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UNIVERSITY OF NORTHERN COLORADO

Greeley, Colorado

The Graduate School

AN INVESTIGATION OF THE USE OF THE WYOMING VERB NETWORK TO TEACH ELEMENTARY SCIENCE

A Dissertation Submitted in Partial Fulfillment
of the Requirement for the Degree
of Doctor of Education

Catherine Herndon Wiegand

College of Education

Summer, 1971

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THIS DISSERTATION WAS SPONSORED

BY

Dale Nebel

Major Adviser

RESEARCH AND EXAMINING COMMITTEE

Dale Nebel

Betty L. Lowrey

Frank D. Cordell

James E. McClung

DEAN OF THE GRADUATE SCHOOL

A. T. Reynolds

Examination Date on Dissertation

22 July 1971

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ABSTRACT

Wiegand, Catherine Herndon. "An Investigation of the Use of the Wyoming VERB Network to Teach Elementary Science." Unpublished Doctor of Education dissertation, University of Northern Colorado, 1971.

The Problem

The investigation was concerned with three questions:

1. Does a series of elementary science programs taught over the Wyoming VERB Network contribute any science content learning to the experimental group?
2. Does the grade level of the students affect the science content learning which might be attributed to VERB instruction?
3. Does community size affect the science content learning which might be attributed to VERB instruction?

Procedure

Classes from five different communities participated in the study. Fifth, sixth, and seventh grade classes were tested for science achievement in February, 1970. This sample had not been exposed to VERB science

instruction and served as a control group.

A series of fifteen elementary science programs was presented over the Wyoming VERB Network to fourth, fifth, and sixth grade students in the spring of 1970. This was the experimental group. This group was tested for science content achievement in February of 1971 when the students reached the fifth, sixth, and seventh grades.

The means of the test scores of the control group tested in 1970 were compared to the means of the experimental group tested in 1971. Comparisons were made between the 1970 and 1971 samples for total group, communities over 5,000, communities under 1,000, fifth grade students, sixth grade students, and seventh grade students.

The *t* test was used to test the significance of difference between means. The .05 level of confidence was selected as the basis for rejecting the null hypothesis.

Results

The means of the experimental group were found to be significantly greater than the means of the control group for the total sample, for students from communities of over 5,000 population and for seventh grade students.

No significant difference was found between the means of the fifth grades or sixth grades.

The mean of the experimental group was significantly less than the mean of the control group in the scores of students from communities of less than 1,000 population.

Conclusions

1. The VERB Elementary Science Program improved the science achievement test scores for the total experimental group.

2. The VERB Elementary Science Program improved the science achievement test scores for students who received VERB science instruction in the sixth grade. It did not improve the science achievement test scores significantly for students who received VERB science instruction in the fourth and fifth grades.

3. The VERB Elementary Science Program improved the science achievement test scores for students from communities of over 5,000 population. The students from communities of less than 1,000 population had significantly lower science achievement scores.

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CHAPTER I

INTRODUCTION

> There is much in the traditional educational practice that must be preserved. An example is the ideal of personal rather than mechanical relationships between teacher and student. But the conditions and responsibilities of education now demand a large investment in innovation that will be adventurous enough to discover and exploit every possible instructional value that is latent in the technical instruments which are now available or will become available in the future. More than anything else, what is needed is a disposition on the part of educators to try the new that is promising as well as preserve the old that is proved.[1]

One of the newest of the technological tools that educators are trying is known as the VERB. The VERB (Victor Electrowriter Remote Blackboard) is a remote teaching system which uses a projection screen for a "blackboard" and the telephone for voice transmission. A teacher in one location using an Electrowriter Transmitter and a microphone can transmit writing and voice over telephone lines to any location possessing the Electrowriter Receiver and a Telelecture amplifier. The classrooms to which a Telelecture or Verbcast is presented have microphones which the

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[1]Sterling M. McMurrin, "Teachers and Technology," Bell Telephone Magazine (September/October, 1970), p. 22.

students use to respond to the VERB instructor.[1]

Wyoming, with a population density of three persons per square mile,[2] has found many uses for the VERB system. The University of Wyoming has used the system for extension classes for credit, for police instruction, for special lectures to nurses, for agricultural conferences, and for meetings with teachers and administrators around the state. Some school districts have used the system to provide mathematics and foreign language instruction to other schools in the district. Since the telephone lines linking the VERB system are open twenty-four hours a day, it has been possible for teachers and administrators to use the lines on the network for casual daily contact in school systems scattered over thousands of square miles.[3]

The VERB Network in Wyoming consists of two networks which can be joined whenever necessary. The first VERB Network was installed in 1967 and was called the Carbon County Network. This network links seven communities scattered over 7,965 square miles in Carbon County. It was

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[1]"News Notes," Audiovisual Instruction (September, 1967), p. 750.

[2]Marjorie H. Seymour, "Audiovisuals Enrich Isolated Schools," The Instructor (August/September, 1968), p. 154.

[3]Ibid.

funded by a grant from the U. S. Office of Education under Title III, Elementary and Secondary Education Act.[1] The second network, designated as the NSF Network, was installed in 1968. This network linked six communities in Wyoming and one city in Colorado. The NSF Network was funded by the National Science Foundation. Both networks were linked to the University of Wyoming in Laramie. Federal funds for the Carbon County Network expired in the spring of 1970.[2]

Most of the original use of the VERB in Wyoming was either at the adult level or secondary level. As the end of federal funding approached, Carbon County expanded the use of VERB at the elementary level to ensure local support of the network. Elementary VERB programs were something new under the sun. Many universities used VERB at the graduate level. A few used VERB at the undergraduate level. In even fewer situations across the country, VERB was used at the high school level. If VERB

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[1]Carbon County Instructional Center, "VERB - An Innovation for Remote Areas," Bulletin distributed by Carbon County Instructional Center, Sinclair, Wyoming (January 31, 1967).

[2]Jeanne Lambert, "An Evaluation of the Telelecture-Telewriter Project at the University of Wyoming" (unpublished Master's thesis, University of Wyoming, January, 1971), pp. 47-48.

was used anywhere at the elementary level, this writer could locate no program characterized by the regularity or magnitude with which it was used in Wyoming.

This study was conducted to evaluate one phase of the Elementary VERB program as it is used in Wyoming. In Wyoming educators have tried the new that is promising. Now the new must be evaluated to see if it has fulfilled its promise.

Statement of the Problem

The problem of this study was to determine the effects of a VERB Elementary Science Program upon the achievement in science content and the relationship of achievement to grade level and to community size.

The focus of this study was on discovering answers to the following questions:

1. Does a VERB Elementary Science Program contribute any science content learning beyond the science content acquired through whatever science program exists in the schools?
2. Does the grade level of any portion of the population affect the degree of science content learning which might be attributed to VERB instruction?
3. Does community size affect the degree of

science content learning which might be attributed to VERB instruction?

Definition of Terms

Terms peculiar to the study:

Electrowriter Transmitter. The Electrowriter Transmitter is the electronic device that the VERB teacher uses to write, draw, or diagram those items the teacher wishes to be transmitted to the remote classrooms.

VERB Microphone. The VERB Microphone is used by the VERB instructor for voice transmission over telephone lines.

Electrowriter Receiver. The Electrowriter Receiver is the electronic device used in the classroom to receive written or diagrammatic work transmitted by the VERB instructor. The instrument receives the electronic impulses over telephone lines. A pen on the Electrowriter Receiver duplicates the motion of the pen made on the Electrowriter Transmitter. The pen on the Electrowriter Receiver enscribes the writing, drawings, or diagrams on transparent acetate fed from a continuous roll. The image from the acetate is projected onto a projection screen.

TeleLecture. TeleLecture is the name given the special amplifying equipment used in the receiving classroom. TeleLecture equipment is also available at the

transmitting location.

Student Microphone. Students at the various receiving classrooms have access to desk microphones scattered throughout the classroom. The student microphone is not an open microphone. It can be used only when a button on the top of the microphone is depressed. The microphones have an amplifying device in them which brings the sound up to the level needed for transmission. When the microphone is open it is capable of lifting the sound of a pencil writing on paper to the level of transmission. Because of this sensitibity it is necessary that the microphones remain closed except when they are needed by the students.

Network. This term indicates connected telephone circuits on the VERB system. A communication from any part of the network can be received in all other parts of the network. Not only can the students respond to the instructor, but they can participate in discussions with other students in any part of the network.

VERB-cast. The time period during which transmission and reception of a particular lesson (see example in Appendix) occurs is referred to as a VERB-cast.

Acetate. The acetate is the portion of the Electrowriter Receiver on which the graphics are recorded.

The acetate serves as a permanent record of the graphics transmission and may be reshown for student review. It can also be reproduced on photocopy machines.

VERB Tape. A VERB tape can be made of the VERB-cast which will reproduce both the voice and the sequential development of the graphics. These tapes can be stored and reused at any time. A VERB tape is not as effective as a live VERB-cast since the student will not be able to question or to respond to the VERB instructor.

