A QUALITATIVE STUDY OF THE EFFECTS OF THE USE OF INTERACTIVE TELEVISION IN AN ELEMENTARY SCIENCE CLASS

A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

MASTER OF SCIENCE IN SCIENCE TEACHING

IN THE GRADUATE SCHOOL OF THE

TEXAS WOMAN'S UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

BY

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DENTON, TEXAS

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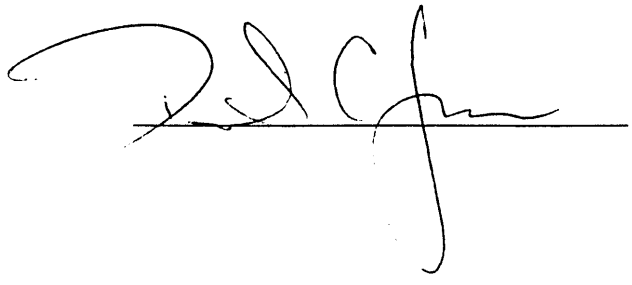
January 12, 1998

To the Associate Vice President for Research and Dean of the Graduate School:

I am submitting herewith a thesis written by Loree Baucum entitled "A Qualitative Study of the Effects of the Use of Interactive Television in an Elementary Science Class." I have examined this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirement for the degree of Master of Science.

Carlton Wendel, Major Professor

I have read this thesis and
recommend its acceptance:



Accepted

Associate Vice President for Research
and Dean of the Graduate School

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I would also like to express my gratitude to Mike Cardwell, Assistant Superintendent, Linda Porter, Technology Coordinator, and Trish Carnagey, Principal, Greenville Independent School District, for their unfailing support. Finally, I would like to thank my husband, Don, my daughters, Whitney and Emily, and my mother, Janet Seright, who would never let me give up.

ABSTRACT

A QUALITATIVE STUDY OF THE EFFECTS OF THE USE OF INTERACTIVE TELEVISION IN AN ELEMENTARY SCIENCE CLASS

LOREE BAUCUM

MAY, 1998

The purpose of this study was to determine the effect of Interactive Television on the attitudes and feelings of fourth-grade students and their parents regarding elementary science education. Learning was also assessed by the use of pre- and post-tests. A questionnaire was given to both students and their parents at the conclusion of a 4-week science study using Interactive Television as a major instructional tool. Students' feelings were also documented through the use of journals and selected interviews.

Results from the data support the hypothesis that attitudes of students and parents would be positive regarding the use of Interactive Television. Learning was also documented through the use of Interactive Television.

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CHAPTER I

INTRODUCTION

Background

In the preceding decade, the use of technology in the classroom has expanded at an astounding rate. One of the many forms of technology that has been introduced for educational use is that of distance learning. There are hundreds of educational programs that are now provided by way of telecommunication links. These uplinks provide instruction for students in grades K to 12, as well as those in university related studies (Shapiro, Heck, & Freedenberg, 1992). For example, students in Amarillo, Texas may elect to participate in an oceanography class conducted by a professor in Galveston, Texas. A middle school science class in Dallas can download material from MacDonald Observatory in Fort Davis and then interact with scientists about their findings.

Distance learning is certainly the wave of the future as it opens up arenas of learning that we have only been able to dream of in the past (Bruder, 1989). The National Information Infrastructure, outlined by Vice President Gore in January, 1994, is the official name of the national information system. The United States Congress has issued four pieces of legislation in support of high tech development (Noor-Al-Deen, 1994). President Clinton called for the interconnection of all schools in America through technology in his State of the Union Address in the winter of 1996.

Texas is a leader in this area as many districts are installing fiber optic networks to connect K to 12 schools with major universities as well as other high schools. There has been much research conducted in the area of distance learning using interactive television, but the overwhelming percentage of these studies are conducted using either middle or high school students as the subjects. The research conducted regarding elementary age children is almost nonexistent. The current research does not seem to be subject specific. Science education, by its very nature, lends itself to be a measurable discipline to be used in a research setting. Interactive Television (I.T.V.) has the potential of bringing a wide range of enriching activities to the classroom in which it is used. Evidence of this is exhibited in a course offered through the Hawaiian Interactive Television called D.A.S.H. (Developmental Approaches in Science and Health). D.A.S.H. is a sequential kindergarten through sixth-grade program that integrates the content of science, health, and technology (Fulford, 1994).

Statement of the Problem

There is very little literature documenting learning and attitudes of the elementary school student using Interactive Television. As our nation sets a mandate for the linking of schools with other sources of learning, we should know the impact of this method on the elementary child. Elementary education forms the foundation for every discipline. Technology should not be excluded. Educators are continually seeking new methods of

making learning more effective; distance learning is an excellent source of opening up the world for young students.

