2-1970

Closed-Circuit Television in Industrial Arts

Larry L. Bradshaw
University of Northern Iowa

Closed-Circuit Television in Industrial Arts

Abstract

The major problem in this study is to find how closed circuit television can De used effectively in Industrial Arts. Several secondary problems are involved with this main problem. The most important of these is teacher presentation. The methodology and mannerisms of a television teacher need to be such that they do not take away from the subject matter to be taught. (Stashoff, 1966, p. 50). The television teacher must be careful to avoid quick distracting movements which would change viewer attention from the learning object to the teacher. This is a special problem because the viewer's attention is confined to the picture on the screen, not as in a normal visual reference where outside distractions are often unnoticed.

Another secondary problem is equipping the shop for televised instruction. Associated with this problem are determining items of cameras and lenses, lighting, receivers, and special equipment which is necessary to make presentations more efficient.

The third item of importance is to specify what can be effectively taught on television in industrial arts and what the limitations of television are.

CLOSED-CIRCUIT TELEVISION IN INDUSTRIAL ARTS

RESEARCH PAPER

Presented to the

DEPARTMENT OF INDUSTRIAL ARTS AND TECHNOLOGY

UNIVERSITY OF NORTHERN IOWA

In Partial Fulfillment

of the Requirements for the Degree

MASTER OF ARTS

BY

LARRY L. BRADSHAW
February 1970

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

Television, although not a new media in education, may need assimulation into industrial education methodology if the needs of students are to be met in a modern educational system. Schools are growing, classes are increasing in size, and any method which may help individual students gain understanding if found to be appropriate, put into use. Television is a channel for conveying whatever is put into it. Classroom television depends upon teacher direction to determine content, presentation, and effective use. (Barnard, 1966, p. 44).

I. THE PROBLEM

Statement of the problem. The major problem in this study is to find how closed circuit television can be used effectively in Industrial Arts. Several secondary problems are involved with this main problem. The most important of these is teacher presentation. The methodology and mannerisms of a television teacher need to be such that they do not take away from the subject matter to be taught. (Stashoff, 1966, p. 50). The television teacher must be careful to avoid quick distracting movements which would change viewer attention from the learning object to the teacher. This is a special problem because the viewer's attention is confined to the picture on the screen, not as in a normal visual reference where outside distractions are often unnoticed.

Another secondary problem is equipping the shop for televised instruction. Associated with this problem are determining items of cameras and lenses, lighting, receivers, and special equipment which is necessary to make presentations more efficient.

The third item of importance is to specify what can be effectively taught on television in industrial arts and what the limitations of television are.

Importance of the study. The pursuance of a study on the effective use of television instruction is important to the writer who has had no formal experience with this media. The findings of the study should help to motivate

readers to consider television as a means of presenting information to students. Further, the study may influence the Department of Industrial Arts and Technology at the University of Northern Iowa to include television training in the preparation of teachers.

II. DEFINITIONS OF TERMS USED

Closed circuit television. This is a system of television picture transmission wherein the camera and receivers are directly connected.

Direct television teaching. In this type of presentation the major portion of a course of study is taught by the television teacher, supplemented by individual study and small group discussions. (Diamond, 1964, p. 126).

Educational television. This is a broad term applied to cultural and community broadcasting which may include some programs for in-school use. (Diamond, 1964, p. 278).

Extension tube. This tube is a small one that is placed between a lens and the camera to permit focusing the lens at a distance closer to the subject than is normally the case.

Depth of field. This expression describes the limits of the nearest and farthest distance, from the camera, which objects will be in focus to the viewer.

Focal length. This is the quality of a lens that determines its angle of view on coverage. As the focal length of a lens increases, its angle of coverage decreases, thereby resulting in greater magnification of the subject.

Image orthicon. The image orthicon is a highly sensitive television camera tube used in commercial television and usually considered an unwanted expense for the normal instructional application.

