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ABSTRACT

The Texas Learning Technology Group (TLTG) is a non-profit organization formed in 1985 by the Texas Association of School Boards, the National Science Center Foundation, and 12 Texas school districts. Believing that science education had become characterized by a shortage of qualified physical science teachers, a high failure rate, a lack of student motivation, and a decreasing number of students enrolling in advanced science courses, the organization established a three-fold mission: (1) to develop high-quality curriculum programs that integrate educational technologies into instructional delivery systems; (2) to evaluate the educational effectiveness of technology-based curricula; and (3) to educate teachers in the use of new technologies and provide support to schools implementing these new curricula. The core of the resulting 15-unit TLTG science program is its interactive video-based instruction. Robbins Secondary School was selected as a site for the TLTG physical science program to determine if interactive video instruction could also enhance the learning of at-risk students. An evaluation of the program found that most students evinced a positive attitude toward the technology provided, felt comfortable using the computer assisted instructional system, enjoyed learning science that way, and felt they were learning the material better using this technology. Survey results also indicated that, despite positive student attitudes, they did not express an interest in continuing science classes. Finally, students' grade equivalent scores on the TAP Science Test were lower than typical for their grade and lower than those of other students at Robbins. A copy of the attitude survey instrument is appended. (3 references) (DB)

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Technology & At-Risk Students:

The TLTG Science Project at Robbins

Austin Independent School District
Office of Research and Evaluation

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Technology & At-Risk Students: The TLTG Science Project at Robbins Executive Summary

**Austin Independent School District
Department of Management Information
Office of Research and Evaluation**

Author: Kris Bliss

Program Description

The Texas Learning Technology Group (TLTG) is a nonprofit organization formed in 1985 by the Texas Association of School Boards (TASB), the National Science Center Foundation (NSCF), and 12 Texas school districts including Austin Independent School District (AISD). Believing that science education had become characterized by a shortage of qualified physical science teachers, a high failure rate, a lack of student motivation, and a decreasing number of students enrolling in advanced science courses, the organization established a three-fold mission:

- a) To develop high-quality curriculum programs that integrate new technologies into instructional delivery systems,
- b) To evaluate the effectiveness of technology-based curricula, and
- c) To train teachers in the use of new technologies and provide support to schools implementing these new curricula.

The core of the resulting 15-unit TLTG physical science program is its interactive video-based instruction. Goals of the TLTG program include increasing students' in-depth understanding of physical science concepts, showing the relevance of physical science to daily life, and preparing students for academic and professional advancement in the sciences. Implemented at a number of Texas schools, pilot studies indicated that the TLTG physical science program was successful in producing significant gains in achievement and in increasing positive attitudes toward science for students identified as having low verbal and low quantitative ability.

Robbins Secondary School was selected as a site for the TLTG physical science program to determine if interactive video instruction could also enhance the learning of at-risk students. Twenty-three students participated in the program during the 1990-91 school year.

Major Findings

1. Most of the TLTG students evinced a positive attitude toward the technology provided. In response to a survey, a majority reported feeling comfortable using the computer and videodisc system, enjoyed using them in class, thought they were a good way to learn science material, and would like to use them in other classes. More than two thirds also believed they learn science better using this technology (pp. 7-8).
2. The survey results also indicate that although the students' attitudes toward science were mostly positive, they did not express an interest in continuing to take science classes or in pursuing science outside the classroom (pp. 8-9).
3. TLTG students' grade equivalent scores on the TAP Science Test are lower than typical for their grade, and lower than those of other students at Robbins (pp. 5-7).

*A copy of the full report for which this is the Executive Summary is available as
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**TECHNOLOGY & AT-RISK STUDENTS:
THE TLTG SCIENCE PROJECT AT ROBBINS
FINAL REPORT**

PROGRAM DESCRIPTION

The TLTG Program

The Texas Learning Technology Group (TLTG) is a nonprofit organization formed in 1985 by the Texas Association of School Boards (TASB), the National Science Center Foundation (NSCF), and 12 Texas school districts (including Austin ISD). Believing that science education had become characterized by a shortage of qualified physical science teachers, a high failure rate, a lack of student motivation, and a decreasing number of students enrolling in advanced science courses, the organization established a three-fold mission:

- o To develop high-quality curriculum programs that integrate new technologies into instructional delivery systems,
- o To evaluate the effectiveness of technology-based curricula, and
- o To train teachers in the use of new technologies and provide support to schools implementing these new curricula (1988-89 Field Test Results of TLTG Physical Science, 1989).

