AN ANALYSIS OF THE FEASIBILITY OF THE UTILIZATION OF TELEVISION IN A SPECIFIC INDUSTRIAL TECHNICAL TRAINING APPLICATION

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ABSTRACT

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Two basic factors are pertinent in assessing the applicability of instructional television to the technical training courses presented to Ford Motor Company engineers located in the Company's Research and Engineering Center. In general, it is necessary to establish the academic suitability of the medium to Ford's needs and the cost of implementing such a system. The matter of academic suitability may be approached through an examination of existing instructional television applications in schools and in industry (including the military). The considerations of cost are dependent upon the nature of the existing conventionally-taught courses at Ford and the equipment and staffing expenditures involved in establishing a specific instructional television system.

Several school applications of instructional television are noteworthy. The suitability of using television in teaching is verified in the experiences of Michigan State University, the University of Michigan, the Milwaukee

Vocational and Adult Schools, and the South Carolina schools. An extensive examination of the Hagerstown, Maryland, closed-circuit system reveals many facts of importance in the design and development of a total instructional television program. Hagerstown further illustrates the form and extent of television's abilities to aid in the instructional process.

Military applications confirm that television is extensively and successfully used in the teaching of technical subjects and that it may be useful in saving time and money. The military experience, particularly as illustrated with the Lowry Technical Training Center in Denver, has been that suitable courses may be adapted to television with a decrease in instructional time and an increase in student performance. The uses found for television in private business have been mostly in extending man's senses to guard gates, watch remotely-located gauges, monitor furnace interiors, etc. Few companies have the money or need to make a company-owned system justifiable. Some companies have met this obstacle by banding together to divide the costs of presenting courses of mutual interest transmitted over an existing distribution system. North American Aviation, however, found it advantageous to establish their own extensive system. This was done upon receipt of a large government contract which caused a sudden and large increase in the Company's workforce and a need for fast and efficient employe orientation and information programs.

The forementioned experiences have established the academic framework for the use of instructional television. The requirements of the Ford Motor Company, as shown in the structure of its Technical Education Program and the statements of its management, are in fact consistent with the medium's abilities. A cost analysis, pursued in the framework of a specific instructional television system proposal, indicates that television will provide a 35% saving on a cost-per-student basis and a 27% saving on a cost-per-student-hour basis in a continuing program.

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By

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CHAPTER I

INTRODUCTION

Purpose

This thesis provides a thorough investigation of the potential value of utilizing some form of the television medium in an industrial technical education program. Specifically, this paper analyzes an application which could be made to a current program offered by the Ford Motor Company to its product engineers. While the need for the present and future use of televion in the Ford training activity is explored more thoroughly in the following pages, some background factors should be mentioned here.

Virtually all of Ford's major styling, engineering and research operations are centered in a several square mile area adjacent to Greenfield Village in Dearborn, Michigan.[1] This area, known as the Research and Engineering Center, is under the administrative control of the Ford Engineering Staff. This Staff, in effect, leases facilities

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[1]Unless otherwise noted, information pertaining to the Ford Motor Company and/or its interest in utilizing television in technical training is based on the writer's familiarity with these matters as gained through employment with the Company in the Industrial Relations Office of the Engineering Staff.

to the various Product Engineering Offices (PEOs) who do the actual engineering of the vehicles. In addition, Engineering Staff provides various services to the PEO residents of the Research and Engineering Center. Such services include, for example, administration of the test track facilities, building and grounds maintenance and industrial relations services. Engineering Staff also has the responsibility for providing proper direction to the Company's engineering efforts as a whole and ensuring that the PEOs operate in an effective and efficient manner.

As part of its Industrial Relations services, Engineering Staff provides various education and training programs for its own employes and those of the various Product Engineering Offices. These programs are initiated and implemented through the Personnel Planning Department and are designed to take advantage of the significant impact such programs are capable of having upon the growth and progress of the Company. These programs fall into three general areas: academic programs, work indoctrination programs and programs for the application of knowledge and updating. Academic programs involve various means through which the employee may pursue additional degrees or enroll in individual courses at local colleges and universities. Work indoctrination programs are aimed at ensuring that newly hired or prospective employes gain the most advantageous sequence of assignments in their early years of employment. Of the remaining programs, one is presented regularly enough, and to large enough numbers of people, to warrant the consideration of its adaptation to television. This is the Engineering Technical Education series, a series of courses designed to present engineers with the opportunity to remain up-to-date in their field and to fill in gaps in their knowledge as their assignments change. These courses are made available to employees holding engineering degrees, are automotive oriented, are taught by university professors, and make use of college texts and lectures. Each of the eleven courses currently offered consists of thirty-two hours of instruction given in a Company classroom.

The feeling of Ford management is that the Engineering Technical Education series has been very successful in meeting its aim to refresh, update and expand technical knowledge and skills. Problems which are currently being felt are not in the realm of academic objectives but in the areas of cost per student and time lost from the job. Under the current method of presentation, for example, enrollment is limited by small classrooms. The cost per student is therefore necessarily high although often there will be twice as many applicants as there are seats available. In addition, as much as thirty minutes may be lost from the job merely in transit to and from the classroom location. Management concern with expense is, however, mixed with concern over the possibility of increasing the effectiveness of the classroom presentation and enhancing student attention and sustaining interest. In other words, financial concerns do not overshadow academic concerns. In examining possible answers to both financial and academic concerns, television teaching has come to be considered as worthy of some further investigation by the Company.