Limitations of the Study

This study was limited:

1. To the fourth, fifth, and sixth grade students participating in the VERB Elementary Science Program in the Wyoming communities of Hanna, Medicine Bow, Worland, Sheridan, and Shoshoni;
2. To a period of one year;
3. To a comparison of a group of students that had been exposed to VERB Elementary Science instruction and a group that had not been exposed to VERB Elementary Science instruction;
4. To an examination of relationships between community size and content learning of the

experimental group;

5. To the use of the Every Pupil Achievement Test, Elementary Science, Grades V-VIII to evaluate any difference in achievement between the experimental group and the control group;
6. To the use of only one VERB instructor for the transmission of the Elementary Science VERB-casts; and,
7. To the statistical treatment of the significance of difference between means in comparing achievement of any two groups.

Summary

The data gathered in this study will be used to examine the advisability of using VERB at elementary levels. It is hoped that the data may also reveal relationships between grade level and VERB instruction and between community size and VERB instruction.

Wyoming strives to serve her wildly scattered children. Perhaps this new tool may be a partial answer to reaching into schools in remote areas. This study seeks a better understanding of the VERB Network as it may be used to educate elementary children in Wyoming.

CHAPTER II

REVIEW OF RELATED LITERATURE

> VERB is an acronym for Victor Electrowriter Remote Blackboard.
>
> VERB enables the teacher by simply writing on an electronic pad known as an Electrowriter Transmitter or an Electrowriter Transceiver to give notes or illustrations to a class in his presence or one remotely situated or both. The class will see the ordinary ink writing enlarged in front of the room on a screen.
>
> Transmission of writing is via telephone lines, although radio can be used (microwave, VHF or UHF).[1]

The electrowriter was developed in the laboratories of Bell Telephone. In 1962 the electrowriter received a trial in several of the nation's hotels where it was used to transmit messages from the main desk to receivers located in the linen closets.[2] The electrowriter provided permanent, written messages at both the sending and receiving points. The messages were recorded

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[1]Mountain Bell, "Teacher's Portfolio, VERB," Bulletin distributed by Mountain Bell, Cheyenne, Wyoming.

[2]Jeanne Lambert, "An Evaluation of the Telelecture-Telewriter Project at the University of Wyoming" (unpublished Master's thesis, University of Wyoming, 1970), p. 26.

simultaneously at both points even if the receiving unit was unattended.[1]

Bell Telephone sold its rights in the electrowriter to Victor Comptometer Corporation, Chicago, Illinois, shortly after the preliminary research on the invention was completed. Victor named the machine Victor Electrowriter Remote Blackboard or VERB. The term VERB technically refers only to the electrowriter, but it is frequently used to refer to the electrowriter and telelecture as they are used together. A VERB Program or a VERB-cast is understood to refer to the use of the electrowriter and the audio facility.[2]

Victor and Bell Telephone working together, offered VERB as an educational tool to universities around the nation. Some advantages of the system were suggested in the advertising.

> Distributes a teacher's talents any distance over telephone lines.
> Makes maximum use of qualified teachers.
> Provides courses otherwise unobtainable due to cost of travel and travel time.
> Alleviates the teacher shortage.
> Eliminates curriculum gaps.
> Upgrades educational standards.

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[1]Victor Comptometer Corporation (Advertising Bulletin 674-181), Chicago, Illinois.

[2]Lambert, "Evaluation of Telelecture-Telewriter," p. 26.

Furnishes master lecture notes for re-use or reproduction.[1]

A number of universities and colleges recognized the potential of the VERB Network for teaching extension courses and serving the needs of continuing education to the state. While most of these university and college programs have not undergone any formal studies, their continuation at least supports the efficacy of the VERB as an educational tool.

Virginia Polytechnic Institute and State University, Blacksburg, Virginia, has offered courses over the VERB system since 1968. Most of the courses have been graduate level, but a few courses have been offered at the senior undergraduate level.[2]

Oregon State University in Corvallis has used the VERB system since 1968. The University has offered engineering courses to Bonneville Power in Portland, to Tektronics Corporation in Beaverton, and the Division of Continuing Education in Portland. Professor Jolor Stone, Assistant to the Dean of Engineering at Corvallis, has

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[1]Victor Comptometer Corporation (Advertising Bulletin 6740168).

[2]Carl L. Epley, Director of Research Support Services, College of Engineering, Virginia Polytechnic Institute and State University, Blacksburg, Virginia (Letter dated December 23, 1970).

stated, "It is my conviction that the Tele-lecture/VERB combination offers the most economical, flexible, and effective way of teaching classes remote from campus."[1]

Wisconsin State University at Stephens Point has used the VERB system for in-service training programs. A project undertaken in 1968 was entitled "The Individualization of the In-Service Program for Professional Staff." This program included the districts of Wausau, Rothschild-Schofield, Antigo, and Mosinee, in Central Wisconsin.[2]

Courses in electrical engineering, mathematics, business administration, and the humanities have been offered by the University of New Mexico at Albuquerque. These courses were conducted via VERB to Hollman Air Force Base, Alamogordo. Prior to that time (the VERB was installed in 1967), these classes had required absence from campus for professors, as well as travel costs. Installation of the VERB has allowed professors to remain on campus while remote students receive full residence credit.[3]

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[1]Office of the Director, Victor Educational Services, "VERB: University Extension Courses" (Victor Comptometer Corporation: Chicago, Illinois).

[2]Ibid.

[3]Ibid.

Graduate level courses in metallurgical engineering have been offered to the NASA Space Center at Redstone Arsenal via the VERB system from Alabama Polytechnic Institute in Auburn. Two way telewriter graphics have been used in these courses. The professor has used graphics to accompany the lectures and the students have written equations back to the professor.[1]

Three colleges in the metropolitan area of Portland, Oregon, have used the VERB system to alleviate problems caused by the instructional costs of small classes. George Fox, Cascade, and Warner Pacific Colleges have offered calculus, geography, and business to students at all three colleges simultaneously over the VERB. To maintain student-professor contact, the classes have originated at the different colleges on a rotating basis.[2]

The University of Illinois has used VERB for extension courses received by centers in Beloit, Rockford, Rock Island, DeKalb, Chicago, Joliet, and Decatur. A refresher course has been offered professional engineers in preparation for state licensing examinations that are necessary for qualification for government contracts. A

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[1] Ibid.

[2] Ibid.

three hour credit course in Experimental Stress Analysis is offered doctorate or masters' degree students.[1]

Michigan State University has used VERB to offer extension courses in electrical engineering at the graduate level. The University has offered these courses live on campus at the same times that the lectures were received at the Lear Siegler Corporation in Grand Rapids. Michigan State University has reported that the "grade ranges between live and remote groups show only a few points difference."[2,3]

The University of Tennessee's VERB Network was installed in 1966 because it was decided that "The fastest way for a professor to travel is by telephone."[4]

With the VERB, professors who were not happy about endless commuting, could serve the students and yet remain on campus. Graduate centers at Kingsport and Chattanooga received courses in mathematics, industrial engineering and home economics. Classes were limited to twenty students, but even with this limitation, the cost

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[1] Ibid.

[2] Ibid.

[3] "Lear Engineers Use Tele-Lecture Link," Communications News (September, 1967), p. 4.

[4] "Teaching Tools," College Management (April, 1968), pp. 54-55.

of remote teaching proved to be less than the cost of travel. The greatest saving, however, was in teacher time.[1]

At the University of Illinois the VERB Network used for extension is called the Univex Net. In 1968 a study was made to compare the Univex Net with on-campus teaching. The study examined four aspects of the programs.

1. Final grades earned by Univex Net students were compared to the grades of on-campus students.
2. Course Evaluation Questionnaire responses of Univex students were compared to those of on-campus students.
3. Written comments of off-campus and on-campus were compared.
4. Written comments from instructors using Univex were examined.

The grades of the Univex students were not significantly different from the on-campus students. The course evaluations were as good from remote students as they were from on-campus students. The comments of Univex students were generally favorable, though many

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[1] Ibid.

students said they would have preferred to have the teacher physically present. Instructors commented on the need for more careful preparation, the lack of eye-to-eye contact, and the small writing area.[1]

The University of Wisconsin Educational Telephone Network (ETN) carried out a study to determine the effectiveness of telephone instruction in adult education. The graduate course was divided into an experimental telephone/electrowriter group and an on-campus, face-to-face group. Evaluation led to some tentative conclusions.

1. Ways of handling telephone course content and format need to be identified and implemented.
2. Participant and program lectures need preparation for the mechanical aspect of such experiences.
3. Certain types of individuals function better with articulated media than others do.
4. Visual aids in telephone instruction enhance presentations and ease remoteness.
5. Certain skills can be learned which enable persons to increase their effectiveness under telephone instruction.
6. Telephone instruction is useful for persons scattered over wide geographical areas and

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[1]Harold W. Wecke, "Univex Net Instruction Equal to Conventional Ways, Study Shows," Statewide Campus (Urbana, Illinois: University of Illinois, January, 1970), p. 3.

its use should be further refined, expanded, and evaluated.[1]

The University of Missouri at St. Louis initiated a research program to determine the feasibility of using Tele-lecture and Remote Blackboard equipment to facilitate off-campus instruction. Three groups of students were involved in the study. One group received traditional lectures on the St. Louis campus. A second group received a live lecture on the St. Louis campus, which was simultaneously transmitted to the third group located at Mineral Area College in Flat River, Missouri.

Pretests given to all three groups showed no significant differences in the test scores of the groups. The same teacher presented the lectures to all three groups. At the conclusion of the lecture series, post tests were administered. There were no significant differences in the post test scores of the groups.