Instructional television. This type of television is used within the classroom on any educational level. (Diamond, 1964, p. 278).

Lens speed. The speed of a lens is determined by the amount of light coming through the lens in proportion to its focal length.

Monitor. A monitor is the standard black and white home receiver capable of displaying radio frequency signals on standard channels. It receives both audio and video signals.

Resolution. This is the ability of the television system to reproduce fine detail of the subject.

Single room television. This television is used as a simple magnification device within the classroom or laboratory. The camera, receivers, and controls are located within the single classroom and are of simple design, usually with the camera controls built into the camera unit. (Diamond, 1964, p. 279).

Supplementary television. This makes use of television lessons that are directly related to the course of study and are presented on a scheduled basis to augment the classroom offerings.

Team teaching. This method of teaching uses the single lesson or course segment by several teachers working cooperatively.

Total teaching. When a class is taught exclusively by television the term total teaching was used. (Diamond, 1964, p. 279).

Vidicon. A vidicon is a camera pickup tube of much smaller size than image orthicon. It requires more light but is less expensive in cost and operation.

Zoom lens. This is a variable focal length lens which, by simple mechanical adjustment without physical movement of the camera, can vary the field of view without losing the clarity of focus.

III. ORGANIZATION OF REMAINDER OF THE PAPER

Literature that pertained to education, instructional and single room television was sought to secure information that would lend insight to the problem of using television effectively in industrial education. This literature was found in journals, books, and unpublished theses.

Information was found about the training a teacher needed to prepare for teaching on television. Manufacturers of television equipment and cost information was obtained. Material written about setting up cameras and receivers for televising was found. Some insight into maintenance of television equipment was gained from a master's thesis. Criteria for choosing items for televised instruction in industrial education was also found. A summary of the practicality of television for industrial education will be presented.

CHAPTER II

REVIEW OF THE LITERATURE

The literature which included information about all forms of educational television was limited to that which pertained to the use of closed-circuit television.

Diamond (1964, pp. 193-194) stated the problem which lead to the use of television in education:

> Given the same amount of time in school, a student of today must learn more information, have more educational experiences, and take more specific subjects than ever before in larger classes and with relatively fewer teachers.

A wider use of television in teaching can be expected, although there will be some subjects and some levels that will use it more than others. Demonstrations, laboratory, and observational kinds of uses will probably be most widespread. (Asheim, 1962, p. 33).

Educational television may be thought of as an all-encompassing term, since any program that informs must be educational by definition. (Lewis, 1965, p. 11). Instructional television is a part of the educational structure. It is designed by the local school for local classroom usage. Closed circuit television within a regular shop makes possible the electronic magnification of objects handled by the instructor during demonstrations. Students have an unobstructed view and the process need not be repeated with small segments of the class, as is common without television. (Lewis, 1965, p. 48).

The nature of Industrial Arts classes make them unlikely subjects for total teaching since the important doing by the student would be eliminated. Direct television teaching could be used for related information and the regular instructor would then direct the shop work. Supplementary television would be better, for the teacher is the primary source of information about his particular shop. (Diamond, 1964, p. 279). These methods of using closed circuit television are quite flexible in scheduling program material throughout the school year. (Costello, 1965, p. 134).

The information presented by Herbert, (1964) dealt with the technical aspect of television production with shop subjects given specific emphasis. This information gave specific information on purchase of equipment and how to use it to obtain quality pictures for the viewers.

The study by Manchak (1961) dealt mainly with the problem of what shop instruction could be presented better through television than without television.

These chief sources gave the writer viewpoints of specialists in the field of educational television, a study from an audiovisual viewpoint, and a study from the shop teacher's viewpoint which were helpful in putting together information to aid teachers in designing and planning for televising in the local school shop.