The mere fact that educational uses of television have so obviously expanded gives reason to consider its possible application at Ford or in other similar applications. Even a cursory appraisal of both trade and general publications forces one to notice the trend to educational television. The point to be made is simply that individuals responsible for the existence and continuation of a highly trained and skilled industrial technical organization, it is presumed, must keep a tight rein on both present and future needs and plan to meet them with the most advanced systems possible; educational television is one such possible system.

In assessing the Company's educational goals, it is clear that the need is for large scale quality education and training economically achieved, not cheaper education and training. Here it is necessary to isolate and identify the potential functions of an educational television installation within an industrial organization. Television can be supplementary to the existing instruction given by Engineering Staff. Television might, for example, provide the additional teacher-contact needed with programmed-learning courses or eliminate the excessive time involved for a temporarily available expert to visit several classes. In some cases, television might do the total teaching job with one teacher reaching a large student body at one time with the same information. Videotape recordings would allow the same presentations to be conveniently repeated. Television might also be utilized for administrative (management) announcements or meetings with selected groups of individuals, or to convey employe-relations information.

This thesis examines educational television's feasibility in a given environment of industrial technical training. This analysis may be characterized as part of a larger concern with the need to bring together the academician's knowledge and the industrialist's needs in the most expeditious use of all available teaching and learning resources.

Plan and Organization of the Study

The conclusions reached in this paper are more than the result of an academic exercise. The writer, working with Engineering Staff management, is responsible for providing a sound basis for management decisions involving technical training within the Company. Because the conclusions reached here will have such extensive and tangible effects, there exists a very real need to ensure maximum accuracy. This need has had a significant effect upon the structure of the study.

The form of this study is partially that of the library survey. It is hoped that in this manner the maximum benefit may be derived from the experiences of others. The form of the study has been tailored to ensure that the writer not only delineate the existing status of the field, but fully utilize the prerogative to emphasize interpretation, judgment-making and application.[1] To borrow from William M. Sattler's pattern for utilizing the library survey as the theme for the complete research form, this study is organized to show: (1) problem formulation, (2) review of knowledge, (3) preliminary observation, (4) implementation recommendations if relevant.[2] It should be understood that certain elements more commonly associated with the case study and the "selective study" (historical) approach are utilized in that ". . . historical methods require the student to seek out and critically evaluate the reports of observers of past events in order to describe accurately what happened and to clarify as best he can the relationships among those events,"[3] and then "[choose] from several alternative courses of action those that appear to be appropriate to the immediate situation."[4]

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[1]Clyde W. Dow, An Introduction to Graduate Study in Speech and Theater (E. Lansing: Michigan State University Press, 1961), p. 33.

[2]Ibid., p. 43

[3]Ibid., p. 53.

[4]Ibid., p. 266.

The table of contents indicates more precisely how the writer has attempted to correlate the pattern of research with the specific objectives implied in the requirements of a large industrial corporation. It is felt that such an eclectic approach to the research pattern will facilitate accuracy and orderliness to a greater degree than would perhaps a more traditional procedure wherein the researcher has no specific application in mind.

It is obvious that the entire study could be devoted simply to a survey of television in education or in industry. Nevertheless, the inclusion of the specific (Ford) application is needed to ensure the future utility of the paper to any who may examine it. This paper may be somewhat unique in that it is concerned with an area of television utilization which is relatively rare and about which rather little has been written. What has been written is found primarily in industrial and technical trade journals, rather than in television or educational journals. Because of this unique aspect of the analysis, the writer feels an added responsibility to his counterparts in other industries and to the student who may be in search of a practical example of a relatively early investigation of television in industrial training.

CHAPTER II

SURVEY OF THE EXISTING STATUS OF TELEVISION IN RELEVANT APPLICATIONS IN PUBLIC EDUCATION

The Stimulus for Television in Education

The use of television in education is, by this time, certainly nothing new. In a report such as this it is immediately apparent, however, that the bulk of the existing experience has been gained in the field of formal education among our public grade and high-schools, colleges and universities. This pattern may be somewhat unusual today in that so many new techniques and ideas are tested and developed by suppliers of classroom materials and come to the academic world on a 'ready-to-serve' basis. Still other new approaches seem to be products of capitalistic serendipity; 'side-effects' of commercial operations quite aside from any academic concerns. This has not occurred with the development of television in education as there are few industrial organizations with either the need or ability to initiate original research in this area.

Whatever its cause, the eventual result of this developmental pattern has been that industrial organizations may now avail themselves of the body of knowledge developed by the school systems. An industrial educator may now take the role of the cautious analyst in making an informed recommendation as to possible adaptations of television teaching to industrial technical training. This section condenses and clarifies the applicable experiences found in non-'industrial' television-teaching. While several distinct cases are cited to gain the value inherent in variety, the single case of Hagerstown is stressed in that it is the most comprehensive and best-documented single example of its type. The Hagerstown situation has the additional value of providing a delineation unobtainable through the exclusive use of individual facts removed from their original context.