The University of Missouri hopes to use the VERB system to extend formal credit courses and to facilitate the transmission of other educational services to the people of the state.[2]

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[1]Bernadine H. Peterson, "Adult Education by Means of Telephone," (February, 1970), ERIC ED036 758.

[2]Office of the Director, Victor Educational Services, "VERB: University Extension Courses."

In 1969 Stephen Douglass undertook a survey of university extension pilot projects using the VERB system. As a result of his survey he concluded that the use of VERB could save time and money, but that its effectiveness was heavily dependent on user attitudes, teacher preparation, and the adequacy of service and facilities.[1]

At West Virginia University a study was made of the applicability of teaching university extension courses by Tele-lecture and electrowriter. Extension courses in mining engineering and modern math were given to classes in Beckley, 265 miles distant from the University in Morgantown. These experimental classes were taught by telelecture and telewriter. Comparable on-campus classes served as the control group.

Comparative analysis of the achievement of the experimental and control groups showed that the achievement of the experimental extension group was equal to or greater than the achievement of the on-campus control group. Analysis of a student questionnaire supported the thesis that tele-lecture teaching was more successful when continuous lecturing was limited to twenty to

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[1]Stephen A. Douglass, "Telewriter: A Survey of Attitudes, Information and Implications," (September, 1969) ERIC ED 038 606.

twenty-five minutes, printed material was provided, supplementary audio-visual techniques were used, two or three personal visits were made to classes, and the classes were based on problem solving techniques.[1]

At Eastern Michigan University the electronic blackboard was used to teach physics to ninety students in four separate high schools during the 1968-1969 school year. Student teachers were used to supervise the VERB classes in high schools and to direct laboratory and recitation. The lecture period encompassed fifty-five minutes at the beginning of the year, but was shortened to thirty minutes by the end of two months as evidence accumulated that the attention span of students to the electronic blackboard was subject to natural limitations.[2]

Students were given pretests at the beginning of the experimental period and post tests at the end of the period. The increment of gain clearly indiciated that learning had occurred in the area to which the

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[1]David A. Puzzuoli, "A Study of Teaching University Extension Classes by Telelecture," (August, 1970), ERIC ED042 961.

[2]Charles B. Breedlove and Walter L. Gessert, "Use of an Electronic Blackboard in a Physics Teaching Project," School Science & Mathematics (February, 1970), pp. 154-155.

instruction was directed. It was assumed that the learning was a result of the remote instruction.[1]

Block Island, off the easternmost point of Long Island, has a school population of thirty-five students, grades one through twelve. Providing a "new math" teacher for the single Block Island school has been impossible. But Block Island students have a "new math" teacher by wire. Naragansett High School, on the mainland, transports their "new math" teacher across the water to Block Island via the VERB system.[2]

The Victor Electrowriter Remote Blackboard (VERB) first came to the University of Wyoming in January of 1967. Its arrival was the result of a U. S. Office of Education, Title III Grant to the Carbon County Schools in Wyoming. Carbon County had six high schools and twenty-three elementary schools scattered over an area of 7,965 square miles. It was hoped that the network that connected the county's schools and the University of Wyoming would improve instruction at all levels and would

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[1] Ibid., pp. 56-65.

[2] George Callahan, "Communication Aids in Education," McGraw-Hill Yearbook of Science and Technology (New York: McGraw-Hill Book Company, Inc., 1970), p. 59.

bring outstanding resource people to the remote areas of Carbon County.[1]

In the spring of 1967 the Denver Post hailed Wyoming's VERB Network as "The Blackboard That's a Window to the World."[2] It sounded as though technology threatened to overcome isolation and ignorance in the backwoods.

While the people engaged in the operation of VERB were proud of the glowing reports about VERB, it seems relevant to report that there were times when technology threatened to overcome not only ignorance and isolation, but everyone involved.

The transmitter from the University was located in a small back room in the Aven Nelson Building. The room was a welter of wires, plugs, headsets, speakers, and telephones. A number had to be dialed for the voice connection and for the electrowriter connection. Operators frequently disconnected the electrowriter line in the middle of a program because they could hear no "voice" on the line. Mysterious music turned up on the voice

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[1]Carbon County Instructional Center, "VERB, An Innovation for Remote Areas" (Sinclair, Wyoming, January 31, 1967).

[2]Jack Guinn, "The Blackboard That's a Window to the World," Sunday Empire of the Denver Post (Denver, Colorado, April 23, 1967).

line. Busy signals and static interrupted on a random basis.[1]

At the other end of the line in the classrooms other phenomena occurred. Strange spirits seized the pen on the telewriters and caused the writing to be palsied. Bubbles developed in the acetate. Microphones and speakers fed piercing whistles into the line. Pens clogged. Background noise blanked out the microphones. A student writing on the same table that supported an open microphone unknowingly produced a noise on the line that resembled the sound of a freight train in a tunnel.[2]

Classroom teachers in Carbon County became frustrated at the perversity of machines that seemed to deliberately plug themselves in wrong. University teachers balked at the lack of visual response from their invisible students. Professors ignored the telewriter as they lectured and left students in the country staring at blank, bright screens. Everyone involved in the project began to feel like pioneers lost in a

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[1]Paul Kipper, interview held in Extension Office, University of Wyoming, Laramie, Wyoming, May 20, 1971.

[2]Ibid.

trackless wilderness of educational and technological impossibilities.[1]

Eventually, it was the pioneering spirit of the classroom teachers and the perseverance of Mountain Bell and Victor technologists that overcame the gremlins that plagued the system and made VERB into the convenient tool it is today. Microphones were developed that operated only when a switch on the microphone was depressed. This kept most of the background noise out of the system. Straight lines used only for VERB eliminated much of the trouble originally stemming from connections. Classroom teachers provided feedback to VERB teachers to develop techniques that were effective for the media. Students learned to respond in a variety of ways that made them more "visible" to the VERB teacher.[2]

By 1970 the tele-lecture courses in the Carbon County Network covered a total of 220 hours a week. The student courses included science, algebra, French, Spanish, and art. Teacher training courses were offered in physics, chemistry, and education. A seminar on the

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[1] Ibid.

[2] Ibid.

use of computers was open to teachers and administrators. Adult courses in horticulture, nursing, and geology were offered.[1]

In June, 1970, the President's Advisory Council on Supplementary Centers and Services cited Carbon County's "blackboard-by-wire" as one of the eight most notable educational projects in the United States.[2]

The National Science Foundation Network became a major network in Wyoming in the fall of 1968. The major objectives of this system dealt primarily with graduate work and continuing education for adults in Wyoming. The network, once in existence, provided many opportunities for enrichment courses for elementary and secondary students during the regular school day since the National Science Foundation Network, like the Carbon County Network, was available twenty-four hours a day.[3]

The National Science Foundation was interested only in the science programs presented as a part of the

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[1]George E. Callahan, "Communication Aids in Education," p. 60.

[2]Ibid.

[3]Lambert, "Evaluation," p. 47.

federally funded grant. The Network had no coordinator and records of uses made of this network are sketchy. The federal grant expired in the spring of 1970 and the future of this portion of the Wyoming VERB network is uncertain.[1]

Summary

The VERB system has been used by some colleges and universities in the United States since 1965. Its uses have been primarily for graduate work and continuing education for adults. In isolated instances it has been used for public school enrichment. Very few studies have dealt with the efficiency of the VERB as a teaching tool. None of the studies have dealt with its effectiveness at the elementary level.

Wyoming's situation of widely scattered schools, sparse population, and uncooperative climate is not unique. Wyoming's attempt to overcome the disadvantages of this situation through the use of a VERB Network is unique. Hundreds of Wyoming's elementary children are exposed to this media during the school year. Perhaps the media is not suitable for this age

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[1] Ibid., p. 48.

group. Perhaps it becomes more suitable for children as they grow older. Perhaps it is more suitable for younger children. Perhaps the children would learn more without the VERB. Perhaps this study will lend support to some of these statements.

CHAPTER III

PROCEDURES

Introduction

This study was designed to investigate the effects of VERB Elementary Science instruction on a sample of students and to evaluate the relationship of community size and grade level to any learning that might result from VERB instruction. The following pages will attempt to describe the general plan and sequence of study.

The Population

The total population was comprised of the schools in Wyoming which had access to the VERB Network.

The sample used in this study consisted of the students from schools or classrooms that did subscribe to the VERB Science Programs through the University of Wyoming Extension Office in 1970 and the students from these same schools during the previous year. The students in the sample were from the communities of Hanna, Medicine Bow, Sheridan, Shoshoni, and Worland.

The experimental group consisted of all 549 students from the fourth, fifth, and sixth grades who received VERB instruction in the spring of 1970, and were tested for science achievement in February, 1971, when they were in the fifth, sixth, and seventh grades.

The control group consisted of 592 students who had attended the same grades in the same schools in the previous year when VERB Science Programs were not available, and who were tested for science achievement in the fifth, sixth, and seventh grades in February, 1970.

Treatment

The students in the experimental group were exposed to one elementary science VERB-cast a week for each separate grade level for a period of fifteen weeks. The length of the VERB-cast was approximately thirty minutes. When weather conditions, school functions, or technical difficulties caused any school to miss a VERB-cast, that lesson was made up at another period, but in the same sequence of lessons.

Prior to the beginning of the instructional programs the investigator used the VERB Network to hold a conference with the teachers and administrators participating in the study. The teachers received instruction in the administration of the tests to be given to the

fifth, sixth, and seventh grades. All testing was completed and the tests were returned to the investigator before the VERB programs were begun for the experimental group.