CHAPTER III

TEACHING WITH TELEVISION

Television will not replace teachers (Asheim, 1962, p. 135). It probably will demand effort if it is to be an adequate teaching tool. Similar to other audio-visual media, television cannot do everything. According to Costello and Gordon (1965, p. 28) television cannot give face to face contact, help develop abstract ideas, or teach seminars. Television has been useful in presenting lectures, demonstrations, panel discussions, interviews, dramatizations, other audio or visual materials, actual happenings or documents, and pupil participation.

Since the purpose of education is teaching individuals, care must be taken to insure each one will have opportunity to adequately see what the television is displaying. Preparing the classroom, though not a difficult job, is an important one. A few helpful charts were presented by Costello and Gordon (1965, p. 120) and are found in Figures 1, 2 and 3 of this study.

Teachers who use television must be well prepared because extraordinary and tense teaching situations, such as televising, require more preparation to allow the teacher to learn to relax. This additional time would help prevent short periods of memory lapse or floundering for a desired word. The well prepared teacher can help insure that television is presenting the subject by continually directing attention toward the subject matter and not toward teacher mistakes. Edward Stashoff (Asheim, 1962, p. 135) felt that three weeks of televising would help a teacher adjust to the television media and not feel like he should be an actor. Some time ought to be spent learning about handling props, graphics, microphones, rising from a seat and standing, and eye contact. Technical training on how to dress (avoiding high or low contrasts) and how to handle flashing (size and shape of charts or posters).

A good deal of thought is required for effective television presentation. The thought process obviously must precede the telecasting attempt. The first step is to determine whether television is the best possible method of presenting the material. How the information is to be presented, whether by the

Size of tube	Average square footage
17 & 19"	155
21 & 23"	260
24"	325

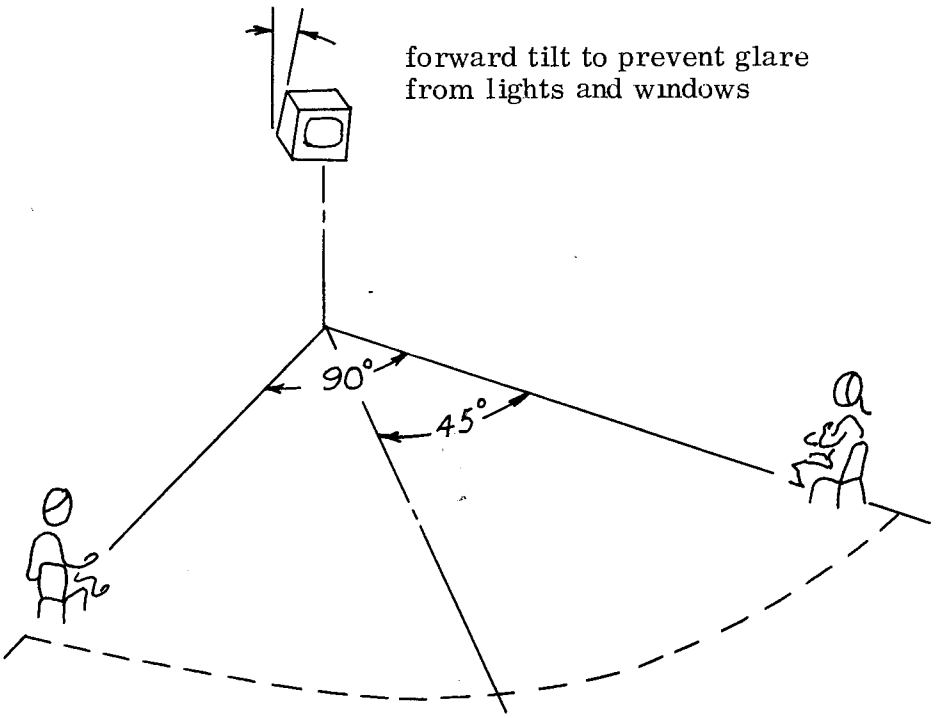

FIGURE 1

ROOM LIMITS ON VIEWING
(COSTELLO AND GORDON 1965, pp. 120-122)