As may be seen in the case of the Hagerstown closed circuit television system, part of the motivation preceding such an installation is often the very real concern over providing ever-increasing numbers of students with a good education in the face of staff and facilities shortages. The other major factor involved in the consideration of television is illustrated in this comment by Benjamin C. Willis, general superintendent of the Chicago public schools:

> It is only fitting that education which creates technological advance, which makes it possible for our engineers, scientists and scholars to invest and create new media--should take advantage of some of its products and attempt to use these new advances in the instructional process.[1]

In short, not only may we view the utilization of the medium simply as a device to meet the physical demands to provide an

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[1]Philip L. Lewis, Educational Television Guidebook (New York: McGraw-Hill, 1961), p. 3.

education of any sort, but we may also hope for the possibility of raising the quality of education. In the latter regard, Thomas C. Pollock of New York University has said: "It now seems clear that television offers the greatest opportunity for the advancement of education since the introduction of movable type."[1]

Literally dozens of lists have been printed attempting to delineate the reasons why there exists such a demand for increased efficiency in teaching today. While the point has been discussed beyond the point of useful repetition in educational journals, a succinct version of the basic reasons would include the following considerations:

1. There is more to learn today--both in school and on the job
2. Educational and training costs have risen--consequently, training has to be more effective
3. Teachers and good training people are scarce--they must be spread around more.[2]

It would appear that the potential ability of television to contribute significantly to the quality of education is not in doubt. Michigan State University's position in this respect, for example, is that the medium is not an end in itself, or a device to replace other media and methods, but a new resource to be used for the purpose of gaining a greater realization of

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[1] *Ibid.*, p. 4.

[2] "Machines That Teach: Graduating Into Profits," *Steel*, October 28, 1963.

the University's educational values and objectives.[1]

From Michigan State University's major emphasis on the resident student to the University of Michigan's emphasis on the general population, it is obvious that the same theme of quality remains common. At the University of Michigan, from the time it created The Television Center in 1950, television has been considered a "unique tool for enriching and broadening its educational offerings to the people of the State of Michigan, as well as containing great potential for supplementary classroom instruction."[2] With these points in mind, we may proceed to considerations of actual applications in a variety of situations.

Survey of Current Applications

One project which contains a rather unique audience and application has been what is commonly termed The Chelsea Project, financed originally by the Ford Foundation and operated by the New York City Board of Education, Hudson Guild Neighborhood House and Language Research Institute, Incorporated, of Harvard University. This operation was designed to serve a small area of New York City comprised largely of low-income foreign-speaking groups. Three objectives were held in mind by the system designers: (1) to develop techniques of instructional television with minimal equipment and personnel for direct teaching,

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[1]Closed Circuit Television (E. Lansing: Michigan State University Press, n.d.), p. 2.

[2]Building The Program (Ann Arbor: The University of Michigan Television Center, n.d.), p. 4.

school enrichment and teacher training, (2) to explore the effectiveness of language teaching films over television as an efficient means of teaching an adopted second language, and (3) to experiment with a community-rooted television system as a means of improving integration and participation in school and community activities.[1]

The system links a 607-apartment housing project, the city health center, a settlement house, and forty-two rooms of an elementary school. The first objective was met through the use of single-lens industrial vidicon cameras mounted on monorails or fixed tripods and operated by only two people: the technician who set up the cameras and lights, and the teacher who presents the class material and switches any of the several 'pre-aimed' cameras.[2] With this system, there have been presentations of elementary school lessons, political discussions, teenage dance programs, and language instruction in Spanish and English. According to the system's backers, results have substantiated their notions that: (1) a low-cost closed-circuit television system is feasible, (2) it is possible for television to serve as a community communication medium after the fashion of the local weekly newspaper, (3) it is possible to have greater

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[1]Lawrence Creshkoff, "Closed-Circuit Television in School and Community: The Chelsea Project," _Society of Motion Picture and Television Engineers' Journal_ (November, 1959), pp. 764-68.

[2]_Ibid_.

sharing of special teaching skills within a school or area, (4) and television can be effective in breaking through communications barriers where there is a high concentration in a small area of people with a hard-core educational or cultural problem.[1]

The well-known case of the South Carolina state-wide instructional television system should be mentioned briefly to indicate the extent to which many educators have been willing to go, based on their knowledge of and faith in television as an effective medium of instructional distribution. The South Carolina system has developed to the point of serving 140 public schools, three denominational schools, three State colleges, three private colleges and five hospitals.[2] Dr. Alvin C. Eurich, director of the Ford Foundation Fund for the Advancement of Education has said of this system: "South Carolina, in our opinion, has the basis and blueprint for what educational TV needs to bring about a healthy revolution in American educational systems."[3]

In Milwaukee, The Milwaukee Institute of Technology of the Milwaukee Vocational and adult Schools is using television in teaching several of its core courses. To the Milwaukee Staff, the primary benefits of television have

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[1] Ibid.

[2] "Educational TV in Action," Radio-Electronics, January 1963, p. 34.

[3] Ibid.

been: (1) economy of classroom space, allowing a single instructor to meet with more students, (2) savings in the number of teachers required to teach core courses, freeing others to develop and teach new courses, (3) unity in teaching for all of the members of the student body taking core courses (using television for basic lectures, then small groups meeting with instructors for follow-up and discussions), (4) and improvement in the quality of teaching, primarily through team-teaching and the increased use of visuals.[1]

In all of the cases mentioned, television for instruction has been accepted by educators as no more inherently good or bad than is conventional classroom presentation. The question, then, is not one of potential ability but proper utilization. In one example of television used in the teaching of physics, this philosophy is expressed in the statement that: "because of TV's mass capabilities it becomes economically sound to spend more money and time on every lesson, and employ this medium of communication. Such lessons, planned in greater detail, employing many forms of visual aids, and presented by better than average teachers, can achieve the goals we so earnestly seek."[2]

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[1]"Milwaukee ETV System Uses Both VHF and UHF Channels," Broadcast News, CXVI (February, 1963), p. 2.

