems as they relate to force, work, rate, resistance, energy and power.

(C) use typical measuring devices to obtain data.

(D) identify and set up conditions, supplies and equipment to manipulate variables in investigating a principle or hypothesis.

(2) Investigative skills; the student will have opportunities to predict outcomes and draw logical inferences from data acquired from experiments. The student will be given the opportunity to:

(A) read graphs, charts and other graphic displays.

(B) relate physical objects and events to other physical objects and events.

(C) work with vector problems.

(D) identify and explain electrical and electronic circuits and their efficiency.

(3) Technological communication. The student will be provided opportunity to sequence technology investigations, and to provide written and oral reports on the conclusions. The student will be able to:

(A) pl t data on graphs and charts.

(B) classify and sequence physical actions, reactions and interactions.

(C) extrapolate possible outcomes based on current data.

(4) Application. The student will be provided opportunities to understand how these principles of technology apply to day by day operations and the student will have the opportunity to investigate and evaluate career opportunities as they relate to the aforementioned area of study.

ESSENTIAL ELEMENTS
PRINCIPLES OF TECHNOLOGY II

Principles of Technology II (1/2-1 Unit). Principles of Technology is a laboratory oriented course that shall include the following essential elements.

(1) Manipulative laboratory skills; the student will be provided opportunities to demonstrate safe use of laboratory equipment, and use data acquisition skills. The student will be provided opportunities to:

(A) observe the interaction of mechanical, fluid, electrical and thermal systems with momentum, waves and vibrations, energy convertors, transducers, radiation, optical systems and time constants.

(B) describe and define the phenomena listed in (A) above.

(C) use measuring and data collecting instruments to obtain necessary information to form inference and proofs concerning the above listed concepts.

(2) The student will be able to set up investigations to predict outcomes and draw inferences. The student will have the opportunity to:

(A) read and interpret graphs, charts and other graphic displays.

(B) classify objects and outcomes and to place events into a logical sequence..

(C) report both in writing and orally, the hypothesis, events, inferences and conclusions of investigations.

(3) The student will be provided oppo..tunities to understand how these principles of technology apply to day by day operations and the student will have the opportunity to investigate and evaluate career opportunities as they relate to the aforementioned areas of study.

(4) Technological communication. The student will be provided opportunity to sequence technology investigations, and to provide written and oral reports on the conclusions. The student will be able to:

(A) plot data on graphs and charts.

(B) classify and sequence physical actions, reactions and interactions.

(C) extrapolate possible outcomes based on current data.

(5) Application. The student will be provided opportunities to understand how these principles of technology apply to day by day operations and the student will have the opportunity to investigate and evaluate career opportunities as they relate to the aforementioned area of study.

FIRST QUARTER REPORT
PRINCIPLES OF TECHNOLOGY
NO. 88420028
JULY 1 - SEPTEMBER 30

JUNE 26, 1987 A LETTER FROM VICTORIA BERGIN HAD BEEN RECEIVED STATING THAT OUR PROPOSAL NO. 550/61/10/87-030 HAD BEEN RECOMMENDED FOR FUNDING.

JULY AND AUGUST APPARATUSES WERE BUILT FOR THE SECOND SEMESTER ACTIVITIES. WE FOUND THAT WE COULD BUILD MANY OF THE APPARATUSES CALLED FOR IN THE ACTIVITIES FOR LESS MONEY AND IMPROVE SOME ON THE DESIGN.

WE STARTED THE SECOND SEMESTER OF THE FIRST YEAR COURSE IN SEPTEMBER. WE HAVE STUDENTS WHO ARE IN THE SECOND SEMESTER OF THE FIRST YEAR OF PRINCIPLES OF TECHNOLOGY AND WE HAVE STUDENTS WHO ARE IN THE FIRST SEMESTER OF PRINCIPLES OF TECHNOLOGY.

WE HAD NOT RECEIVED OFFICIAL INFORMATION FROM TEA ABOUT FORMAL APPROVAL FOR THE CONTINUATION OF THE PROGRAM BY THE END OF THE FIRST QUARTER.

SECOND QUARTER REPORT
PRINCIPLES OF TECHNOLOGY
NO. 88420028
OCTOBER 1 - DECEMBER 31

ON OCTOBER 23 WE RECEIVED OUR OFFICIAL APPROPRIATION PACKAGE FOR THE CONTINUING GRANT.

IN OCTOBER, NOVEMBER AND DECEMBER PLANS WERE MADE FOR RECRUITMENT OF STUDENTS, AND SCHEDULES WERE MADE FOR THE SPRING SEMESTER AND THE SECOND YEAR STUDENTS.

A LIST OF NEEDED SUPPLIES AND EQUIPMENT WAS MADE FROM MATERIALS FURNISHED BY CORD. BIDS WERE SOUGHT AND PLANS WERE MADE TO ORDER THE SUPPLIES AND EQUIPMENT FOR THE SECOND YEAR COURSE TO START JANUARY 25.

THIRD QUARTER REPORT
PRINCIPLES OF TECHNOLOGY
No. 88420028
JANUARY 1 - MARCH 31

In the month of January equipment, books, and supplies were purchased to begin the second year program. A post test was given to the first year students and a pretest was given to the second year students. Results of these are attached.

An advisory committee was formed with the first meeting held March 10, 1988 at Crockett High School. Ben Botbol, teacher, presented the program. He acquainted the committee with what was being taught in Principles of Technology and some of its goals in order to orientate the new committee members. Committee members are:

Shevawn Eisman	Lockheed, Chairperson
Roger Weekly	I.B.M., Vice-Chair
Ralph Gohring	Tracor
Louis Igo	AISD
David Kernwein	AISD
Janice Walker	AISD
Bert Marcom	ACC
Hal Meyer	Motorola

AUSTIN INDEPENDENT SCHOOL DISTRICT
March 10, 1988

ARTICULATION AGREEMENT

This is a joint articulation agreement between the Austin Community College and the Austin Independent School District for providing a mechanism which will enable graduates at the secondary level who have successfully completed the Principles of Technology course of study to interface with identified programs at the Austin Community College.

Austin Community College believes they have an obligation to place students at the proper educational level to enhance student success to recognize individual differences, and to avoid duplication of effort between our two institutions.

This agreement is based on the fact that vocational programs at the Austin Community College and the Austin Independent School District have common interests and characteristics.

Elbert Marcom
Assistant Vice President of
Academic Affairs
Austin Community College

Louis Igo
Director, Vocational Education
Austin Independent School District.