Minimum viewing distance

Size of tube	Row spacing		
	3'0"	4'4"	5'2"
17"	5'6"	4'2"	3'9"
19"	5'8"	4'4"	3'10"
21"	7'1"	5'5"	4'10"
23"	7'2"	5'6"	4'11"
24"	8'0"	6'0"	5'5"

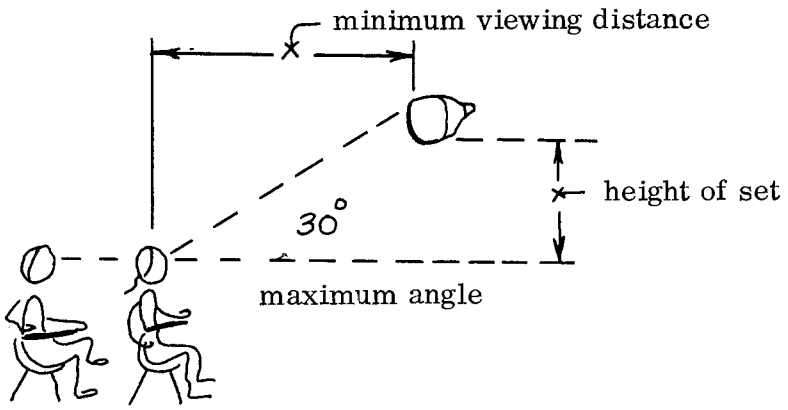

FIGURE 2

MINIMUM VIEWING DISTANCE
(COSTELLO AND GORDON 1965, pp. 120-122)

Maximum viewing distance

Size of tube	Maximum distance
17"	14'9"
19"	15'2"
21"	19'0"

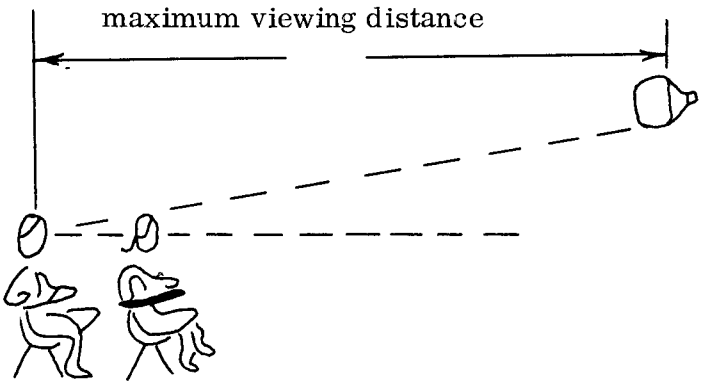

FIGURE 3

MAXIMUM VIEWING DISTANCE
(COSTELLO AND GORDON 1965, pp. 120-122)

teacher operating the camera, or some other means ought to be decided early in the plans. Scheduling equipment for practice and presentation should be done well in advance. Adequate time for rehearsal is an important step in the preparation process. Herbert (1964, p. 121) found ten of fourteen demonstrators who were unable to hold rehearsals who believed a rehearsal would have been helpful. Several of the demonstrators who did rehearse said a longer rehearsal time would have been worth the additional effort. Everything to be presented in front of the camera must be planned. (Costello, 1965, p. 72).

CHAPTER IV

PURCHASE AND MAINTENANCE INFORMATION

The pickup of program material may be done by the use of either the image orthicon camera or the vidicon camera. A comparison of their characteristics (Table I) was published by Lewis, (1961, p. 81).

Several accessories help the pickup capabilities of television cameras. Wide ranges of usage in televising requires appropriate lens to make information intelligible to viewers. The specific knowledge about lenses needed includes focal lengths, depth of field, and lens speed. Table II illustrates the relationship between lens speed and the amount of light that will produce an adequate picture.

If the camera has to follow motion, a monitor mounted directly on the camera is essential so the camera operator can keep the subject matter centered on the screen.