[2]"More Effective Teaching of Physics Through Television," American Journal of Physics, XXVIII (April, 1960), p. 374.

The author of this statement taught a highschool introductory physics course on WQED in 1956-1957, and served as a science teacher on NBC's Continental Classroom series in 1958-1959. It is his belief that his experience with the medium has shown that television allows more time for the teacher to polish his presentation, provides the best equipment to help make graphic presentations, and provides technical abilities (such as close-ups, split-screens, etc.) not available to the teacher or student in the conventional situation.[1] This instructor, a member of the Physics Department of the University of California at Berkeley, concludes that television "can do a superior job in the lecture room teaching and demonstrating phase of instruction."[2]

The Joint Council on Educational Television seems to substantiate the feeling that it is not the medium itself which limits successful presentation, but rather the limited numbers of teachers trained in television utilization. The Council felt, in fact, that limiting television science instruction only to supplemental or enrichment areas is necessary presently due to this deficiency. The need to train classroom teachers in the use of television, the Council said, is the "greatest problem educational television faces."[3]

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[1] Ibid., p. 369.

[2] Ibid.

[3] "TV Science Turns Up Some Problems," Chemical and Engineering News, XXXVIII (February 15, 1960), pp. 62-63.

An Analysis of a Single Large-scale Application

From what has been said of the general development of in-school television and the needs which it attempted to meet, it is logical to proceed to a more thorough examination of a single large-scale example. It should be noted that every effort has been made to profit from a variety of sources and reporters in examining the case of Hagerstown. This is done in an effort to avoid the inaccuracies possible when using only a limited number of sources.

Even to the casual observer, it would appear that the undisputed leader of public-school closed-circuit educational television experiments is that found in the school system of Washington County, Maryland. To those interested in this use of the medium, Hagerstown (the County seat) has come to symbolize the case of the wide-spread practical application. Great benefit may be had from this illustration of the applied situation.

With an eye toward the eventual absorption of the Hagerstown data into an industrial application of training via television, it must be assumed that the major concern in the latter case is not with the examination of the device after its installation, but with the assurance of its success before its acceptance. To this question of applied value, the case of the actual example appears to be the most efficient and effective answer. In the case of Hagerstown, as well as in the cases of the previously presented instances, it is expected that answers will be apparent through an examination of actual experiences. This same form of substantiation is followed again in later examinations of the existing industrial applications of television. A final preliminary note to the Hagerstown case is simply to emphasize that, regardless of the generalities applicable to all television instruction, the context of primary education is far removed from that of post-graduate technical education. Appropriate precautions should be taken against prematurely projecting the results from the one to the analysis of the other.

The Hagerstown closed-circuit instructional television project was not the product of someone's attempt to sell the Washington County Board of Education on a pet idea, nor did it materialize as a spur-of-the-moment movement. Hagerstown officials did not, however, originate the idea; they did take advantage of an opportune offering. Several years prior to the opening of the Hagerstown instructional television facilities in the Fall of 1956, the Ford Foundation (through one of its organizations, The Fund for the Advancement of Education) made known its desire to accept applications for a large scale experiment involving the extensive usage of instructional television in elementary and secondary schools.[1] The experiment would involve focusing

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[1]U. S., Department of Health, Education and Welfare, Office of Education, Television in Our Schools (Bulletin 1952, No. 16, Revised 1956) (Washington: U. S. Government Printing Office, 1956), pp. 23-24.

instructional television efforts on a particular system rather than in numerous widely separated and unrelated schools, although The Fund undertook such a project at a later time.[1] The Ford Foundation was not alone in its generosity but had teamed up with RETMA (Radio-Electronics-Television Manufacturers Association) which had agreed, through its member companies, to supply the needed equipment for such an undertaking. RETMA, incidentally, officially changed its title to EIA (Electronics Industries Association) sometime later and there is often seen the confusing reference to both "RETMA" and "EIA" in various publications regarding Hagerstown.[2]

Communities vary greatly in their propensity to accept change of any sort and their degree of community interest and involvement. Naturally, this characteristic would affect such a radical development as the introduction of televised instruction in public education. Hagerstown appears to have had a history indicating official desire to ensure both the common and individual good, and to provide for future expansion where feasible. An early and extensive modification in the city's sanitation facilities, for example, provided not just a short-term improvement but provided a

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[1]Alexander J. Stoddard, Schools For Tomorrow: An Educator's Blueprint. A Report by the Fund for the Advancement of Education (New York: The Ford Foundation, 1957).

[2]U. S., Department of Health, Education and Welfare, op. cit.

capacity for any eventuality in population increase for many years.[1]

More notable in this regard, perhaps, is the example of civic concern and involvement evidenced in Hagerstown's public housing. This project was in full swing several years prior to the Hagerstown closed-circuit television project and is worthy of some consideration because of its exemplification of the values and attitudes of Hagerstown's citizenry. Hagerstown had a history of housing shortage accentuated by a rapid growth of the locally-based aircraft industry and a resultant crowding of low-wage groups. Whole families, for example, were occupying each of the rooms in what had formally been a one-family dwelling. In 1950 city officials, with the assistance of aircraft industry executives, began implementing corrective plans. These plans were the result of official concern and study and brought the establishment of a local housing authority. This was done because of the realization that private owners of slum dwellings would not sacrifice their tremendous financial gains for the public good. Typical of the results were larger, better and less expensive living quarters for the great majority of those in need and an increase in city and county income due to utilities and tax money. A characteristic expression in Hagerstown became "Public Housing is a

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[1]"Hagerstown Doubles Primary Settling Capacity," American City, LXIV (October, 1949), p. 115.