There is a need for technology to become an integral part of the elementary curriculum. There is also a need for early learners to become comfortable and experienced with the aspect of distance education using Interactive Television. The purpose of this study was to investigate the assertion that the use of Interactive Television would have a positive affect on the attitudes of fourth grade students and their parents regarding science education.

Statement of Hypothesis

Learning and attitudes of fourth-grade science students as well as attitudes of their parents will be affected positively regarding science education by the use of Interactive Television as a form of distance education.

Definitions

The term Distance Learning in this thesis is used to mean instruction that is delivered by any means to any single or multiple locations via instructional telecommunications to any other distance location by the use of two-way full motion video (Interactive Television) which is transmitted via fiber optic line (Macy, 1997). Fiber optics are transmission lines that are composed of extremely thin strands (fibers) of glass. The optics are composed of laser emitters in the electronic parts of the network. Fiber optics are reliable and faster than regular "wired" networks which use metal (copper, etc.)

as conductors. All fiber optic systems use light to transmit information, rather than electrical energy (Macy, 1997).

Two-way Interactive Television is defined as a process of communication involving an audio and visual system that connect two or more specifically designed environments through an interactive network so that physically separated groups can take part in the same educational experience (Arnold, 1987).

CHAPTER II

LITERATURE REVIEW

A review of the literature related to the use of interactive television proved to be a difficult task. Much of the literature is written in a first person, narrative form and contains explanations of how they implemented distance education in their own district, but there seems to be little true research. This problem was restated by Williams, Eiserman, and Quinn (1988). They indicate that there is a great need for more sophisticated and frequent evaluation of the research concerning I.T.V., in relationship to the elementary classroom. Some aspects of the research concerning student attitudes toward the use of I.T.V. as a form of distance education are applicable to different age levels. Let us then consider these attitudes in general.

Attitudes of Students Using Interactive Television

Burge and Howard (1990) studied the attitudes of students at the University of Toronto toward audio teleconferencing as a form of distance education. Students usually felt successful in their courses; eighty-seven percent said they "often" or "almost always" felt successful. The researchers asked a number of questions about the teleconferencing equipment. About 57% of the students said practice with the equipment made them feel more comfortable with it. The students did express some concerns with the use of the equipment and the rules that were required in order to be able to interact with their

instructor. The students made many comments on how to have a more personal relationship with the instructor.

Ross et al. (1991) discussed two programs for tutoring at-risk elementary school children at a distance; one using a local electronic bulletin board system and the second using AppleLink, a national network system featuring both electronic mail and teleconferencing. In the first program, student reactions were negative. More than half of the students did not understand corrections made by their instructors. They felt they received little help with their writing skills, found the assignments difficult, and said they did not learn much from their instructors.

Most instructors, 89%, felt they needed more intensive training and 67% said they would have liked more personal contact with their students. In the second program, student comments were more positive. Sixty-nine percent of the students said they liked their assignments, and 65% said that they had learned from their instructors.

Johnson (1988) studied the attitudes of students from small, rural Iowa high schools toward interactive satellite instruction. Survey results showed that the students held positive attitudes toward satellite-delivered instruction, especially when it pertained to the personal aspects of the instructor. Even though the students only had weekly contact with their instructor, they still gave the interaction between teacher and student a positive rating. Students were only slightly positive in regard to the benefits they received from the satellite-delivered instruction as compared to what they were generally receiving

from the course content. They did not feel the relationships with other students and the development of independent learning to be among the major benefits of interactive satellite instruction. These students believed that the interactive courses were easier than regular classes. Even though students were generally supportive of the interactive satellite courses, they still preferred traditionally taught courses.

Interactive Television as a Form of Distance Learning

Distance education, in the form of I.T.V., is certainly extending the boundaries of the traditional physical campus and classroom. An article in Time magazine (Elson, 1992) described the educational institution of the future as one with open access to information, with a fully networked electronic learning environment and a flexible time schedule. I.T.V. certainly can be a part of this future.

The literature of distance education using I.T.V. seems to be largely reports of specific projects (Whittington, 1987). It is mainly comparison studies in which students in distance learning centers are compared to students learning in a traditional classroom. Most of the research has involved adult, off-campus college students, or advanced placement high school students. Their experiences may not be an accurate reflection of a younger population. However, there are some general statements that are supported in the literature (Egan et al., 1992). Distance learners are able to learn as much as a student in a more traditional setting. Preparation and preplanning on the part of the instructor is a main component on the effectiveness of I.T.V. Teachers using this method just cannot

"wing it." In spite of the flexibility and convenience of using distance classrooms, students still seem to prefer the traditional classroom (Egan et al., 1992).