The core of the resulting 15-unit TLTG physical science program is its interactive video-based instruction. Goals of the TLTG program are to:

- o Increase students' in-depth understanding of physical science concepts,
- o Show the relevance of physical science to daily life, and
- o Prepare students for academic and professional advancement in the sciences.

Robbins Secondary School

The TLTG physical science program was first implemented at a number of Texas schools including Austin's Anderson High School. Pilot studies indicated that the program was successful in producing significant gains in achievement and in increasing positive attitudes toward science for students identified as having low verbal and low quantitative ability. The next step was to determine if interactive video instruction could enhance the learning of at-risk students as well.

Robbins Secondary School is an alternative school offering a self-paced academic program for students having difficulties in a traditional school setting. While AISD's 1990-91 high school at-risk population was 49%, the at-risk population at Robbins in

grades 9-12 was a staggering 91%. The Robbins alternative education plan uses a contract system in which students work individually at their own pace to accomplish what is necessary for each course. Keeping students motivated to stay in school and complete their studies is a high priority.

The objectives of the TLTG program implemented at Robbins were to:

- o Decrease dropout rates at Robbins,
- o Increase students' science achievement,
- o Increase students' positive attitudes towards science and technology,
- o Increase students' knowledge about technology in their environment, and
- o Increase teachers' use of technology-oriented instructional programs.

PROGRAM IMPLEMENTATION

Teacher Training

The Robbins science teacher attended two training sessions before introducing the TLTG program on her campus in the fall of 1990. The first one took place in February 1990 and involved everyone using the system. The second was held in August at the TLTG office. During this one-on-one session, the teacher received instruction on the software and how to present it to the class.

Equipment and Software

TLTG provided one teacher station and two student stations along with two semesters of physical science courseware for the program. The equipment included one IBM PS/2 Model 60 computer, two IBM PS/2 Model 50Z computers, two IBM color monitors, one Sony PVM-2539 color monitor, three Sony LDP-1200 laser disc players, and three Sony RM2001 remote control units. The curriculum included 14 videodiscs, accompanying software, chemistry and physics resource guides, chemistry and physics student guides, and assessment program.

The software arrived on the first day of the fall semester but because of some initial debugging, the students did not begin working with it until a few weeks later.

Class Structure

An alternative school, Robbins structures its classes in a unique way. All the students in the first-period science class are not enrolled in the same course. As many as nine students or as few as one are registered for Introduction to Physical Science during any given period. The other courses offered by the teacher include Physical Science, Introduction to Biology, Astronomy, and

Chemistry. Because Robbins is a self-paced school, students work on their individual contracts at their own pace. Instead of lecturing to the class as a whole, the teacher assists students individually during the class period.

All assignments for each class are outlined in a contract, and all courses at Robbins use contracts. For each lesson, the TLTG contracts require students to watch a video presentation (in lieu of reading a chapter or section in a textbook) and complete a practice set or worksheet. Students then either watch another video presentation, complete a lab, or do an interactive assignment on the computer. Not all students use the videodisc system every day, but the systems are used by someone every day. The textbook functions mostly as a reference, and the teacher has designed a chart that correlates all TLTG assignments with chapters in the physical science textbook.

All science students, regardless of the course in which they were enrolled, were introduced to the system. Every contract used the computer and videodisc system for the first three assignments which included lessons on safety and the scientific method. The students enrolled in the Introduction to Physical Science course were trained individually or in small groups to turn the system on, pull up the materials, and read the contracts.

STUDENT CHARACTERISTICS

A total of 23 students was enrolled in the Introduction to Physical Science course during the 1990-91 school year. Ten students took the course in the fall (six of these students continued with the second semester in the spring), and 15 more students enrolled during the spring.

Of the 23 students served:

- o The mean age was 17 years, eight months; the youngest student was 16 years, four months, and the oldest student was 19 years, five months;
- o 52% (12) were male, and 48% (11) were female;
- o 65% (15) were Black, 30% (7) were Hispanic, and 4% (1) were Other;
- o 44% (10) of the students were 9th graders, 44% (10) were 10th graders, 9% (2) were 11th graders, and 4% (1) were 12th graders;
- o 43% (10) were from low-income families.

At-Riskness

At-risk students are those with certain characteristics which increase the likelihood that they will drop out of school. In order to identify and track these students, AISD operationalized State at-risk criteria and developed a list of 22 at-risk

categories (see ORE Publication Number 88.36). The categories include:

- o Overage for grade; that is, a student is two or more years older than expected for the grade level as of September 1;
- o Scoring two or more years below grade level on a norm-referenced standardized achievement test;
- o Failing two or more courses during one semester;
- o Failing any section of the most recently administered state-mandated minimum skills test;
- o Combinations of the above categories.