A second VERB conference was held with the teachers involved in the experimental program. These teachers were notified in advance of the conference and asked to be prepared to identify those science concepts or areas which they felt they would like to have enriched or expanded on the VERB-casts. During the conference the teachers discussed their needs and agreed to a list of topics to be used as a basis for the Elementary Science VERB-casts. This procedure has been used in formulating elementary programs in areas other than science.

The investigator used the topics agreed upon by the teachers to develop scripts for fifteen elementary science lessons for each grade level. The development of scripts dealt chiefly with the preparation of problem situations, possible questions that might help to develop discussions, and a collection of diagrams and drawings that might prove helpful during the VERB-cast. Since the students' attention was focused on the screen during the VERB-cast, it was necessary to keep relevant material before them and to build a sequence in keeping with the

subject. There was no fixed script. The development of the lesson depended on the spontaneous responses of the students.

Worksheets were mailed to the various classes prior to the time of each weekly VERB-cast. The work sheets included data the students could refer to during the VERB-cast, problem solving situations that could be used after the VERB-casts, and experiments or activities the students could use following the VERB-casts.

Teachers were sent suggested supplementary activities, names of films that could be used in connection with the subject of the VERB-cast, and lists of sources of information for the students' or teachers' use. No effort was made to see that the teachers used this material.

The investigator wishes it to be understood that the VERB-casts taught little or no science content. The programs attempted to increase interest in science, to provide some guidance in methods of questioning and to develop scientific attitudes. Any increase in content learning was the result of increased motivation in the area of science. The content itself did not come from the VERB-casts.

It was hypothesized that increased motivation would lead students to avail themselves more fully of

science opportunities in the regular school program. It was further hypothesized that the programs would develop an awareness in the student which would lead to scientific interest in his environment and in various items offered through communications media.

Although the VERB science programs dealt more with the affective area than the cognitive, and more with process than content, it was felt that any changes in behavior or attitude would reflect themselves in the cognitive or content area. For this reason, as well as the present dearth of reliable measures in the affective domain, a content test was chosen to measure the efficiency of VERB instruction in elementary science.

The teachers were requested not to test or grade the students on anything pertaining to the VERB-casts. The work sheets were distributed to the students, but they were not returned to the teacher. The use the student made of the VERB-casts and the work sheet was left to the individual student. The follow-up activities that the teacher used or did not use was left to the discretion of the teacher.

In January, 1971, a VERB conference was held with the teachers of the fifth, sixth, and seventh grades. These were the teachers of the students who had been exposed to the VERB Elementary Science Program during the

previous year. These teachers were instructed in the administration of the science achievement tests to be given to the students in February of 1971.

Tests

The tests which were used were the Every Pupil Achievement Test, Elementary Science, Grades V - VIII.[1] A new form of this test is issued each January and April. Norms for the new forms are available after the testing program is completed. The time required to administer the test is forty-five minutes.[2]

All the tests were mailed to the various schools and were administered by the teachers of the many classrooms involved. The Every Pupil Achievement Test was especially suitable in this situation since it was easy to administer and could be given in a relatively short period of time. The students marked the answers on the test booklet and the tests were returned to the investigator for scoring.

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[1]Jean Stohs Tichy, "Every Pupil Achievement Test, Elementary Science, Grades V-VIII," Bureau of Educational Measurement (Emporia, Kansas: Kansas State Teachers College, 1970).

[2]Oscar K. Buros, The Sixth Mental Measurements Yearbook (New Jersey: Gryphon Press, 1965), p. 871.

Hypotheses Tested

The questions listed in Chapter I have guided the formulation of the null hypotheses tested in this study. They were as follows:

I. There is no significant difference in achievement in science content between groups of fifth to seventh grade students who have been exposed to the VERB Science Programs and groups of fifth to seventh grade students who have not been exposed to the VERB Science Programs.

II. There is no significant difference in achievement in science content between groups of students from communities with a population of over 5,000 who have been exposed to VERB Science Programs and groups of students from communities with a population of over 5,000 who have not been exposed to VERB Science Programs.

III. There is no significant difference in achievement in science content between groups of students from communities with a population of less than 1,000 who have been exposed to VERB science programs

and groups of students from communities with a population of less than 1,000 who have not been exposed to the VERB Science Program.

IV. There is no significant difference in achievement in science content between groups of fifth grade students who have been exposed to VERB Science Programs and groups of fifth grade students who have not been exposed to VERB Science Programs.

V. There is no significant difference in achievement in science content between groups of sixth grade students who have been exposed to VERB Science Programs and groups of sixth grade students who have not been exposed to VERB Science Programs.

VI. There is no significant difference in achievement in science content between groups of seventh grade students who have been exposed to VERB Science Programs and groups of seventh grade students who have not been exposed to VERB Science Programs.

Analysis of Data

The Every Pupil Elementary Science Test is scored in percentiles. The tests are made up and normed twice a year. This procedure has both advantages and disadvantages. The chief advantage lies in the assurance that science information on which the student is tested is current in nature and embodies those concepts which are a part of the students' environment in time and space. One of the disadvantages resides in the fact that the raw score data of the two tests is not comparable, requiring that comparisons be made only on the basis of percentile scores.

For the purpose of this study, percentile scores rather than raw scores were used to compare data from the 1970 and 1971 groups of students. The t test was used to determine the significance of difference between the experimental group mean and the control group mean and the means of the various subgroups of the samples.

To test the first hypothesis, the mean rank of the percentile scores for the 1970 group of students was compared to the mean rank of the percentile scores for the 1971 group of students.

The following statistical hypothesis was used and tested at the .05 level of confidence to determine the significance of difference between the mean percentile rank of the two groups.

$$H_o: \mu_1 = \mu_2$$

Where μ_1 represents the mean of the students tested in 1970 and μ_2 represents the mean of the experimental group tested in 1971.

To test the second hypothesis the student scores from Sheridan and Worland were grouped together. Both of these communities had populations of over 5,000. The mean of the percentile scores for the 1970 subgroup was compared to the mean of the percentile scores for the 1971 subgroup. The following statistical hypothesis was used and tested at the .05 level of confidence to determine the significance of difference between the means of the two subgroups.

$$H_o: \mu_1 = \mu_2$$

Where μ_1 represents the mean percentile rank of the subgroup of students from communities with a population of over 5,000 who were tested in 1970 and μ_2 represents the mean percentile rank of the subgroup of students

from communities with a population of over 5,000 who were tested in 1971.

To test the third hypothesis the students' scores from Shoshoni and Medicine Bow were grouped together. Both of these communities had populations of less than 1,000. The mean of the percentile scores for the 1970 subgroup was compared to the mean of the percentile scores for the 1971 subgroup. The following statistical hypothesis was used and tested at the .05 level of confidence to determine the significance of difference between the means of the two subgroups.

$$H_o : \mu_1 = \mu_2$$

Where μ_1 represents the mean of the subgroup of students from communities with a population of less than 1,000 who were tested in 1970 and μ_2 represents the mean of the subgroup of students from communities with a population of less than 1,000 who were tested in 1971.

To test the fourth hypothesis the student scores from the fifth grade classes tested in 1970 were placed in one subgroup and the student scores from the fifth grade classes tested in 1971 were placed in a second subgroup. The mean of the percentile scores for the 1970 subgroup was compared to the mean of the percentile scores for the 1971 subgroup. The following

statistical hypothesis was used and tested at the .05 level of confidence to determine the significance of difference between the means of the two subgroups.

$$H_o : \mu_1 = \mu_2$$

Where μ_1 represents the mean of the subgroup of fifth grade students tested in 1970 and μ_2 represents the mean of the subgroup of fifth grade students tested in 1971.

To test the fifth hypothesis the student scores for the sixth grade classes tested in 1970 were placed in one subgroup and the student scores from the sixth grade classes tested in 1971 were placed in a second subgroup. The mean of the percentile scores for the 1970 subgroup was compared to the mean of the percentile scores for the 1971 subgroup. The following statistical hypothesis was used and tested at the .05 level of confidence to determine the significance of difference between the means of the two subgroups.

$$H_o : \mu_1 = \mu_2$$

Where μ_1 represents the mean of the subgroup of sixth grade students tested in 1970 and μ_2 represents the mean of the subgroup of sixth grade students tested in 1971.

To test the sixth hypothesis the student scores from the seventh grade classes tested in 1970 were placed in one subgroup and the student scores from the seventh grade classes tested in 1971 were placed in a second subgroup. The mean of the percentile scores for the 1970 subgroup was compared to the mean of the percentile scores for the 1971 subgroup. The following statistical hypothesis was used and tested at the .05 level of confidence to determine the significance of difference between the means of the two subgroups.

$$H_o : \mu_1 = \mu_2$$

Where μ_1 represents the mean percentile rank of the subgroup of seventh grade students tested in 1970 and μ_2 represents the mean of the subgroup of seventh grade students tested in 1971.

Summary

To investigate the efficiency of the VERB system as a teaching tool, a group of students in remote classrooms was tested to ascertain the science content achievement of the students exposed to a series of VERB Science Programs. The science achievement of the previous year's classes in the same communities was used as a control. The data was used to determine whether or

not VERB Programs affected science learning, and whether community size or grade level affected the degree of learning which might be attributed to VERB instruction.