Hands-on Science Instruction

Hands-on Science is "any science lab activity that allows the student to handle, manipulate or observe a scientific process" (Lumpe & Oliver, 1991, p. 345). Hands-on science seems to encourage students to conceptualize science principles, so they are able to see that science is a verb, not a noun (Harty, Kloosterman & Markin, 1989). Higher level thinking skills are being stressed in every discipline. It has been the theory that by the teaching of hands-on science, the student would be able to have increased higher level skills in other subjects (Gagne, 1967, cited in Stohr-Hunt, 1996).

According to Stohr-Hunt (1996), curriculum reform in science began many years ago. "The successful flight of the Soviet Sputnik in 1957 gave renewed impetus to the curriculum reform movement toward the end of World War II" (Klopfer & Champagne, 1990). After this history-changing event, science education evolved into a more student-centered process.

There were suddenly many new hands-on science programs developed. "Although these programs differed in their style, each placed a great deal of stress on, and value in, hands-on activities that were oriented toward discovery learning" (Storh-Hunt, 1996, p. 101). A quantitative study of the research Kyle, Shymansky, and Alport (1982) reviewed revealed that "students in activity based programs achieved more, liked science

more, and improved their skills more than students in traditional textbook-based classrooms" (p. 15).

Bredderman (1983) performed a study using meta-analysis techniques to analyze approximately 60 studies of three different activity-based science programs. These included Science--A Process Approach (SAPA), Elementary Science Study (ESS), and Intermediate Science Curriculum Study (ISCS). This was an extensive study involving thousands of students. When the results were evaluated, the analysis showed that students in hands-on programs performed better than those in traditional science classrooms, not only in science process skills, but science content as well.

Conclusion

There exists a void in the literature regarding the use of Interactive Television in the science instruction of elementary age students. This study will seek to determine if learning and attitudes are affected by the use of Interactive Television with fourth-grade science students.

CHAPTER III

RESEARCH DESIGN

Subjects

The subjects of this study were twenty fourth-grade students attending one elementary school in a semi-rural community within 60 miles of a metropolitan area. The children were selected from a population of 108 fourth-grade students. Each student was identified by her or his third-grade teacher as being a member of one of three subgroups: high, average, or low achieving student. In the process of assigning students to a classroom, efforts were made to assure that a balance of the subgroups was maintained in each of the five fourth-grade classrooms. The students were then assigned to form a class of heterogeneous, mixed ability students. The parents of these students were also included in this study in order to gain another perspective on the use of I.T.V.

Instrument

The study was designed using a pretest and posttest method to measure learning that took place with the class of fourth-grade students. Along with this instrument, a questionnaire was constructed to determine attitudes of students and their parents regarding the use of Interactive Television for science instruction. Journal entries and individual interviews were also incorporated.

The questionnaire was constructed to identify attitudes of both students and their parents. The content of these surveys included questions of their perception of difficulty

of this class compared to others, their ability to achieve better grades in this setting, as well as students' attitudes toward their instructor in a distance learning classroom.

Procedure

The students participated in a four-week science study of water quality issues using Interactive Television as a major instructional tool. The students participated in hands-on and lecture experiences by interacting with a Distance Learning instructor located at another site. Students tested their individual tap water taken from their home. These included tests for pH, chlorine, iron, copper, and hardness. The students were taught by the distance learning instructor who worked in conjunction with the classroom teacher, who acted as facilitator in the Interactive Television classroom.

Students were bussed to the local high school where they connected to the coordinating site. The Distance Learning Classroom was located on the second floor. Maneuvering elementary school children through a hall full of high schoolers proved to be a challenge.

The configuration of the classroom included a remote camera which focused on the teacher, as well as a camera which focused on the students. The facilities included an overhead document camera that the instructor could use to zoom in on items at the teaching station. The teacher's workstation, located on a 4-inch platform, held a videotape recorded/player, as well as a laser disc player. It also contained a multimedia PC station with CD-ROM and Internet access. The workstation also housed the control

panel, a fax/copier/printer machine, and telephone. There were eight 25-inch television monitors which were mounted to the ceiling, four of which faced the students and four faced the instructor. There were five recessed ceiling microphones and one microphone attached to the workstation.

The camera monitoring the classroom could be controlled by the teacher to either be a wide angle or zoom in lens. The option of putting the on-site classroom on camera either as a group or an individual was available.

There were ten trapezoid-shaped tables that could accommodate three padded, adjustable, wheeled chairs. These tables and chairs allowed for maximum flexibility in arranging and managing the room configuration.