Public Benefit."[1]

To this atmosphere, then, came The Fund's open invitation. Here was an opportunity for a very specific test-case for extensive instructional television utilization. It might be noted for the clarification of the over-all developmental picture, that The Fund initiated a national program the year after Hagerstown's program began. This latter project involved about 250 school systems and 250,000 students, although Hagerstown remained the largest single example.[2]

Because of the generally low economic situation but generally high public spirit, Hagerstown eagerly submitted its bid for the test-case experiment. With relation to psychological readiness, it is interesting to note that, in this city of 40,000, teacher involvement had been rather the rule than the exception in the past; future planning was a primary goal.[3] This is evidenced by the eight year curriculum re-evaluation which was well underway and which involved <u>all</u> county teachers and polled, among other things, their ideas and attitudes regarding both the good and the bad parts of the instructional program.[4] In addition,

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[1]"Public Housing Comes to Hagerstown, Maryland," <u>American City</u>, LXIX (July, 1954), pp. 126-27.

[2]<u>National Parent-Teacher</u> (November, 1960).

[3]<u>Teaching by Television</u>, A Report by the Fund for the Advancement of Education (New York: The Ford Foundation, n.d.), p. 41.

[4]<u>Ibid</u>.

summer workshops and between-semesters workshops had been conducted for six years prior to the arrival of television on the Hagerstown scene.[1] Instructional television arrived in a context and environment conducive to its ready acceptance and smooth implementation.

With this background, Hagerstown was chosen from among the forty applicants to The Fund and RETMA.[2] The position of the Washington County Board of Education officials was additionally enhanced by the offer of the local telephone company to supply and install the necessary coaxial cable without cost to the school system.[3]

The general feeling in Hagerstown included a realization that the increases in school population had turned at least their larger schools from small, informal and personal types of organizations, into large institutions. In this environment, 'administration' could readily mean management of plant and staff rather than guidance of boys and girls.[4] This, then, was another factor motivating the search for a richer yet less costly method of instruction than that characterized by the conventional situation.[5]

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[1] Ibid., p. 42.

[2] Saturday Review, XL (August 24, 1957), pp. 9-11.

[3] Organization for European Economic Cooperation, Office for Scientific and Technical Personnel, Television for School Science. A Report on an OEEC Seminar, Ashridge, England (Paris: July, 1960).

[4] National Education Association Journal, XLVII (January, 1958), pp. 26-28.

[5] Fund for the Advancement of Education, Teaching by Television, p. 39.

Implementation activities really got under way in the summer preceding the beginning of the 1956-1957 school year. This was the beginning of a project which, by 1960, would include 48 schools with 18,000 students over 460 square miles of Washington County.[1] The initial season, however, was planned only for the inclusion of the schools within Hagerstown itself. In fact, in the Fall of 1956, the closed-circuit system opened with ten subjects presented to 4,941 students in eight Hagerstown schools.[2]

Superintendent William M. Brish, in opening the special summer-1956 workshop, indicated the over-all purpose of the experiment by saying that it was to:

> 1. . . . discover ways in which CCTV may be used to improve the program of public education at the elementary and secondary level.
>
> 2. . . . test ways of dealing with problems like the shortage of qualified teachers, rapidly increasing enrollments, [and] lack of adequate facilities. . . .[3]

While much of the planning was done with the assistance and cooperation of the U. S. Office of Education, the National Education Association and other educational leaders,[4]

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[1]Organization for European Economic Cooperation, *op. cit.*

[2]Fund for the Advancement of Education, *Teaching by Television*, p. 41.

[3]"The Hagerstown Story," *The A.E.R.T. Journal*, XVI (October, 1956), pp. 20-23.

[4]*Ibid.*

the great bulk of actual matters of application fell to Hagerstown's teachers and administrators during the July 9-August 17 workshop in the summer of 1956.[1] Here again it was noted that Hagerstown showed great suitability for such an experiment through the curriculum study and building construction programs then in progress in Washington County.[2] The workshop was attended by some forty teachers and supervisors and staffed by guest specialists from existing educational television projects. The meetings themselves took place at the actual television origination facility (a converted Board of Education building) in order to enhance first-hand knowledge and familiarity.[3]

From the outset the keynote of planning was the emphasis on effectively integrating the instructional television with the classroom situation and making an effective team of the television teacher and the classroom teacher. The overriding objective of the planners was, of course, how best instructional television could serve a system involving more lessons, a broader range of subjects, and more schools, pupils and teachers than there was precedent for; in brief, to establish the best precedent.[4]

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[1] Ibid.

[2] Ibid.

[3] U. S., Department of Health, Education and Welfare, op. cit.

[4] Fund for the Advancement of Education, Teaching by Television, p. 39.