CHAPTER IV

FINDINGS

Total Sample

Hypothesis I. The distribution of the scores on the Every Pupil Achievement Test--Elementary Science, for the years 1970 and 1971 for the total sample are recorded in Tables 1 and 2 respectively. The t test was used as the test for significance.

1. Hypothesis: There is no statistical difference in achievement in science content between groups of fifth to seventh grade students who have been exposed to the VERB Science Programs and groups of fifth to seventh grade students who have not been exposed to the VERB Science Programs.
2. Statistical hypothesis: H_o: $\mu_1 = \mu_2$
3. Level of significance: .05
4. Region of rejection: With 1139 degrees of freedom, a t equal to or greater than $\pm$ 1.96 was required for rejection of the null hypothesis.

TABLE 1

DISTRIBUTION OF SCIENCE ACHIEVEMENT SCORES IN THE CONTROL GROUP, 1970

Number of Scores	GRADE V						GRADE VI					GRADE VII					
	Shoshoni	Worland	Medicine Bow	Sheridan	Hanna	TOTAL	Shoshoni	Worland	Medicine Bow	Sheridan	TOTAL	Shoshoni	Worland	Medicine Bow	Sheridan	TOTAL	FINAL TOTAL
95-99	3	9	0	0	1	13	4	9	0	1	14	2	4	3	2	11	38
90-94	2	11	0	1	0	14	4	10	0	2	16	7	3	1	0	11	41
85-89	2	8	0	2	0	12	0	11	0	0	11	1	6	1	0	8	31
80-84	1	8	0	0	0	9	1	4	0	1	6	2	7	0	2	11	26
75-79	1	12	1	1	0	15	3	10	0	1	14	2	7	2	2	13	42
70-74	2	11	2	0	0	15	1	8	0	0	9	0	6	1	0	7	31
65-69	2	2	1	0	0	5	2	11	0	2	15	3	8	0	1	12	32
60-64	2	13	1	0	0	16	6	7	1	5	19	1	5	0	0	6	41
55-59	0	8	1	1	0	10	0	5	0	2	7	1	4	2	0	7	24
50-54	0	6	1	2	1	10	1	4	1	3	9	1	1	2	5	9	28
45-49	1	8	2	0	0	11	0	7	0	1	8	3	6	0	1	10	29
40-44	1	14	0	1	1	17	2	10	1	0	13	1	4	0	2	7	37
35-39	0	4	0	0	0	4	1	6	0	2	9	1	10	0	2	13	26
30-34	1	2	1	4	0	8	0	5	0	0	5	0	4	0	1	5	18
25-29	1	3	0	2	2	8	0	11	1	2	14	1	7	0	2	10	32
20-24	2	3	0	1	1	7	0	8	0	0	8	0	5	0	3	8	23
15-19	0	6	0	0	0	6	0	6	2	3	11	1	6	0	0	7	24
10-14	1	2	1	2	1	7	1	6	0	1	8	0	3	0	2	5	20
5-9	0	4	0	5	0	9	2	6	2	3	13	1	7	1	0	9	31
0-4	3	3	1	2	0	9	3	2	0	1	6	0	3	0	0	3	18
N	25	137	12	24	7	205	31	146	8	30	215	28	106	13	25	172	592

TABLE 2

DISTRIBUTION OF SCIENCE ACHIEVEMENT SCORES IN THE EXPERIMENTAL GROUP, 1971

Number of Scores	GRADE V						GRADE VI					GRADE VII					FINAL TOTAL
	Shoshoni	Worland	Medicine Bow	Sheridan	Hanna	TOTAL	Shoshoni	Worland	Medicine Bow	Sheridan	TOTAL	Shoshoni	Worland	Medicine Bow	Sheridan	TOTAL	
95-99	1	5	6	0	1	13	1	15	0	1	17	0	19	0	2	21	51
90-94	0	4	1	2	1	8	1	14	0	0	15	2	5	0	2	9	32
85-89	1	5	0	2	1	9	1	8	1	0	10	2	5	0	3	10	29
80-84	3	4	0	2	0	9	1	0	0	1	11	0	7	0	1	8	28
75-79	0	4	0	1	1	6	0	7	0	1	8	2	11	0	3	16	30
70-74	0	4	0	0	1	5	1	10	2	0	13	2	15	0	0	17	35
65-69	1	11	1	1	1	15	1	9	3	1	14	2	14	0	3	19	48
60-64	4	5	0	1	0	10	0	3	0	1	4	0	9	1	3	13	27
55-59	0	2	0	0	2	4	2	16	0	2	20	1	5	0	0	6	30
50-54	1	0	0	0	0	1	1	1	0	3	5	0	11	0	3	14	20
45-49	5	4	0	3	1	13	0	7	0	0	7	0	4	0	0	4	24
40-44	1	1	1	1	0	4	0	11	0	1	12	5	10	0	3	18	34
35-39	5	3	0	3	0	11	4	13	0	1	18	0	2	0	3	5	34
30-34	4	3	0	1	0	8	1	4	0	0	5	1	8	0	1	10	23
25-29	1	1	0	0	0	2	2	11	0	0	13	0	1	0	0	1	16
20-24	4	4	0	1	1	10	0	8	0	2	10	3	6	1	0	10	30
15-19	0	1	0	1	0	2	3	2	0	2	7	2	3	0	1	6	15
10-14	2	0	0	2	1	5	2	8	0	2	12	2	3	0	0	5	22
5-9	0	1	0	2	2	5	3	0	2	2	7	2	2	1	0	5	17
0-4	0	1	0	0	1	2	0	0	0	0	0	0	0	2	0	2	4
N	33	63	9	23	14	142	24	156	8	20	208	26	140	5	28	199	549

5. $$s^2 = \frac{\sum X^2 - (\sum X)^2 / N_1 + \sum X^2 - (\sum X)^2 / N_2}{N_1 + N_2 - 2}$$

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{s^2/N_1 + s^2/N_2}}$$

$$s^2 = \frac{2207913-31989^2/592+2106226-31435^2/549}{592 + 549-2} \doteq 691$$

$$t = \frac{57.26 - 54.03}{\sqrt{691/592 + 691/549}}$$

$$t = 3.08$$

6. Decision: The null hypothesis was rejected. The mean of the science achievement scores of the group of students exposed to the VERB Science Program was significantly greater than the mean of the scores of the group of students which was not exposed to the VERB Science Program.

Subgroups of Students from Communities of over 5,000 Population

Hypothesis II. The distribution of the scores of the Every Pupil Achievement Test--Elementary Science for the years 1970 and 1971 in the subgroups of students from communities of over 5,000 are recorded in Table 3.

TABLE 3

DISTRIBUTION OF SCIENCE ACHIEVEMENT SCORES OF STUDENTS FROM COMMUNITIES OVER 5,000

Number of Scores	1970							1971						
	V		VI		VII			V		VI		VII		
	Sheridan	Worland	Sheridan	Worland	Sheridan	Worland	TOTAL	Sheridan	Worland	Sheridan	Worland	Sheridan	Worland	TOTAL
95-99	0	9	4	9	2	4	28	0	5	1	15	2	19	42
90-94	1	11	4	10	0	3	29	2	4	0	14	2	5	27
85-89	2	8	0	11	0	6	27	2	5	0	8	3	5	23
80-84	0	8	1	4	2	7	22	2	4	1	9	1	7	24
75-79	1	12	3	10	2	7	35	1	4	1	7	3	11	27
70-74	0	11	1	8	0	6	26	0	4	0	10	0	15	29
65-69	0	2	2	11	1	8	24	1	11	1	9	3	14	39
60-64	0	13	6	7	0	5	31	1	5	1	3	3	9	22
55-59	1	8	0	5	0	4	18	0	2	2	16	0	5	25
50-54	2	6	1	4	5	1	19	0	0	3	1	3	11	18
45-49	0	8	0	7	1	6	22	3	4	0	7	0	4	18
40-44	1	14	2	10	2	4	33	1	1	1	11	3	10	27
35-39	0	4	1	6	2	10	23	3	3	1	13	3	2	25
30-34	4	2	0	5	1	4	16	1	3	0	4	1	8	17
25-29	2	3	0	11	2	7	25	0	1	0	11	0	1	13
20-24	1	3	0	8	3	5	20	1	4	2	8	0	6	21
15-19	0	6	0	6	0	6	18	1	1	2	2	1	3	10
10-14	2	2	1	6	2	3	16	2	0	2	8	0	3	15
5-9	5	4	2	6	0	7	24	2	1	2	0	0	2	7
0-4	2	3	3	2	0	3	13	0	1	0	0	0	0	1
N	24	137	31	146	25	106	469	23	63	20	156	28	140	430

The t test was used as the test for significance.

1. Hypothesis: There is no significant difference in achievement in science content between groups of students from communities with a population of over 5,000 who have not been exposed to VERB Science Programs.
2. Statistical hypothesis: H_o: $\mu_1 = \mu_2$
3. Level of significance: .05
4. Region of rejection: With 896 degrees of freedom, a t equal to or greater than $\pm$ 1.96 was required for rejection of the null hypothesis.
5. $$s^2 = \frac{\sum X^2 - (\sum X)^2 / N_1 + \sum X^2 - (\sum X)^2 / N_2}{N_1 + N_2 - 2}$$

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{s^2/N_1 + s^2/N_2}}$$

$$s^2 = \frac{1679857 - 24801^2/468 + 1823185 - 25695/430}{468 + 430 - 2} = 896$$

$$t = \frac{59.75 - 52.99}{\sqrt{896/468 + 896/430}}$$

$$t = 3.38$$

6. Decision: The null hypothesis was rejected. The mean of the science achievement scores of the subgroup from communities of over 5,000 population who were exposed to the VERB Science Program is significantly greater than the mean of the scores of the subgroup from communities of over 5,000 population who were not exposed to the VERB Science Program.