The room was capable of being connected to three other remote sites at once. The classroom was equipped with full-motion video so that any four sites could see or hear each other at any given time on this network configuration. Our class, however, was only connected to one other remote classroom.

Data Analysis

Qualitative data collection and the use of an interpretive research method seemed to be appropriate for this study. Repeatedly appearing categories and concepts helped to construct themes. For each emerging theme, sources were analyzed to confirm or deny an apparent attitude for each student or parent. The researcher attempted to categorize the degree of contentment or discontent expressed by both the students and their parents.

Multiple data sources were used, namely, student reflective journals, open-ended questionnaires, and individual interviews helped to triangulate emerging themes. Learning was documented by the implementation of a pretest and posttest. Scores were compared to determine growth.

CHAPTER IV

RESULTS AND DISCUSSION

The purpose of the study was to determine the effect of Interactive Television on the attitudes and feelings of fourth-grade students and their parents regarding elementary science education. Students were given pre- and posttests to assess learning. A questionnaire was given to both students and their parents at the end of the study.

Themes that emerged from students' journals, interviews, and questionnaires primarily portrayed a positive attitude toward the use of Interactive Television as a method of science instruction. This same attitude was reflected by the parent surveys that were returned. There were, however, common threads that were expressed regarding negative aspects of this method of teaching.

The student attitude survey was divided into three major themes (see Table 1). The first theme was in regard to the difficulty of the Interactive Television class in comparison to other science classes. The majority of the students (90%) felt the Interactive Television classes were less difficult than their regular science classes. This attitude was also documented in student journals and interviews. One student remarked, "If I had a choice between ITV or regular (science class), I would choose ITV because it's easier and I learn more." The novelty of this instruction seemed to play a major role in the students' perception in the lack of difficulty of the class. "It was so much fun when my

teacher faxed the other teacher a letter and we saw her get it out of her fax machine. It was so excited!" Perhaps the novelty of the learning setting and the concreteness of the novelty (fax transmission) played a role in the students' perception of the class being easier.

Table 1. Student Attitude Survey.

	Agree	Strongly Agree	Disagree	Strongly Disagree	Don't Know
1. ITV classes are more difficult for me than my other science classes.	1	0	8	10	1
2. I could make a better grade if I was in a regular setting.	1	1	4	12	2
3. My ITV experience has been beneficial.	3	16	0	1	0

A second theme of the students' beliefs was that their grades were better in this setting as compared to a regular classroom. Seventeen of the twenty students polled agreed with the statement that they made a better grade using ITV than they would have in a regular classroom setting.

A third theme that emerged centered around the students' perception of a positive interaction with the students and instructor at the remote site. Eighteen (90%) of the

commented in their journal, "I think all of the other kids should get to go there (ITV classroom). It is better to learn with another group, so you can know each other. I like having two teachers." When given a chance to respond as to whether or not they would like to continue this method of science instruction, all but one student agreed.

Out of the twenty Parent Attitude Surveys sent out, sixteen of them were returned. These surveys were generally positive toward their child's experiences with Interactive Television (see Table 2). Out of the questionnaires returned, all but one of the parents felt the experience had been beneficial for their child.

Table 2. Parent Attitude Survey.

	Agree	Strongly Agree	Disagree	Strongly Disagree	Don't Know
1. ITV classes are more difficult for my child than my child's other science classes.	1	0	8	10	1
2. My child could make a better grade if the class was in a regular setting.	1	1	4	12	2
3. My child's ITV experience has been beneficial.	3	16	0	1	0

A major theme emerged when parents were asked what they felt was the most positive area of using Interactive Television. They felt the fact that the students were

exposed to new technology was beneficial. One parent commented, "I am happy my child has been introduced to this new technology in our district." This type of positive attitude was expressed throughout the parent questionnaires.

Students and parents were both asked to respond to not only the positive aspects of Interactive Television, but also to negative. Out of the sixteen parents questionnaires, only five offered any negative feedback. A recurring negative theme was that the classroom was not on-site at the elementary school and students had to travel by bus to the distance learning classroom. One parent commented, "I feel this may take time away from other subjects and I worry about them being on a bus." The children's negative responses had more to do with the technical and physical aspects of the class. The audio portion of the broadcast malfunctioned on two occasions, and the first attempt to communicate failed altogether. Four of the children commented on the high pitched squeal that hurt their ears. One student also mentioned that the screen was difficulty to see when they were seated at the back of the classroom.