Throughout the planning, Brish emphasized that television was not a gadget but an important development such as was the textbook; it would give everyone a front-row seat, make normal audio-visual material more usable and economical and allow more time for better preparation.[1] The feeling of the teachers and other planners was that Hagerstown would be ". . . one of the most significant experimental studies in the educational television field . . ." and that every care would be taken to see that no human error consciously adulterated the degree or direction of the significance.[2]

Besides establishing procedural channels for a constant supply of 'feedback' from the classrooms to the television personnel, the workshoppers laid out and 'scripted' the basic presentations for the coming season. At the same time, a list was established to indicate the abilities and inabilities associated with the new medium:

It probably could--

- Motivate and stimulate
- Inform
- Demonstrate
- Develop ideas
- Show application
- Enrich backgrounds
- Raise questions
- Provide common experiences

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[1] Saturday Review, loc. cit.

[2] Fund for the Advancement of Education, Schools For Tomorrow: An Educator's Blueprint, op. cit.

Suggest activities
Challenge pupils to assume more responsibility for their own study

It probably could not--
Handle classroom discussion
Clear up misunderstandings
Provide for follow-up of lessons
Help pupils apply what has been learned
Direct and supervise the activities growing out of the lesson.[1]

Instructional classroom presentations, while the primary area of initial concern, were only a part of the anticipated uses for the closed-circuit system. The over-all areas for utilization are noted in Table 1. The basic courses presented and the initial signal distribution are shown in Table 2 and Figure 1 respectively (as of September 1956). These facts indicate something of the status of the initial planning. The system soon grew until it bore little resemblance to that of the early times. By 1960, 125 lessons per week went out from five studies to reach ninety-two per-cent of the students in the County.[2]

The project grew quickly from the first lessons televised with mobile equipment from makeshift studios.[3] The initial equipment lack caused the reduction of the original schedule to include only the four high-school subject areas

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[1]Closed-Circuit Television Project Notes (Hagerstown: Washington County Board of Education, January 16, 1957).

[2]"Tape Recorded Teaching at Hagerstown," Educational Screen and Audiovisual Guide, XXXIX (May, 1960), pp. 226-28.

[3]"Dateline: Hagerstown," The A.E.R.T. Journal, XVI (March, 1957), pp. 8-10.

TABLE 1

AREAS OF CLOSED-CIRCUIT TELEVISION PROJECT 1956-1960[a]

Direct Instruction	Grade	Supplementary Instruction	In-Service Teacher Training	Special Groups
Science	9	Science Demonstrations	Presentation of Professional Material to Faculty	Parent-Teacher Association
Geometry	10	Films	Annual Curriculum Workshop	Local Service Clubs
History	11	General Orientation		Community Organizations
English	12	Coordination As Needed		
Science	6	Special Displays		
Arithmetic	5	Dramatics		
Social Stud.	4	Student Council		
Reading	1-2-3	Citizenship Activities		
Art	1-2-3 4-5-6	Current News		
Music	4-5-6	Use of Special Network Programs		

[a]Closed-Circuit Television Project Notes (Hagerstown: Washington County Board of Education, 1957).

TABLE 2

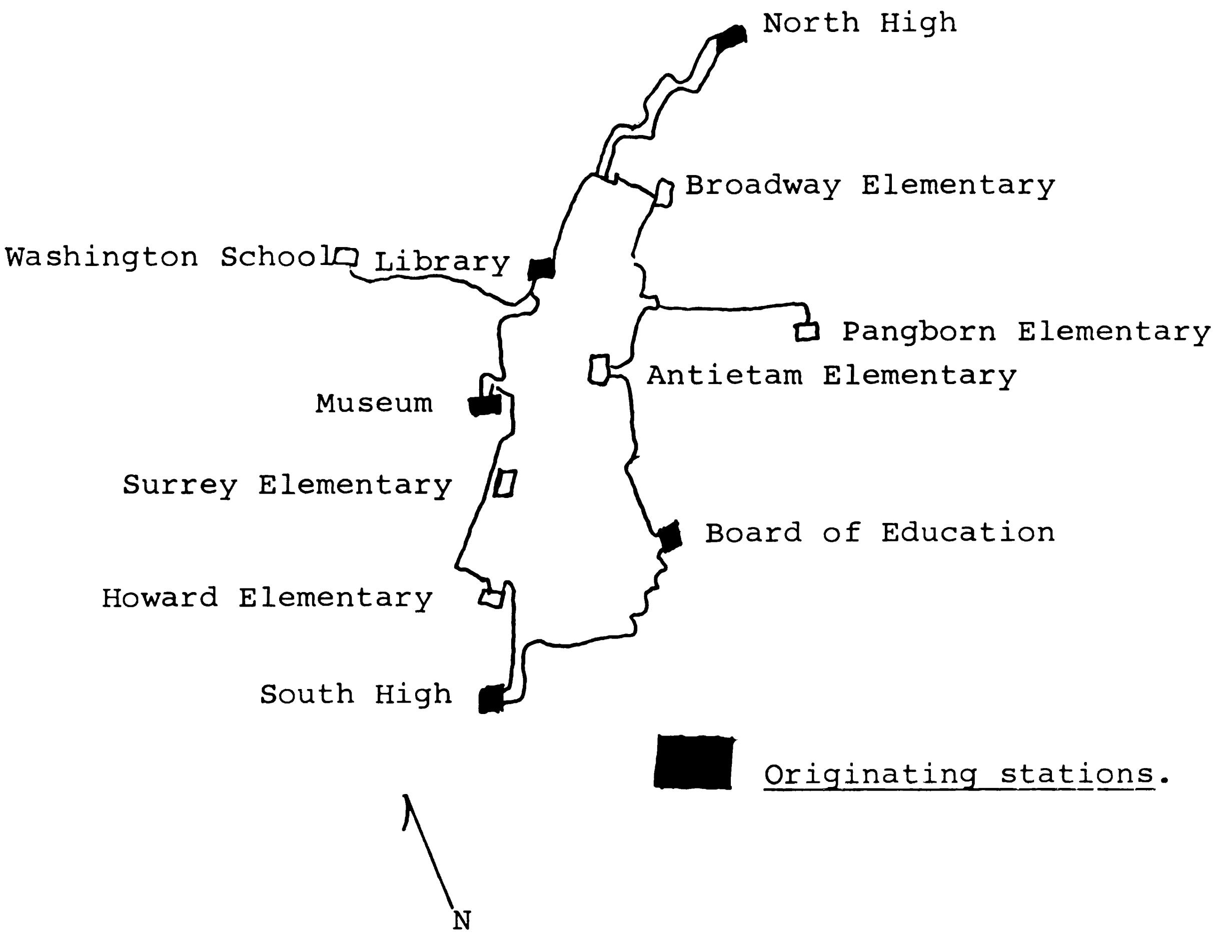
INITIAL PRESENTATIONS
1956-1957[a]