In 1990-91, every one of the TLTG students was identified as being at-risk:

- o All but one (96%) were overage for grade.
- o All students scored two or more years below grade level on at least one section of the Tests of Achievement and Proficiency; 83% scored two years or more below grade level on two sections.
- o Most (16, 70%) failed two or more courses in one semester.
- o Most (17, 74%) failed one or more sections of the last Texas Educational Assessment of Minimum Skills (TEAMS) taken.

It is important to note that these at-risk statistics for the TLTG students are higher than for the Robbins Secondary School population overall.

PROGRAM RESULTS

Did the dropout rate at Robbins decrease?

Yes. The dropout rate at Robbins in 1990-91 through the fifth six weeks for grades 9-12 was 19.4%, which is 89.8% of the dropout rate for 1989-90. During the year of program implementation, 13% (3) of the TLTG students transferred to another school in the District, and 4% (1) dropped out.

Did TLTG students' science achievement increase?

Although the TLTG students made some achievement gains, their scores were lower than typical for their grade level, and not as large as other Robbins students.

Achievement was measured by comparing program students' scores on the Science Test of the Tests of Achievement and Proficiency (TAP) with their scores from previous years and with the scores of other high school students at Robbins and in the District (see Figures 1-4). It should be noted that other comparisons are possible, including comparisons to at-risk students at other

schools taking Introduction to Physical Science. The comparisons shown here are reasonable since TLTG students are Robbins students, and other Robbins students have taken other science courses, and therefore should also be making some achievement gains in science.

To compare the achievement of TLTG students and Robbins students in science, a straightforward comparison of the median TAP Science scores of these students was first considered. This comparison was not satisfactory, however, because students at different high school grade levels take different levels of the TAP, and the number of TLTG students at some grade levels was too small to compute a median. A single group score representative of the TLTG students as a whole was preferable, but computing a single score across grade levels, effectively collapsing across test levels, is technically dubious. Another measure reflective of group achievement was needed for both the TLTG and Robbins students.

Two comparative achievement measures were found:

- 1) The average gain on the TAP Science Test from spring 1990 to spring 1991, and
- 2) The average distance from typical (average) grade equivalent on the spring 1991 TAP Science Test.

The first measure was calculated by computing the spring-to-spring gain (in grade equivalents) for each student, summing the gains for all students, and dividing by the number of students with scores for both years.

The second measure was derived as follows. The average grade equivalent score at any grade level is the number of years corresponding to the grade level and the number of months corresponding to the month in which the test was administered. In AISD, achievement tests are administered in April, the eighth month of the school year; therefore, the average grade equivalent for ninth graders is, for example, 9.8, for tenth graders, 10.8, and so on. For each student, the difference between the student's spring 1991 grade equivalent score and the average score expected for a student in that grade level was computed. Differences were summed for all students, and the resulting total was divided by the number of students.

As shown in Figure 1, the median grade equivalents for TLTG students on the TAP Science Test in spring 1991 were lower than the scores of all Robbins students for the last three years. Medians could not be calculated for grades 11 and 12 because too few students enrolled in TLTG in those grades. In all cases, the number of TLTG students for each grade level is small, and a median for these groups should not be considered a reliable measure of achievement.

**FIGURE 1
TAP SCIENCE ACHIEVEMENT
TLTG STUDENTS VS. ROBBINS**

Grade Level	TLTG 1991	ROBBINS 1991	ROBBINS 1990	ROBBINS 1989
9				
GE	7.25*	8.95	7.93	9.31
%ile	16*	39	24	44
N	8	77	61	69
10				
GE	7.9*	8.44	8.68	9.04
%ile	17*	21	24	25
N	9	43	34	25
11				
GE	NA	9.05*	9.80	11.00*
%ile	NA	22*	30	40*
N	1	18	20	8
12				
GE	NA	10.08*	9.00*	9.45*
%ile	NA	26*	16*	21*
N	1	12	9	14

NA=Not available. There are too few students to calculate a median.
* A median calculated for a small number of students should not be considered as a reliable measure of a group's achievement.

As shown in Figure 2, TLTG students' grade equivalent scores on the TAP Science Test are lower than expected for their grade and lower than other students at Robbins and in the District.