Both students and parents were asked to list the three best and worst things about ITV science. Eight students expressed that they enjoyed working with other children. This included working not only with partners in a lab setting, but interacting with students at the remote site. They also enjoyed doing experiments. Student's negative comments were that the electronic equipment did not work the first time and there was a noisy

high-pitched squeal. They also did not like the fact that the teacher had to do much of the talking because of the arrangement of microphones and cameras.

Parents' positive comments focused on the fact that their children were being exposed to new forms of technology. They were also pleased that their children were interacting with children from the other site by means of Interactive Television. The majority of parents wished there could be more time spent using ITV. One parent stated, "I wish you could spend more time at the Distance Learning Classroom. Forty-five minutes, one day a week just doesn't seem like enough."

Results that learning took place are found in Table 3. This was documented by a pre- and posttest.

The average of the pretest scores was 16 and the average of the posttest scores was 84. An Analysis of Variance (ANOVA) was run to determine if the gain was significant. The calculated F = 861; the critical F-value was 4.08, hence the gain was significant.

Table 3. Results of Tap Water Study Pretest and Posttest.

Student	Pretest	Posttest
1	20	80
2	15	85
3	10	75
4	25	80
5	10	90
6	5	85
7	20	90
8	10	80
9	20	90
10	5	75
11	20	80
12	10	70
13	30	90
14	15	95
15	25	90
16	20	75
17	20	85
18	10	80
19	5	95
20	25	85

The researcher was also the local site instructor in this study and, as such, comes to this discussion with a certain perspective. The Interactive Television Classroom was a positive experience for the students in all the ways they expressed, but it possessed certain challenges for the instructor. The classroom is set up to perform more as a lecture hall than a science lab. There is no water nor electrical outlets readily available for even an elementary science class. This is not from lack of planning; the room was not intended to

be used in this manner. The classroom's primary purpose was to provide college level classes to high school students, so the furniture and equipment are constructed for that age group. Control panels are located on an instructor's desk which is confining in the fact of mobility needed to manage the behavior of a fourth-grade classroom. Students had to spend much time off-task as the instructor traveled from the control panels to student's lab tables. The sound quality was poor unless it came from the instructor standing directly in front of the microphone located at the control panels. The ceiling microphones were not clear when a student was speaking from their desk, and when more than one student spoke at a time it became even more distorted.

Based on this experience, the following recommendations are set forth. The I.T.V. classroom, to be used most effectively, should be on site. If it is to be used for a hands-on science class, it is important that it be designed with electrical outlets, as well as a water supply. One teacher in the room can hardly manage the electronic equipment, the lab equipment, and student behavior. There needs to be an assistant assigned to running the camera and other technical controls. To free the instructor so they may be more actively involved with the students, a portable microphone needs to be provided. There also needs to be a person who is in charge of coordinating classrooms in various districts in order to use this medium to its fullest advantage. Finally, training of the teachers should be a priority in budget concerns. Training must be ongoing to secure the future effectiveness of the I.T.V. classroom.

The positive attitudes of the students as well as those of the parents may outweigh the challenges of the use of Interactive Television. An additional benefit is that the students are exposed to students different than themselves. The differences included cultural, social, and economic, as well as living in different environmental locations. If the instructor is aware of these areas and comes not only with Plan A, but Plans B, C, and D, it can be a rewarding experience for everyone. The use of technology in education is increasing, although Interactive Television may have certain aspects that need to be refined for the elementary classroom. It can be a powerful tool which can be used to expose our students to the classroom of their future. Interactive Television, although embedded with its own set of challenges, certainly seems to have the promise of being a rare medium, well done!

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APPENDICES

APPENDIX A

Pretest and Posttest

PRETEST

TAPWATER TOUR

1. Three quarters of the earth is covered with _____.

2. A condition of water that can decrease soap suds and clog pipes is called _____.

3. A metal dissolved in water than can cause orange stains is called _____.

4. A metal in water than can caused blue-green stains is called _____.

5. A substance added to drinking water, swimming pools, and laundry to make water safe. _____

6. A source of water; some are shallow and some are deep. _____

7. Crusty stuff on the inside of some pipes. _____

8. Water with a pH of 14.8 is _____.

9. Water with a pH of 1.8 is _____.

10. A basic type of rock that can change the pH of water is called _____.

11. Iron metal will _____ with oxygen to form rust.

12. Measured on the scale of 0-14, 7.0 is neutral If it is too low, it can corrode pipes. _____

13. The opposite of soft water is _____ _____.

14. The paper where we record our test results is called _____.

15. _____ and magnesium are minerals that make our water hard.