Studio A	Grade	Studio B	Grade
9:05-9:35		9:05-9:35	
Eng. (Part 1)	12	Eng. (Part 2)	12
10:05-10:35		10:05-10:25	
Science 1	9	Mon - Reading	3
		Wed - Reading	2
		Thur - Reading	1
11:15-11:35		Fri - Reading	1-2-3
Mon - Music	4		
Tues - Music	5		
Wed - Art	4-5-6	11:10-11:35	
Thur - Music	4	Geometry	10
Fri - Music	5		
		12:00-12:40	
1:10-1:30		Thur - Guidance	--
Soc. Studies	4		
		1:10-1:40	
1:45-2:05		Arithmetic	5
Mon - Arith.	1		
Tues - Arith.	2		
Wed - Arith.	3	2:35-3:05	
Thur - Arith.	1-2-3	History	11
Fri - Film	1-2-3		
2:30-3:00			
Mon - Science	6		
Tues - Science	6		
Wed - Music	6		
Thur - Science	6		
Fri - Music	6		

[a]*Ibid*.

FIGURE 1

INITIAL DISTRIBUTION SYSTEM
(1956-1957)[a]



[a]L. L. Lewis, "Equipping the Hagerstown ETV Project," The American School Board Journal, (January, 1958), pp. 39-41.

for the first several months.[1] This problem, in fact, prompted at least a small amount of friction between sponsors of the project. On this occasion, John Weiss, Fund treasurer, noted that RETMA had shown ". . . [an] appalling failure to deliver first-class equipment" and cited such examples as "sixty kids watching on one twenty-one inch receiver" as illustrative of inadequate supplies.[2] Even such comments as these, however, were mixed with bouquets for RETMA and, perhaps, appear more severe in retrospect than at the time.

The emphasis upon classroom and television teacher interaction was continued. Soon it was apparent that Hagerstown would be able to serve more students with the able teachers already on the staff and to get along with fewer new teachers than would otherwise have been possible.[3] One important factor in this respect was the fact that consolidation was possible; some classes were made much larger than usual, up to four times the County average of thirty-two.[4] It became apparent, too, that the original question regarding the relative merits of closed- versus open-circuit

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[1]Ibid.

[2]Television Digest, March 16, 1957.

[3]"Classroom TV Enters a New Era," Saturday Review, XLIV (May 20, 1961).

[4]Fund for the Advancement of Education, Teaching by Television, loc. cit.

distribution was answered in favor of the closed-circuit system.[1]

Throughout the planning and subsequent development, the point of qualitative reference was not television but education. To quote Brish: "we began by talking about television, and we find ourselves constantly talking about education."[2] The project stimulated an intensive re-examination of educational needs and processes in the staff and a general enthusiasm among educators and other community members over the "quality of education and the quality of learning that television lessons make possible."[3] Again to quote Mr. Brish, "everyone found himself re-evaluating his set ideas about education for the first time in a long time."[4]

Beside the specific case of the television experiment, Hagerstown evidenced its approach to education in the design of two new high schools. Designers, working closely with teachers and administrators, produced two schools rather than the single but larger central facility which had been contemplated. The new buildings were fashioned around a central

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[1]Ibid.

[2]"Nearly 6,000 Hagerstown Students View Closed-Circuit TV Lessons," The School Executive, LXXVI (March, 1957), p. 78.

[3]"Teaching by Television in Hagerstown," The School Review, LXV (December, 1957), pp. 466-73.

[4]Saturday Review, XL (August 25, 1957), pp. 9-11.

general-education laboratory which is equipped for many kinds of work. The curriculum is planned to bind the separate subject areas into a cohesive whole; the teachers (as in the television project) work as a team and emphasize the individual student.[1]

No trained television personnel were utilized as TV teachers; the existing teachers served this role.[2] While some teachers who were offered positions as television teachers preferred to remain in the more personal atmosphere of the classroom, others found the new function both stimulating and challenging.[3] "The important thing, too," said geometry teacher James Davis, "is that we can now give better lessons because of the greater time and thought we can devote to them. With the new challenge of TV, we continually look for new ways, as in the case of the magnetic board and pegboard, to improve the quality of each lesson as we become more aware of the factors that make for effective teaching."[4]

Measurable results were seen available to indicate that improved teaching had indeed materialized as hoped. The art and music programs would not have been financially feasible without television. Fifth grade arithmetic with television

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[1]*National Education Association Journal*, *loc. cit.*

[2]*The School Review*, *op. cit.*

[3]*Saturday Review*, XL (August 25, 1957), pp. 9-11.