Subgroups of Students from Communities of Less than 1,000 Population

Hypothesis III. The distribution of the scores of the Every Pupil Achievement Test--Elementary Science for the years 1970 and 1971 in the subgroups of students from communities of less than 1,000 population are recorded in Table 4. The t test was used as a test of significance.

1. Hypothesis: There is no significant difference in achievement in science content between groups of students from communities with a population of less than 1,000 who have been exposed to VERB Science Program and groups of students from communities with a population of less than 1,000 who have not been exposed to the VERB Science Program.

TABLE 4

DISTRIBUTION OF SCIENCE ACHIEVEMENT SCORES OF STUDENTS FROM COMMUNITIES UNDER 1,000

Number of Scores	1970							1971						
	V		VI		VII			V		VI		VII		
	Medicine Bow	Shoshoni	Medicine Bow	Shoshoni	Medicine Bow	Shoshoni	TOTAL	Medicine Bow	Shoshoni	Medicine Bow	Shoshoni	Medicine Bow	Shoshoni	TOTAL
95-99	0	3	8	4	3	2	12	6	1	0	1	0	0	8
90-94	0	2	0	4	1	7	14	1	0	0	1	0	2	4
85-89	0	2	0	0	1	1	4	0	1	1	1	0	2	5
80-84	0	1	0	1	0	2	4	0	3	0	1	0	0	4
75-79	1	1	0	3	2	2	9	0	0	0	0	0	2	2
70-74	2	2	0	1	1	0	6	0	0	2	1	0	2	5
65-69	1	2	0	2	0	3	8	1	1	3	1	0	2	8
60-64	1	2	1	6	0	1	11	0	4	0	0	1	0	5
55-59	1	0	0	0	2	1	4	0	0	0	2	0	1	3
50-54	1	0	1	1	2	1	6	0	1	0	1	0	0	2
45-49	2	1	0	0	0	3	6	0	5	0	0	0	0	5
40-44	0	0	1	2	0	1	5	1	1	0	0	0	5	7
35-39	0	0	0	1	0	1	2	0	5	0	4	0	0	9
30-34	1	1	0	0	0	0	2	0	4	0	1	0	1	6
25-29	0	1	1	0	0	1	3	0	1	0	2	0	0	3
20-24	0	2	0	0	0	0	2	0	4	0	0	1	3	8
15-19	0	0	2	0	0	1	3	0	0	0	3	0	2	5
10-14	1	1	0	1	0	0	3	0	2	0	2	0	2	6
5-9	0	0	2	2	1	1	6	0	0	2	3	1	2	7
0-4	1	3	0	3	0	0	7	0	0	0	0	2	0	2
N	12	25	8	31	13	28	117	9	33	8	24	5	26	105

2. Statistical hypothesis: H_o: $_1 = \quad _2$

3. Level of significance: .05

4. Region of rejection: With 220 degrees of freedom, a $\underline{t}$ equal to or greater than $\pm$ 1.96 was required for rejection of the null hypothesis.

5. $$s^2 = \frac{\sum X^2 - (\sum X)^2/N_1 + \sum X^2 - (\sum X)^2/N_1}{N_1 + N_2 - 2}$$

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{s^2/N_1 + s^2/N_2}}$$

$$s^2 = \frac{512093 - 6909^2/117 + 332560 - 5070^2/105}{117 + 105 - 2} = 872$$

$$t = \frac{48.28 - 59.05}{\sqrt{872/117 + 872/105}}$$

$$t = -2.71$$

6. Decision: The null hypothesis was rejected. The mean of the science achievement scores between groups of students from communities with a population of less than 1,000 who had been exposed to VERB Science Program was significantly less than the mean of the scores of the subgroup from communities with a population of less than 1,000 who had not

been exposed to the VERB Science Program.

Subgroups of Fifth Grade Students

Hypothesis IV: The distribution of the scores of the Every Pupil Achievement Test--Elementary Science, for the years 1970 and 1971 for the subgroups of fifth grade students are recorded in Tables 1 and 2 respectively. The t test was used as the test for significance.

1. Hypothesis: There is no significant difference in achievement in science content between groups of fifth grade students who have been exposed to the VERB Science Program and groups of fifth grade students who have not been exposed to the VERB Science Program.
2. Statistical hypothesis: H_o: $\mu_1 = \mu_2$
3. Level of significance: .05
4. Region of rejection: With 220 degrees of freedom, a t equal to or greater than $\pm$ 1.96 was required for rejection of the null hypothesis.
5. $$s^2 = \frac{\Sigma X^2 - (\Sigma X)^2/N_1 + \Sigma X^2 - (\Sigma X)^2/N_2}{N_1 + N_2 - 2}$$

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{s^2/N_1 + s^2/N_2}}$$

$$s^2 = \frac{568508 - 8094^2/142 + 782725 - 11255^2/205}{142 + 205 - 2} = 788$$

$$t = \frac{57 - 54.9}{\sqrt{788/142 + 788/205}}$$

$$t = .69$$

6. Decision: The null hypothesis was retained. The means of the science achievement scores of the subgroups of fifth grade students who were exposed to the VERB Science Program did not differ significantly from the mean of the fifth grade students who were not exposed to the VERB Science Program.

Subgroups of Sixth Grade Students

Hypothesis V. The distribution of the scores on the Every Pupil Achievement Test--Elementary Science for the years 1970 and 1971 for the subgroups of sixth grade students are recorded in Table 1 and 2 respectively. The t test was used as the test for significance.

1. Hypothesis: There is no significant difference in achievement in science content between groups of sixth grade students who

have been exposed to the VERB Science Program and groups of sixth grade students who have not been exposed to the VERB Science Program.

2. Statistical hypothesis: $H_o: \mu_1 = \mu_2$

3. Level of significance: .05

4. Region of rejection: With 421 degrees of freedom, a t equal to or greater than $\pm$ 1.96 was required for rejection of the null hypothesis.

5. $$s^2 = \frac{\sum X^2 - (\sum X)^2/N_1 + \sum X^2 - (\sum X)^2/N_2}{N_1 + N_2 - 2}$$

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{s^2/N_1 + s^2/N_2}}$$

$$s^2 = \frac{792917 - 11481^2/208 + 784980 - 11410/215}{208 + 215 - 2} = 804.4$$

$$t = \frac{55.20 - 53.07}{\sqrt{804/208 + 804/172}}$$

$$t = .73$$

6. Decision: The null hypothesis was retained. The mean of the science achievement scores of the subgroup of sixth grade students who

were exposed to the VERB Science Program did not differ significantly from the mean of the sixth grade students who were not exposed to the VERB Science Program.

Subgroups of Seventh Grade Students

Hypothesis VI. The distribution of the scores of the Every Pupil Achievement Test--Elementary Science for the years 1970 and 1971 for the subgroups of seventh grade students are recorded in Tables 1 and 2 respectively. The t test was used as the test of significance.

1. Hypothesis: There is no significant difference in achievement in science content between groups of seventh grade students who have been exposed to the VERB Science Program and groups of seventh grade students who have not been exposed to the VERB Science Program.
2. Statistical hypothesis: $H_o: \mu_1 = \mu_2$
3. Level of significance: .05
4. Region of rejection: With 369 degrees of freedom, a t equal to or greater than $\pm$ was required for rejection of the null hypothesis.

5. $$s^2 = \frac{\sum X^2 - (\sum X)^2/N_1 + \sum X^2 - (\sum X)^2/N_2}{N_1 + N_2 - 2}$$

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{s^2/N_1 + s^2/N_2}}$$

$$s^2 = \frac{640208 - 9324^2/172 + 744801 - 11860^2/199}{172 + 199 - 2} = 468.1$$

$$t = \frac{59.59 - 54.21}{\sqrt{481.1/199 + 468.1/172}}$$

$$t = 2.39$$

6. Decision: The null hypothesis was rejected. The mean of the science achievement scores of the subgroup of seventh grade students who were exposed to the VERB Science Program was significantly greater than the mean of the seventh grade students who were not exposed to the VERB Science Program.

CHAPTER V

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Summary of Findings

The following differences were found to be statistically significant at the .05 level of confidence:

1. The science achievement scores of the group of students exposed to the VERB Science Program were greater than the scores of the group of students who were not exposed to the VERB Science Program.

2. The science achievement of the subgroup of students from communities of over 5,000 population who were exposed to the VERB Science Program was found to be greater than the achievement of the subgroup of students from communities of over 5,000 population who were not exposed to the VERB Science Program.

3. The science achievement of the subgroup of students from communities of less than 1,000 population who were exposed to the VERB Science Program was found to be less than the achievement of the subgroup of students from communities of less than 1,000 population who were not exposed to the VERB Science Program.

4. The science achievement of the subgroup of seventh grade students who were exposed to the VERB Science Program was greater than the achievement the seventh grade students who were not exposed to the VERB Science Program.