16. When a pH is neither acidic or basic, it is called _____.

17. The word ecology means _____.

18. What is Interactive Television?

19. Give two reasons why the study of water quality is important.

    (a)

    (b)

20. On the back of this paper tell one thing you would like to learn about water quality.

POSTTEST

TAPWATER TOUR

1. Three quarters of the earth is covered with _____.

2. A condition of water that can decrease soap suds and clog pipes is called _____.

3. A metal dissolved in water than can cause orange stains is called _____.

4. A metal in water than can caused blue-green stains is called _____.

5. A substance added to drinking water, swimming pools, and laundry to make water safe. _____

6. A source of water; some are shallow and some are deep. _____

7. Crusty stuff on the inside of some pipes. _____

8. Water with a pH of 14.8 is _____.

9. Water with a pH of 1.8 is _____.

10. A basic type of rock that can change the pH of water is called _____.

11. Iron metal will _____ with oxygen to form rust.

12. Measured on the scale of 0-14, 7.0 is neutral If it is too low, it can corrode pipes. _____

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14. The paper where we record our test results is called _____.

15. _____ and magnesium are minerals that make our water hard.

16. When a pH is neither acidic or basic, it is called _____.

17. The word ecology means _____.

18. What is Interactive Television?

19. Give two reasons why the study of water quality is important.

(a)

(b)

20. On the back of this paper tell one thing you would like to learn about water quality.

APPENDIX B

Parent and Student Surveys

PARENT ATTITUDE SURVEY

	Don't Know	Strongly Agree			Strongly Disagree
	0	1	2	3	4	5

1. I.T.V. classes are more difficult for my child than my child's other science classes.

2. My child could make a better grade if the class was in a regular setting.

3. My child's I.T.V. experience has been beneficial

4. What are the three best things about I.T.V. science?
   1.
   2.
   3.

5. What are the three worst things about I.T.V. science?
   1.
   2.
   3.

STUDENT ATTITUDE SURVEY

	Don't Know	Strongly Agree			Strongly Disagree
	0	1	2	3	4	5

1. I.T.V. classes are more difficult for me than my other science classes.

2. I could make a better grade if the if the class was in a regular setting.

3. My I.T.V. teacher is as friendly to me as my regular teachers.

4. It is easy for me to ask my I.T.V. teacher questions.

5. My I.T.V. teacher known my name.

6. What are the three best things about I.T.V. science?
   1.
   2.
   3.

7. What are the three worst things about I.T.V. science?
   1.
   2.
   3.

APPENDIX C

Unit Plan--"Tapwater Study"

UNIT PLAN--"TAPWATER STUDY"

Lesson 1

I. Introduction

A. Discuss water facts.
B. Pass out Water Facts handout and Research Contract.
C. Remind students to bring in a tap water sample in an appropriate container.
D. Distribute and take Pretest.

Lesson 2

I. What is pH?

A. Materials

1. pH Wide Range TesTabs®* (1 for each student; 3 per group)
2. Sample bags
3. Sample #1: Baking soda (prepare with students)
4. Sample #2: Vinegar (prepare with students)
5. Sample #3: Aspirin (prepare with students)
6. Tap water (student sample)
7. Straws (1 for each student)
8. Distilled water (4 quarts)
9. Quart containers (3)
10. Data Sheets (1 for each student)

B. Handout: pH Data Sheet

C. Activity 1: Carbon dioxide in water

1. Use pH table to test student's water; compare the color of the reaction to the color chart. Record pH on data sheet.
2. Open bag and blow into sample with a straw. Carbon dioxide decreases pH of water; increases acidity.

D. pH Activity 2

1. Prepare samples #1, #2, and #3.
2. Pour into clean bags and test pH of each sample. Record results.
3. Record results of each student's tap water pH results on the chart.
4. Compare results with the other classroom at the Distance Learning site.

E. Discuss why different homes have different things in their water.

1. City water vs. well water

F. Distribute water pipe diagram.

G. Play Matching Game.

Lesson 3

I. Chlorine

A. Materials

1. Several drops of liquid chlorine bleach
2. Cup and teaspoon
3. One eye dropper
4. Three quarts distilled water
5. Two quart containers
6. Chlorine DPD #4R TesTabs® (1 for each student, 2 per group)
7. Sample bags (1 for each student)
8. Data Sheet (1 for each student)
9. Chlorine Sample #1 (5 ml of chlorine bleach to 15 ml of water)
10. Chlorine Sample #2 (10 drops of Sample 1 added to 1 liter of water)
11. Students' tap water sample
12. Color Chart

B. Discuss chlorine and its uses.

C. Prepare Sample #1 and Sample #2.

D. Test chlorine in Sample #1 and Sample #2 using TesTabs® and record on Data Sheet.

E. Test students' tap water.

F. Play Scramble Game.

Lesson 4.