Lighting accessories are helpful in obtaining better pictures and clarifying three dimensional objects. The scoop reflector fixture is designed for use with high diffusion frosted white bulbs. This type of fixture is usually used as base lighting, light which casts minimum shadow. Fresnel spot lights are employed in key lighting, where a two-dimensional effect is emphasized. Fresnel lamps are also used for back lighting, that which is set behind and above an object leaving the front surface dark for accent on depth in the picture.

Occasionally lamps give noises which affect the television transmission. Mercury vapor lamps (low noise and high wattage) are recommended for use with standard scoop fixtures. Some quiet flourescent power groove tubes are also being used.

A dolly for the tripod is essential if location changes of the camera must be made.

Recent development of low cost video tape recorders make them a versatile accessory. Information about several brands are listed in Table III along with information about cameras which can be used for closed circuit television.

TABLE I

COMPARISON OF IMAGE ORTHICON AND VIDICON TUBES
(LEWIS, 1961, p. 81)

CHARACTERISTIC	IMAGE ORTHICON	VIDICON
Lighting requirements	Moderate	High
Size and weight	Large and heavy	Small and light
Operator skill required	Skilled	Amateur
Sensitivity	Excellent	Light
Initial cost	Approx. $1,000	Approx. $200
Warranted life of tube	500 hours	500 hours
Life expectancy of tube	600-700 hours	5,000 hours

TABLE II

COMPARISON OF LIGHT AND SPEED FOR
BLACK AND WHITE CAMERAS
(LEWIS 1961. p. 96)

TUBE TYPE	FOOT CANDLES	f/STOP
Image Orthicon	80-150	5.6
Vidicon	500	5.6
	250	2.8
	30-50 satisfactory for some applications	

TABLE III

VIDEO TAPE RECORDERS

Concord Electronic Corporation 1935 Armcost Avenue Los Angeles, California 90025		
Video tape system	camera * tape recorder monitor/receiver	$1,700.
	tape recorder	$1,200.
Sony Corporation of America 580 Fifth Avenue New York, New York 10036		
	Tape recorder monitor/receiver	$ 995.
	camera * tripod microphone	$ 350
	1/2" 1-hour tape	$ 40
General Electric	tape recorder camera *	$ 850 400
Shibaden	tape recorder camera *	$1,295 450.
	C O L O R	
General Electric	tape recorder 25" monitor AM-FM tuner	$2,000
	camera *	under development
Matsushita Electric Corporation of America Panasonic		
	tape recorder camera *	no price available

(*) can be used with conventional receivers for closed circuit television

The receiver used in the system can help determine how well the subject matter is in view. The standard household television set is the lowest cost and adequate as long as it is kept in adjustment. Costello (1965, p. 120) indicates the twenty-three inch set as the best choice since the screen is fairly large and the cost is low due to high production. It should be kept in mind that the maximum number of viewers should not exceed thirty-five for each receiver. (Costello, 1965, p. 120).

Herbert (1964, p. 172) in his research made recommendations for this equipment for televising Industrial Arts demonstrations. They are:

1. A transistorized camera where ruggedness was needed in case equipment has to be moved around.
2. The camera must have a viewfinder built into it.
3. The zoom lens and the 150mm lens were used most frequently with the 15mm, 25mm, 50mm, and 75mm lenses being used only occasionally. A six inch lens with an extension tube for extremely small image magnification was helpful.
4. A close-up stand was needed.
5. A standard 23" television set was lowest in cost.
6. Stands for television sets were found to be 50-60 inches high for ease of viewing.

The only specific information concerning maintenance of television equipment was obtained from Herbert's research. Ten hours were spent in maintenance of the television camera during his study which covered one semester. This time was used to make adjustments so the camera and monitors would be synchronized. Forty minutes were spent repairing connection ends of coaxial cable. (Herbert, 1964, p. 172).