**FIGURE 2
TAP SCIENCE ACHIEVEMENT 1991
TLTG STUDENTS COMPARED TO ROBBINS AND AISD**

Grade Level	TLTG 1991	ROBBINS 1991	AISD 1991
9			
GE	7.25*	8.95	10.69
%ile	16*	39	60
N	8	77	3779
10			
GE	7.90*	8.44	12.85
%ile	17*	21	67
N	9	43	3050
11			
GE	NA	9.05*	13.54
%ile	NA	22*	65
N	1	18	2517
12			
GE	NA	10.08*	13.28
%ile	NA	26*	54
N	1	12	2232

NA=Not available. There are too few students to calculate a median.

* A median calculated for a small number of students should not be considered as a reliable measure of a group's achievement.

The average gain on TAP Science from spring 1990 to spring 1991 for TLTG students and Robbins students is depicted in Figure 3. TLTG students' gain was not as large as that of other Robbins students.

FIGURE 3
AVERAGE GRADE EQUIVALENT GAIN ON TAP SCIENCE TEST 1990-91
TLTG COMPARED TO OTHER ROBBINS STUDENTS

	N	AVERAGE GRADE EQUIVALENT GAIN
TLTG	19	0.54
ROBBINS	135	0.61

Figure 4 shows that the average distance of TLTG students' grade equivalent scores from expected grade-level scores is much greater than that of other Robbins students.

FIGURE 4
AVERAGE DIFFERENCE OF GRADE EQUIVALENT
SCORE FROM GRADE LEVEL 1990-91
TLTG COMPARED TO OTHER ROBBINS STUDENTS

	N	AVERAGE DISTANCE FROM GRADE LEVEL
TLTG	15	-2.97
ROBBINS	71	-0.88

Student Attitude Survey

In May 1991, a survey assessing previous experience with technology and attitude toward science and technology was administered to students enrolled in the Introduction to Physical Science course during the spring semester. Thirteen surveys were completed. The results for all survey questions are shown in the Appendix.

Before taking this course, the TLTG students had limited exposure to computer and videodisc technology. The responses to the survey show that almost two thirds (62%) of the students had never or almost never used a computer, and all but one (92%) had

never used a videodisc system. Three fourths (77%) said that they are comfortable using computers, and the remainder (23%) were neutral. Two thirds (69%) said that they are comfortable using a videodisc system, 23% were neutral, and one respondent (8%) was not comfortable. Almost all students (92%) report that they enjoy using the computer, while two thirds (69%) said they enjoy using the videodisc system.

Did positive attitudes toward science and technology increase?

Most students evinced a positive attitude toward using the technology provided in that a majority felt comfortable using the computer and videodisc system, enjoyed using them in class, thought they were a good way to learn science material, and would like to use them in other classes. Students' responses were generally more positive about computers than videodisc systems.

Results to the attitude toward technology questions include:

- o More than three quarters (77%) agree that since taking this course, they think it is more important to be able to use technology to succeed in the future; the remainder were neutral.
- o Most (85%) thought that computers are a good way to learn science material, and a slightly lower percentage (69%) reported the same about videodisc systems.
- o Two thirds (69%) agree that they learn science better using a videodisc system, and two thirds (69%) agree that they learn science better using a computer.
- o Most (84%) agreed that it is more interesting to learn science using a videodisc system, and 88% agreed (54% strongly agreed) that it is more interesting to learn science using a computer.
- o Three fourths (76%) reported that they like using computers in their science class, and a higher percentage (85%) would like to use computers in other courses; two thirds (69%) like using the videodisc system in their science class, and 77% would like to use videodiscs in other courses.

Although the students' attitudes toward science were mostly positive, they did not express an interest in pursuing science outside the classroom. For example, while more half of the students surveyed agreed that science lessons are fun (53%), almost half (46%) were neutral. Almost half (46%) said science was interesting to them, one third were neutral, and one fourth expressed disinterest. In response to such questions as "I would like to belong to a science club," and "I like to read books about science," however, most students answered negatively or neutrally.

Responses to the attitude toward science questions indicate that:

- o Most (70%) said that they would not like to take another science course after this one; almost one fourth (23%) were neutral, and one respondent (8%) would like to take more science courses.
- o A vast majority (85%) disagreed with the statement, "Since taking this course, I am more likely to pursue a career in science." One respondent (8%) strongly agreed.

Some responses, however, did indicate that attitudes toward science had become more positive:

- o Nearly one third (30%) said that since they started taking this course, they have become more interested in science; almost half (46%) were neutral, and about one fourth (23%) have not increased their interest.
- o Almost half (46%) agreed that since taking this course, they think it is more important to study science to understand how things work; more than one third (38%) were neutral, and 15% disagreed with the statement.

Did students' knowledge about technology in their environment increase?