The following differences were not found to be statistically significant at the .05 level of confidence:

1. The means of the science achievement scores of the subgroups of fifth grade students who were exposed to the VERB Science Program did not differ significantly from the mean of the fifth grade students who were not exposed to the VERB Science Program.

2. The means of the science achievement scores of the subgroup of sixth grade students who were exposed to the VERB Science Program did not differ significantly from the mean of the sixth grade students who were not exposed to the VERB Science Program.

Conclusions

1. Does a VERB Elementary Science Program contribute any additional science content learning to the experimental group of students?

Within the total experimental group it seems justifiable to conclude that the VERB Elementary Science Program did contribute science content learning to the

experimental group. The results, however, were not consistent throughout the experimental group.

A VERB teacher is not aware of all the factors which may influence the degree of learning in the remote receiving station. The VERB teacher is able to communicate with the students, but largely unable to communicate with the teachers or administrators in the participating schools. The VERB teacher does not know if the remote teacher remains in the classroom during the VERB-cast or if all students in the class are free from other responsibilities. It is often impossible to determine whether the programs are desired by the classroom teacher or imposed by the adminstrator of a particular school.

The inconvenience of receiving the VERB programs may influence the amount of gain possible in some schools. It was learned that in some schools the VERB room was scheduled for the use of other classes who were not receiving VERB programs. The use of the VERB room necessitated shifting classes during the period. In one school, the students had to walk two blocks to another building to attend the VERB classes. In Wyoming's weather, this trip would cool the interest of the most ardent science fan.

In Coffeen School in Sheridan, the teachers and the principal frequently communicated with the investigator to inquire about films, current science magazines, books, transparencies, or related investigations. The Worland teachers allowed their students time to write to the investigator and comment on their interests. All teachers in all the participating schools were invited to communicate their needs to the investigator, but the teachers in various schools responded in different degrees.

In the community of Medicine Bow, Wyoming, an unforeseen event may have influenced the outcome of the experiment. In 1970 the community sat astride Interstate Highway 30. Several cafes, service stations, a hotel, motel, and gift shop profited from the tourist trade. In 1971 a new strip of highway was completed and opened to through traffic. The new highway left Medicine Bow without one of its sources of revenue and the population dropped in the school system. The student group with which this experiment dealt, dropped from thirty-three to twenty-two between the years of 1970 and 1971.

Despite the many factors which could have influenced the degree of learning possible from a VERB Science Program, the investigator feels that the situation was reasonably normal for any series of VERB-casts. Some schools or classes appear to have depended too heavily on

the VERB-casts to teach all the science. Some schools or classes treated the VERB-casts as the supplementary program it was intended to be. The mean of the entire experimental group indicates that most of the students profited from the program.

2. Does community size affect the degree of science content learning which might be attributed to VERB instruction?

In this study, the difference between the means of science achievement scores was significantly greater for the experimental group in communities of over 5,000 population. The difference between the means of science achievement scores was significantly less for the experimental group in communities of less than a thousand population.

3. Does the grade level of any portion of the population affect the degree of science content learning which might be attributed to VERB instruction?

The only grade level for which there was a significant difference between the mean scores of the experimental and control groups was the seventh grade. This indicates that this series of VERB Science Programs was more profitable for those students who received the Elementary Science VERB-casts in the sixth grade and were tested in the seventh grade.

Recommendations

On the basis of this study the investigator recommends the continued use of VERB at the elementary level. The study also indicates that the VERB Science instruction is more effective at sixth grade level than at fourth or fifth grade level.

The investigator recommends that this study be regarded as a pilot study and that further studies be done in which the design be strengthened in terms of sample, controls, and measurements.

The investigator further recommends that in implementing the above recommendations the researcher attempt to clarify the extent to which the problems pertaining to the classroom situations as described on page fifty-seven and fifty-eight, do or do not exist in the experimental schools.

APPENDIX

ABBREVIATED TRANSCRIPT OF A REPRESENTATIVE VERB-CAST

The following is an abbreviated transcript of the verbal portion of one of the fifteen VERB-casts made to the fourth grade students during the experimental period. This transcript is included to convey the general tone of the VERB-casts. The exchanges recorded here are representative of the type of communication which took place during the entire VERB-cast. Conversations concerning technical problems involved in adjusting voice or tele-writer transmission have been omitted.

Teacher: Hello, Scientists. How is the weather in Worland today?

Worland: It's snowing here. How is the weather in Laramie?

Teacher: So far, the weather is nice here. The sky is clear and the sun is shining. I wonder if we'll get your weather later today.

Sheridan: We've already got it.

Teacher: What about Medicine Bow?

Med.Bow: It's starting to snow here.

Teacher: Oh, Oh, we'll probably get it soon then. Is Hanna on yet?

Hanna: Hanna is ready.

Shoshoni: We're just coming in, but we'll be ready in a

minute.

Teacher: Fine, Shoshoni. How is your weather?

Shoshoni: We have snow, too. It's really blowing.

Teacher: I guess Laramie is the only clear spot right now. Sometimes we stay clear here because the snow drops off on the mountains to the west of us, but it sounds like it's moving in from the north this time so we'll probably have snow before the day it out. Are you ready Shoshoni?

Shoshoni: Yes, we're ready.

Teacher: Fine. I have a problem I'd like to ask you about. Maybe you can solve it for me. Some other people have already told me what they think about my problem, but I'd like to know what you think. Every night I leave a bowl of milk on the doorstep outside and every morning when I go out to look the bowl is empty. Now I have some very good neighbors and they told me that elves often come and drink milk that you leave outside. They asked me if I had had any good luck lately. Well, I found a quarter on the sidewalk just last week and my car hasn't had a flat lately and no one in my family has been sick. And I get to talk to a lot of nice scientists over the VERB--so I guess I'm pretty lucky. When I told my neighbors about how lucky I was, they said, "Aha! that proves it. Elves always bring good luck to people that leave milk for them."
Since I am a scientist, I can't say that I know the elves get the milk. I can't even say that I have a theory that the elves get the milk. A theory would mean that I had evidence to support the theory. I can only say that I have a hypothesis. A hypothesis is just a kind of guess I can use while I look for evidence to show me that my hypothesis is either true or false. My hypothesis is that the elves get my milk. Could you make a hypothesis about what happens to my milk?

Worland: There's not any such thing as elves.

Teacher: Do you have any evidence to prove that there are no elves.

Worland: My mother told me there weren't any.

Shoshoni: But her neighbor told her there were elves and that's the same thing.

Teacher: Hey, there is a real scientist in Shoshoni. I can't call what my neighbor said evidence. Do you want to make a hypothesis, Shoshoni?

Shoshoni: Yes, I think the cat got it.

Teacher: Good. Why do you think the cat got it?

Shoshoni: Well, cat's drink milk. Do you have a cat?

Teacher: Very good. Now you're asking questions to see if you should make a hypothesis about a cat. Yes, I do have a cat.

Hanna: My hypothesis is that the cat got it, too.

Sheridan: Sheridan thinks the cat got it.

Teacher: Good. We have two hypotheses now. My hypothesis is that the elves drank the milk. Sheridan, Shoshoni, and Hanna think the cat drank the milk. Do we have any other hypotheses?

Med.Bow: A duck.

Teacher: Medicine Bow, do you mean that your hypothesis is that a duck drank the milk?

Med.Bow: Our ducks do. (Laughter)

Teacher: You're right, Medicine Bow. A duck could drink the milk. At this stage we shouldn't overlook any possibilities. Well, now we have three hypothesis. Perhaps we should look for some evidence. Do you have any suggestions?

Sheridan: Where was your cat last night?

Teacher: That is a very good question. My cat is always locked up in the basement at night.

Worland: So your cat couldn't ever get it. Maybe it was a dog.

Hanna: Do you have a dog?

Teacher: Yes.

Hanna: Could your dog get to the milk?

Teacher: No, he has to stay in his yard at night. He can't get to the milk.

Shoshoni: Are there ever any tracks?

Teacher: Beautiful question! Right! Sometimes the milk is spilled and there are tracks. Sometimes there are tracks in the snow. They look like this. (Tracks are drawn on Tele-writer.)

Med.Bow: What kind of tracks are those?

Teacher: I don't know. Maybe they are elf tracks.

All: Much hooting

Shoshoni: Those are dog tracks.

Hanna: No, they're cat tracks.

Sheridan: No, they're skunk tracks.

Med.Bow: They're not duck tracks.

Teacher: Good for you, Medicine Bow. It is just as important sometimes to know what something isn't. What does that prove about your hypothesis?

Med.Bow: (sadly) It proves it's no good.

Teacher: Oh no! It proves that your hypothesis is false. It does not prove that it was no good. Now that we have got that hypothesis out of the way, you can make another one. Scientists often work this way. They don't feel badly about a hypothesis that is proved wrong. Let's take a minute and let each town discuss whether or not they feel that they have enough evidence to withdraw their hypothesis or whether the evidence supports their hypothesis. You might also decide on some questions to ask me. When you've had a few minutes to talk I'll call the name of each town. When I call the name of your town, I want you to tell me what you decided about your first hypothesis. Then I want you either to restate

your old hypothesis or tell me your new one. Then you may ask me your questions.

(3 minute intermission)

Teacher: Let's start with Medicine Bow.

Med.Bow: Our first hypothesis about the duck was false. We want to ask some questions before we make another hypothesis.

Teacher: Good. What are your questions?