I. Checking for Iron

A. Materials

1. Two quarts containers
2. Iron supplement tablet (1)
3. cup
4. Three quarts distilled water
5. 1/2 cup measuring cup
6. Sample bags
7. Iron LR Tablets® (1 for each student, 2 per group)
8. Iron Sample #1 (one iron tabled added to 1 liter distilled water)
9. Iron Sample #2 (1/2 cup of Sample #1 added to 1 liter distilled water)
10. Students' tap water sample
11. Data Sheet (1 per student)
12. Color Chart

B. Prepare Sample #1 and Sample #2.

C. Test iron in Sample #1 and Sample #2 using TesTabs® and record results on Data Sheet.

D. Test students' tap water.

E. Record and compare results.

Lesson 5

I. Checking for Copper

A. Materials

1. Copper HR Tablets® (1 for each student)
2. Sample bags (1 for each student)
3. Tap water (1 for each student)
4. Data Sheet (1 for each student)
5. Color Chart

B. Test students' tap water for copper.

C. Record and compare results.

D. Play Word Search game.

Lesson 6

I. Checking for Hardness

A. Materials

1. Water sample bag (1 for each student)
2. Hardness T Tablet® (1 for each student)
3. Tap water sample (1 for each student)
4. Data Sheet (1 for each student)
5. Liquid hand soap (1 bottle; Ivory works well)
6. Piece of cardboard, 1/4" x 3" (1 per group)
7. Paper cup, small (1 per group)
8. Color Chart

B. Discuss definition of hardness.

C. Distribute Data Sheet.

D. Test students' tap water for hardness.

E. Record results.

F. Conduct Bubble Test.

1. Fill one bag with hard water, one with distilled water.
2. Using the cardboard strip add drops of soap to each bag until bubbles appear.
3. Record the number of soap drops it took to make bubbles for each bag.

G. Play Bubblegram Game.

H. Compare results.

I. Distribute and take Posttest.

*TesTabs are a registered trademark of LaMotte Company, P. O. Box 329, Chestertown, Maryland, 21620.

RESEARCH CONTRACT

The members of _____ class are about to begin an exciting research project on drinking water. They will be testing drinking water from your home using new safe tablet methods. Upon completion of this research, they will bring home a report on the quality of your water.

Please remind them to collect a water sample for (date:) _____ in the following manner.

1. Rinse out a pint size container or jar several times. (A small plastic jug or mayaonnaise jar will suffice--no rusty lids, please!)

2. Let the water run for several minutes.

3. Fill the jar and cap tightly. Write your name on the container.

Questions:

Do you have a water treatment system in your home? _____

Do you have city water or well water: _____

DATA SHEET

pH Test

Scientist's Name _____ Date: _____

Research Team _____

Your Water Sample

Color _____

pH _____

Sample #1

What was added? _____

Color _____

pH _____

Sample #2

What was added? _____

Color _____

pH _____

Sample #3

What was added? _____

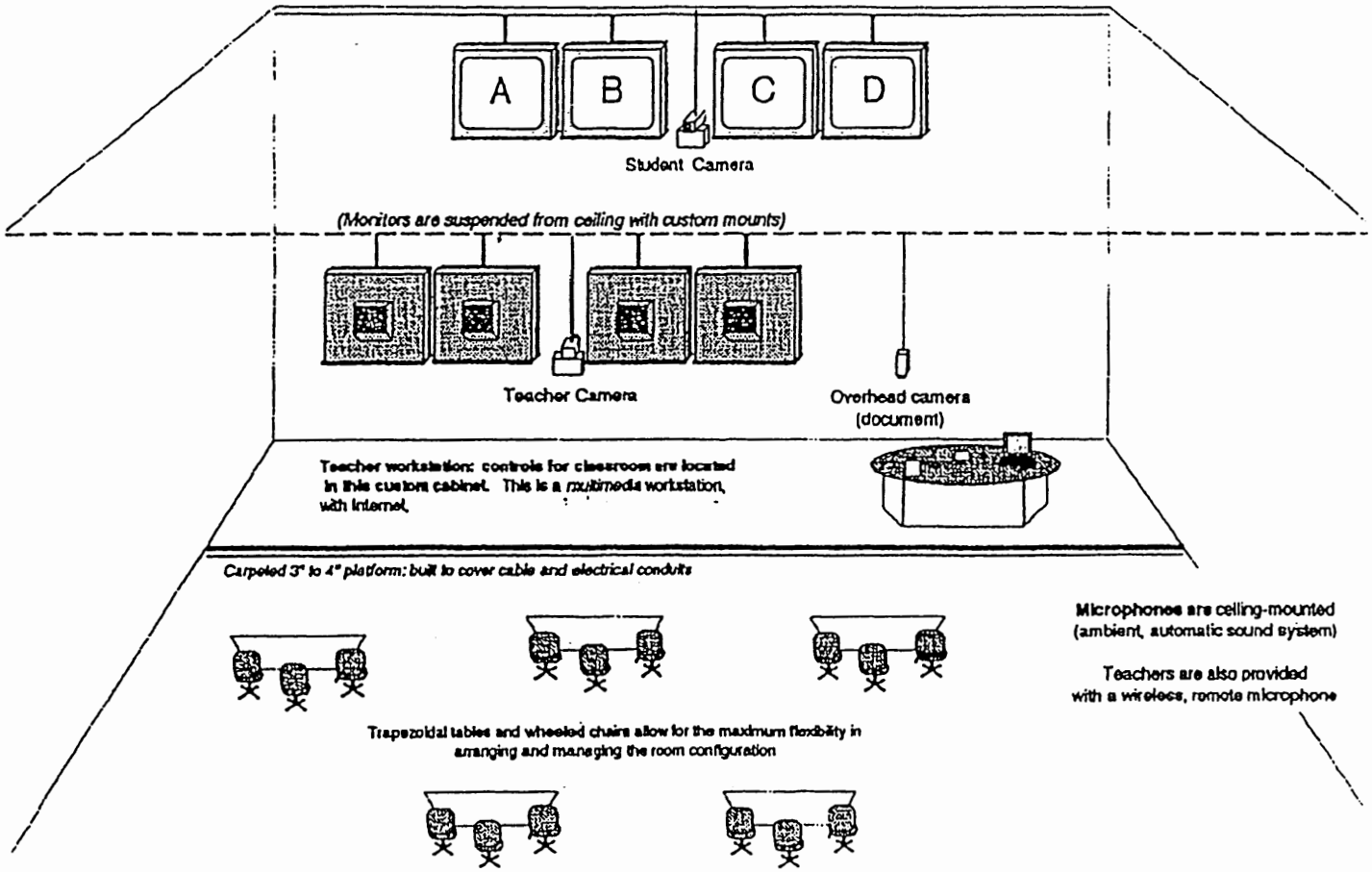
Color _____

pH _____

MATCHING GAME

Match one item from Column A with one item from Column B. Draw a line to connect the matched items.

COLUMN A	COLUMN B
Its pH is about 2.3	very acidic
A pH value of 7 is _____	basic
Acidic water is _____	corrosive
Bleach is _____	distilled water
The gas that we exhale	Cola drink
Pure water	limestone
A rock that changes the pH of water	neutral
Battery acid is _____	carbon dioxide



* This drawing depicts a custom classroom equipped with full-motion video (dedicated analog or digital broadband) in a *multi-point, continuous presence format*. Any four remote sites can see and hear each other at any given time on this network configuration.

DATA SHEET

Chlorine

Scientist's Name _____ Date: _____

Research Team _____

Sample #1	Sample #2
How many drops of chlorine bleach were in the water sample? _____	How many drops of chlorine bleach were in the water sample? _____
Was the sample pink? _____	Was the sample pink? _____
How much chlorine was in the water sample? _____	How much chlorine was in the water sample? _____

Your Tap Water

Was it pink?

_____

Does it contain chlorine?

_____

How much chlorine was in your tap water?

_____

DATA SHEET

Iron

Scientist's Name _____ Date: _____

Research Team _____

Sample #1

Was the reacted sample purple?

_____

How much iron was in the sample?

_____

Sample #2

Was the reacted sample purple?

_____

How much iron was in the sample?

_____

Your Tap Water

Guess! Do you think you have iron?

_____

Do you have iron stains in your bathtub?

_____

Did your tap water sample turn purple?

_____

How much iron do you have in your tap water?

_____

SCRAMBLE GAME

Unscramble the letters to make words that appeared in the chlorine unit.

N H R L I E C O _ _ _ _ _ _ _ _ _

R S E G M _ _ _ _ _

T C N F S I I D E _ _ _ _ _ _ _ _ _

N I P K _ _ _ _

I A E T A C B R _ _ _ _ _ _ _ _

Y T C I T W A R E _ _ _ _ _ _ _ _ _

DATA SHEET

Hardness

Scientist's Name _____ Date: _____

Research Team _____

Your Tap Water

Do you think you have hard water?

_____

What color was the reacted sample?

_____

Is it hard or soft?

_____

Do you leave a bathtub ring?

_____

Bubble Test

Who's hard water sample did you use?

_____

How many drops of soap did the distilled water take to make bubbles?

_____

How many drops of soap did the hard water take to make bubbles?

_____