A mechanical problem was encountered when the zoom lens was added to the camera turret. As reported, it was impossible to hold constant the distance between the vidicon and the lens seat causing the picture to be out of focus while the focal length of the zoom lens was being changed. (Herbert, 1964, p. 172). It was thought by Herbert that this problem could have been eliminated had the commercial equipment been changed from its condition as purchased.

CHAPTER V

CHOOSING WHAT SHOULD BE TELEVISED

The type of television instruction which was found in the literature to be best suited for Industrial Arts is the use of a single camera, operated by the instructor, and one receiver for magnification of objects during demonstrations. This does not eliminate the possibility of educational programs or regular instructional television but they were not discussed in this paper, as the available literature made no mention of their use in Industrial Arts.

Several types of material were televised clearly. The administration of tests, especially on nomenclature or identification of parts, have been satisfactorily projected. Making use of the three-dimensional effect and the allowance for everyone to see the same object are advantages of television testing. Instructions for standardized tests have been effectively presented on television. Materials which could be projected on either the overhead or opaque projectors can be presented on television. Occasionally lectures have been useful if held to about fifteen minutes. These lectures could be given by either the classroom teacher or a specialist.

The single room closed circuit television is used primarily for demonstrations. Demontrations should have one or more "deficiencies" to justify spending time televising them. The deficiency of not being able to see adjustments of small parts such as the air-fuel mixture adjustment on a carburetor would merit its being televised. The instructor is able to present a magnified view on television and all students observe the demonstration. Things that are difficult to see because of close quarters may be well presented if the camera is set up properly. Any shop where the floor area limits students from getting close enough to see demonstrations, such as the UNI Graphic Arts shop, should give consideration to television for demonstrations. Often items for display are expensive and fragile. These items can be televised with little danger of breakage. Some demonstrations are dangerous, especially if students wish to observe closely. Televised demonstrations of pouring molten metal and spinning could remove the danger to observers. An over the shoulder

view of paper placement and line-drawing will enable drafting students to observe the work as if they were doing it themselves.

Even though a demonstration would have the deficiencies which would place it under consideration for telecasting, it may need to be rejected. Demonstrations which require positional changes of the camera lose their continuity and take excessive preparation time. Those that require many steps to complete are usually better presented by some other method. Operations that require quick movements cause ghosting on the monitor screen and should be avoided. Objects should not be televised that have either high or low contrast, unless the surfaces are especially prepared. An example of excessive contrast is a piece of aluminum being spun, when undiffused light hits its surface, all the camera produces is a bright glare. At this writing, closed circuit color television is rare, so caution is given for items which require color for comprehension. Asheim states (Asheim, 1962, p. 120) if color is needed, use loop film or color slides after the television presentation.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The single room closed circuit television is the best use of the television media for Industrial Arts. As with any teaching aid, television has certain limitations which should be kept in mind while planning televised lessons. The gaining of understanding from televised instruction is dependent upon the quality of the picture on the screen. Thus the camera, lens, and receiver and their placement are important to the learning process. Many Industrial Arts shops should be using television as a means of instruction so students can realize greater visual clarity. Experience should be offered in the use of this media in training Industrial Arts instructors so they will know how to use television intelligently.

Researchers in the use of television in Industrial Arts have been seeking how it could be used to best advantage. Future research may compare the effectiveness of televised to non-televised instruction in Industrial Arts. Data which show the relative effectiveness of television as compared with single concept loop film would be of value to Industrial Arts instructors. A study to find how or if television affects teacher efficiency would be of value.

BIBLIOGRAPHY

Asheim, Lester, and others. Educational Television. Stanford, California: Stanford University Press, 1962.

Barnard, David P., "Audio Visuals," Industrial Arts and Vocational Education, 52, 1, January, 1963.

Barnard, David P. and Herbert, Harry. "Closed Circuit Television - Progress Report," Industrial Arts and Vocational Education, 55, 4, April, 1966.

Bridgewater, Earl. "National Seminars Study Educational Innovations," Midland Schools, 82, 3, January, 1968.