Med.Bow: Does your dog ever get loose?

Teacher: Sometimes, but not every night.

Med.Bow: Do you have a fence around your yard?

Teacher: No.

Med.Bow: Then our hypothesis is that it is a dog and we have some evidence.

Teacher: Very good. What is your evidence?

Med.Bow: Well, those tracks have claws showing on them and cat's claws don't show but dog's claws do.

Teacher: Beautiful! that is really good thinking.

Med.Bow: Were we right then?

Teacher: Goodness, I don't know the answer. We're just working on this problem. But you are really thinking like a scientist and I'm proud of you. Hanna, do you want to say anything about your hypothesis now?

Hanna: We said it was a cat. We think our hypothesis is false too.

Teacher: Very good. Have you another hypothesis?

Hanna: Maybe it's a coyote.

Teacher: All right. Do you have any questions?

Hanna:	Do you live in town where there are lots of houses?
Teacher:	I live in town, but I live just a block from open country.
Hanna:	Then it might be a coyote because they walk with their claws out, too.
Teacher:	Very good. How about you, Sheridan?
Sheridan:	We thought it was a cat, too, so our hypothesis was false, too. Now we think it might be a skunk, Does it ever smell at your house--like a skunk, I mean?
Teacher:	I haven't noticed it! (laughing)
Sheridan:	I mean really. You know how it smells when a skunk comes around.
Worland:	Your dog would have barked if a skunk came around. Did your dog bark?
Teacher:	My dog barks a lot, but I don't know if he barked at a skunk. I know what a skunk smells like and I really don't remember smelling one near the house.
Sheridan:	I think our hypothesis will be about a dog, too.
Teacher:	What does Worland think?
Worland:	We thought it was a dog all along. Our hypothesis is still that it's a dog. But we have some questions.
Teacher:	Good, what are they?
Worland:	Do your neighbors have dogs?
Teacher:	Yes.
Worland:	The one that told you it was elves?
Teacher:	Yes.
Worland:	I'll bet they just told you it was elves so you wouldn't know their dog was getting your milk.

Teacher: (laughing) In other words, you don't think their information was reliable.

Worland: Nope.

Teacher: That's very good. Scientists do have to consider whether sources of information are reliable. You think my neighbors are not a reliable source,is that right?

Worland: Yes. Our hypothesis is that it's the neighbor's dog--the one that told you about elves.

Teacher: Well, that narrows it down. That's a very specific hypothesis.

Worland: Well, we can't be sure, but we know how you could find out.

Teacher: Very good. If you tell me a way to get more evidence, that would be very helpful.

Worland: You could sit up one night and watch.

Teacher: Excellent. That's a very good idea. You know, I did sit up and watch one night, but I won't tell you what I saw until I've heard from the others. What was your hypothesis, Sheridan? Shoshoni, what about you?

Shoshoni: We thought it was a cat and we still think it could have been a cat some of the time. Maybe the dog just came in to chase the cat. My dog doesn't like milk.

Teacher: Good. It always helps to relate something you already know about to the problem you're trying to solve. But you'll have to ask yourself if you're sure that all dogs don't like milk.

Shoshoni: No, I know some dogs like milk. Puppies do, I guess it could have been a puppy. How long has something been getting this milk?

Teacher: About a year.

Shoshoni: That would be too long for a puppy. He'd grow up to a dog that didn't like milk--maybe--unless he was a dog that did like milk. I don't know.

I just think its a cat. Most of the time, anyway. Because cat's wander around at night.

Teacher: That was a very good thought. We call animals that wander more at night nocturnal animals. Since the milk disappears at night, it would be more apt to be a nocturnal animal. That's very good thinking.
I'm also glad you thought about the possibility of its not being the same animal all the time. Well, let's see where we are now. We have no evidence that it's a duck. We have some evidence that it is an animal that walks with its claws out. We have to consider that it is a nocturnal animal. We know it is an animal that likes milk.
Our hypotheses state that it is a cat or a dog or a coyote or elves. Before we could say that any of the hypotheses was a theory, we would have to say that all the facts we have support one hypothesis. Could any of the hypotheses meet this test? What do you think, Sheridan?

Sheridan: Well, I think it would fit a dog, but it would-not have to be the neighbor's dog. I don't know if a dog is nocturnal, but he does wander around at night sometimes. So he could be. But a cat can see in the dark, so he's nocturnal, but it still could be a dog.

Teacher: Do you think we could call it a theory then?

Sheridan: Nooo--I think we need more evidence. What did you see that night you sat up and watched?

Teacher: Okay. What I saw was the neighbor's dog.

All: Yay!

Teacher: Does that prove that the dog hypothesis is right?

Shoshoni: No, because the dog could have just come once.

Worland: It proves it wasn't elves!

Teacher: How does it prove that?

Worland: Well, if the dog got the milk then the elves would be mad at you and you'd have bad luck.

Teacher: You know, I think maybe you're right. I'm willing to say my hypothesis was false.

Worland: Well, finally!

Teacher: I think Sheridan is right. We don't really have enough evidence to say that it is a theory. Now you have asked me questions. May I ask you some questions?

Ald: Yes.

Teacher: All right. Sheridan. What is a hypothesis?

Sheridan: It's kind of a guess that you try to find evidence to see if its true or false.

Teacher: Hey, that is really good. I think you must have really been listening.

Sheridan: Yes, I was.

Teacher: Okay, Shoshoni. Can you believe what people tell you?

Shoshoni: No.

Teacher: Not ever?

Shoshoni: Well, maybe sometimes.

Teacher: Worland, what do you think?

Worland: You'd have to be careful.

Teacher: I know Shoshoni was thinking I shouldn't have believed my neighbor about the elves. He's right. I shouldn't have. But how do you mean to be careful about who you believe, Worland?

Worland: Well, some people know about things and some people just talk a lot.

Teacher: Very good. Let's ask Shoshoni how they would decide whether to believe someone or not.

Shoshoni: Well, if you know someone knows about other stuff, then they might know about something else.

Teacher: I know somethings about Laramie. Would you believe what I told you about your town?

Shoshoni: Not if you hadn't been here.

Teacher: Right, you would know more about your town than I would. Who would you ask if you wanted to know about airplanes? Your teacher?

Shoshoni: She might know something, but it would be better to ask someone who made airplanes.

Teacher: Very good. We can believe somethings that we are told if we know the person who is telling us has had some experience with the thing we're asking about. We do have to be careful not to believe everything people tell us. I shouldn't have believed my neighbor about the elves. You probably can believe your mother because she wants you to learn things that are right. Hanna, are you ready to answer a question?

Hanna: Yes.

Teacher: If we see something happen once, does it prove that it always happens that way?

Hanna: No

Teacher: If we saw something happen the same way several times could we believe it always happened that way?

Hanna: No, but I'd think maybe it happened that way most of the time.

Teacher: Very good! You said that beautifully. It would certainly make you believe it was true most of the time.
Medicine Bow, are you ready for your question?

Med.Bow: Yes.

Teacher: What is a theory?

Med.Bow: It's when everything fits.

Teacher: It sounds like you've got the right idea. Could you talk about it a little more?

Med.Bow: Well, like if the tracks didn't have claw marks and everything else still looked like a dog, then you couldn't have a theory because that didn't fit.

Teacher: Lovely! You did a very good job with that. You know I think our time is nearly up. I do thank you for helping me with my problem. I'm pretty sure now that it isn't elves--

Hanna: You didn't really think it was elves?

Teacher: Well no, but I don't know that there aren't any elves do I?

Hanna: I guess that would be pretty hard to prove.

Teacher: You remember that. A lot of scientific discoveries have been made about things that people "knew" couldn't happen. You have to be awfully careful about saying things couldn't be true. Like I can't say for sure that there are no people on Mars. I don't think there are--but I can't prove it yet.

Sheridan: There might be.

Teacher: You'll probably find out for sure one day.

Med.Bow: Could we talk about that sometime?

Teacher: We certainly can. Would you like to talk about it next time?

All: Yes.

Teacher: All right. I'll tell you what. You find out everything you can about the planets. Look in the science books you have at school and look in the newspaper or in magazines. You might find out something on T.V. if you listen for it. And I'll do the same thing. Then we can talk about it next Wednesday. See if you think there could be life on some of the planets.

Med.Bow: Is it snowing there yet?

Teacher: You're right, it is! I guess we're in for it. I'll have to say goodbye now. If you have any special questions, come on early next Wednesday. I'll be here.

GOODBYE SCIENTISTS

(Students manage to say goodbye into at least one of the microphones as they leave the VERB room. The "goodbyes" last until the teacher pulls the plug on the speaker.)

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VITA

Catherine Herndon Wiegand was born November 13, 1922, in San Marcos, Texas. She has four sons, a daughter, and three grandchildren.

She received a Bachelor of Science degree from Southwest Texas State Teachers College in 1946 and a Masters of Arts degree from that same institution in 1953. Since 1953 she has attended Texas Agricultural and Mechanical College, Texas Women's University, Colorado School of Mines, and the University of Wyoming.

Professional experience includes:

1947-1952	Teacher, Grade II, Pharr, Texas.
1952-1963	Elementary Teacher, Campus School, San Marcos, Texas.
1963-	Assistant Professor of Education, University Laboratory School, University of Wyoming, Laramie, Wyoming.

She is a member of the National Education Association, Wyoming Education Association, and Delta Kappa Gamma.