Yes. More than half (53%) of the students reported that they had noticed more computers being used at school and outside of school since taking this course. A small percentage (8%) noticed more videodisc systems being used at school, and nearly one third (30%) noticed them being used outside of school. Most (77%) students agreed that since taking this course, they think it is more important to be able to use technology to succeed in the future.

Did teacher use of technology-oriented instructional programs increase?

Yes. In an interview during the spring semester of 1991, the science teacher was asked about her use of technology-oriented instructional programs. She reported that she used the video lessons to instruct other classes in addition to the Introduction to Physical Science course. She believes the system is more effective in depicting relationships between concepts (e.g., volume and density) than a textbook is, and it is easier for students to grasp the concepts because of how they are visualized on the computer.

APPENDIX

TLTG Student Attitude Survey
May 1991

ATTITUDE TOWARD SCIENCE

Survey Question	% Responding				
	SA	A	N	D	SD
Science lessons are fun.	15%	38%	46%	0%	0%
Science is interesting to me.	8%	38%	31%	15%	8%
I would like to belong to a science club.	15%	8%	8%	62%	8%
I like to read books about science.	0%	8%	54%	38%	0%
I like to do experiments more than read about them.	46%	23%	23%	8%	0%
I would enjoy visiting a science museum.	15%	54%	31%	0%	0%
Schools should have more science lessons each week.	8%	0%	38%	54%	0%
I would like to do science experiments at home.	15%	31%	31%	31%	8%
It is more interesting to learn science with a computer.	54%	23%	15%	0%	8%
It is more interesting to learn science with a videodisc system.	46%	38%	0%	8%	8%
I would like to be a scientist one day.	0%	8%	0%	62%	23%
I would like to take more science courses after this one.	8%	0%	23%	62%	8%
I enjoy watching science programs on TV.	23%	23%	31%	14%	8%
I get excited about new things in science class.	8%	23%	38%	23%	8%
I like to find out about new things.	31%	31%	31%	8%	0%
I learn science better using a videodisc.	23%	46%	23%	0%	8%
I learn science better using a computer.	38%	31%	15%	8%	8%
Since taking this course, I have become more interested in science.	15%	15%	46%	23%	0%
Since taking this course, I am more likely to pursue a career in science.	8%	0%	8%	62%	23%
Since taking this course, I think it is more important to study science to understand how things work.	15%	31%	38%	15%	0%

SA = Strongly Agree A = Agree N = Neutral D = Disagree SD = Strongly Disagree

N=13

ATTITUDE TOWARD TECHNOLOGY

Survey Question	SA	A	% Responding		SD
			N	D	
I like using computers in my science class.	38%	38%	15%	0%	8%
I think computers are a good way to learn science material.	31%	54%	8%	0%	8%
I like using a videodisc system in my science class.	38%	31%	15%	8%	8%
I think videodisc systems are a good way to learn science material.	38%	31%	15%	8%	8%
I would like to use computers in my other courses.	54%	31%	8%	8%	0%
I would like to use a videodisc system in my other courses.	46%	31%	15%	8%	0%
I am comfortable using computers.	54%	23%	23%	0%	0%
I am comfortable using a videodisc.	31%	38%	23%	8%	0%
I enjoy using the videodisc system.	38%	31%	15%	8%	0%
I enjoy using computers.	54%	38%	8%	0%	0%
I would rather learn about science from a teacher and a textbook than by using a videodisc system.	8%	8%	15%	31%	38%
I would rather learn about science from a teacher and a textbook than by using a computer.	8%	8%	8%	38%	38%
I would enjoy learning more about how computers work.	62%	31%	8%	0%	0%
I would enjoy learning more about how videodisc systems work.	46%	23%	23%	0%	0%
Since taking this course, I have noticed more computers being used in my school.	31%	23%	31%	15%	0%
Since taking this course, I have noticed more videodisc systems being used in my school.	8%	0%	62%	23%	8%
Since taking this course, I have noticed more computers being used outside of school.	15%	38%	15%	23%	8%
Since taking this course, I have noticed more videodisc systems being used outside of school.	15%	15%	38%	23%	8%
Since taking this course, I have become more interested in technology as a way to learn in school.	15%	15%	38%	23%	8%
Since taking this course, I think it is more important to be able to use technology to succeed in the future.	15%	62%	23%	0%	0%

SA = Strongly Agree A = Agree N = Neutral D = Disagree SD = Strongly Disagree
 N = 13

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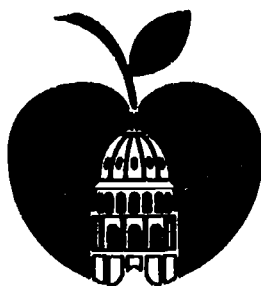
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