Costello, Lawrence and Gordon, George. Teach with Television. New York: Hastings House Publishers, 1965.

Diamond, Robert M. A Guide to Instructional Television. New York: McGraw Hill, 1964.

Diamond, Robert M. "Single Room Television," Audiovisual Instruction, 6, December, 1961.

Diamond, Robert M. "Television Tailored to High School Classroom," Audiovisual Instruction, 4, November, 1959.

Fazzini, Philip. "Experimenting with Closed Circuit Television," Industrial Arts and Vocational Education, 53, 2, February, 1964.

Gilbert, Harold G. "Closed Circuit Television," The Journal of Industrial Arts Education.

Herbert, Harry A. "Single Room Closed Circuit Television in Industrial Education," Unpublished Master's thesis, Stout State University, Menomonie, Wisconsin, 1964.

Hodges, Lewis C. and Silver, Gerald. "Quickening the Pulse of Industrial Education," School Shop, 27, 8, April, 1968.

Hulit, Darl. "Team Teaching in Industrial Education," Industrial Arts and Vocational Education, 55, 6, June, 1966.

Lewis, Philip. Education Television Guidebook. New York: McGraw Hill, 1961.

Manchak, Paul J. "Closed Circuit Television and Industrial Education," School Shop, 22, October, 1962.

Manchak, Paul J. "Direct Camera to Receiver Television as an Instructional Aid in Industrial Education," Unpublished Master's thesis, University of Maryland, College Park, Maryland, 1961.

Manchak, Paul J. "What can Television Offer Industrial Arts Teaching?" Industrial Arts Teacher, 20, 1, September, 1960.

Mitchell, Wanda B. "The Closed Circuit Television Facility," National Association of Secondary Principals Bulletin, 50, 312, October, 1966.

Neubert, Robert N. "Television in the Graphic Arts Classroom," Visual Communications, 3, 406, June 1968.

Parry, Ernest B. "Try Closed Circuit Television for Better Industrial Education," Industrial Arts and Vocational Education, 49, 10, December, 1960.

Reid, J. Christopher. "Television for Demonstrations," National Association of Secondary Principals Bulletin, 50, October, 1966.

Rudisill, Alvin E. "Packaging the Media into a Console Controlled Classroom," School Shop, 27, 8, April, 1968.

Stashoff, Edward. "Teaching the Television Teacher," National Association of Secondary Principals Bulletin. 50, 312, October, 1966.

Tucker, C.A. "Video Recordings Implement Teaching," Industrial Arts and Vocational Education, 56, 6, June, 1967.

MAGNIFICATION

Type Composition

Micrometer Reading

Spray Gun Parts

Saw Sharpening

Grid Dip Meter Operation

Vernier Calipers

Leather Tooling

Carburetor

Meter Movement

Voltage Measurements

Oscilloscope Patterns

DANGEROUS

Grinding Drill Bits

Grinding Lathe Bits

Welding

Pouring Molten Metal

Machining

Etching

Spinning

Electroplating

INACCESSIBLE

Platen Press Makeready

Spray Painting

Lock Up Printing

Paper Marbling

Electrical Motor Troubleshooting

Test Foundry Sand

Carburetor Adjustment

Viewing Inside a TV

FIRST PERSON

Set Type

Saw Filing

Turn Wire Edge

Leather Carving

Set Up Circular Saw

Use of Hand Saws

POSSIBLE DEMONSTRATIONS FOR TELEVISING

copy

University of Northern Iowa
Cedar Falls, Iowa 50613

June 27, 1968

Snyder Public Schools
Snyder, Texas

Dear Sir;

Do you have printed material on how you are using CCTV in your school? I am interested in its application at the secondary level, especially in the industrial arts department. Thank you for sending this information.

Sincerely,

/s/ Larry L. Bradshaw

Dear Sir:

Sorry, we do not have printed materials.

/s/ W.T. Falls
Assistant Superintendent
Snyder Public Schools