[4]*Ibid.*

indicated the TV-students above the national norms with "striking progress."[1] In the school year 1957-1958, third through eighth grade matched-pair tests showed TV-students significantly better in five of the six grades. In this case, students matched in ability and initial status were split between TV and non-TV classes. Classroom teachers indicated that the television courses (or segments of a course) were interesting, well received by students and helpful in up-grading classroom-teacher quality through example.[2] Students sometimes found, especially on the secondary level, that they would like to ask a question when they couldn't, but admitted that this increased the necessity of paying close attention to the material and created livelier discussions in the ensuing classroom follow-up. In the elementary grades, children often reacted to the TV teacher much as if she were physically in the room.[3]

The reader is encouraged to spend a few moments considering Tables three through seven. These Tables, while by no means a complete survey of the total body of data, are typical of the experimental results obtained and serve to indicate the theoretical basis of television's utility in Hagerstown.

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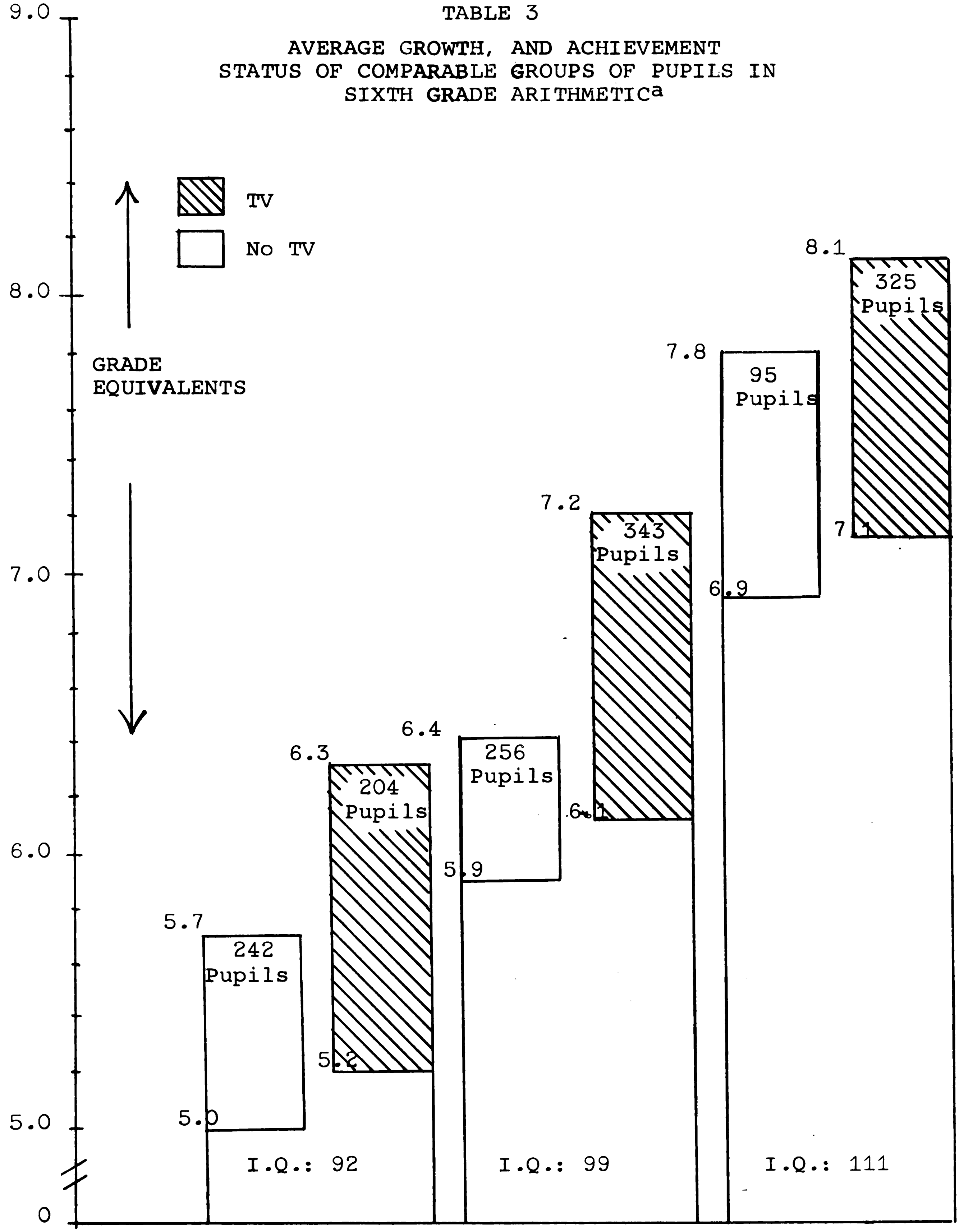
[1]Fund for the Advancement of Education, Teaching by Television, p. 43.

[2]Ibid.

[3]Saturday Review, XL (August 25, 1957), pp. 9-11.

TABLE 3

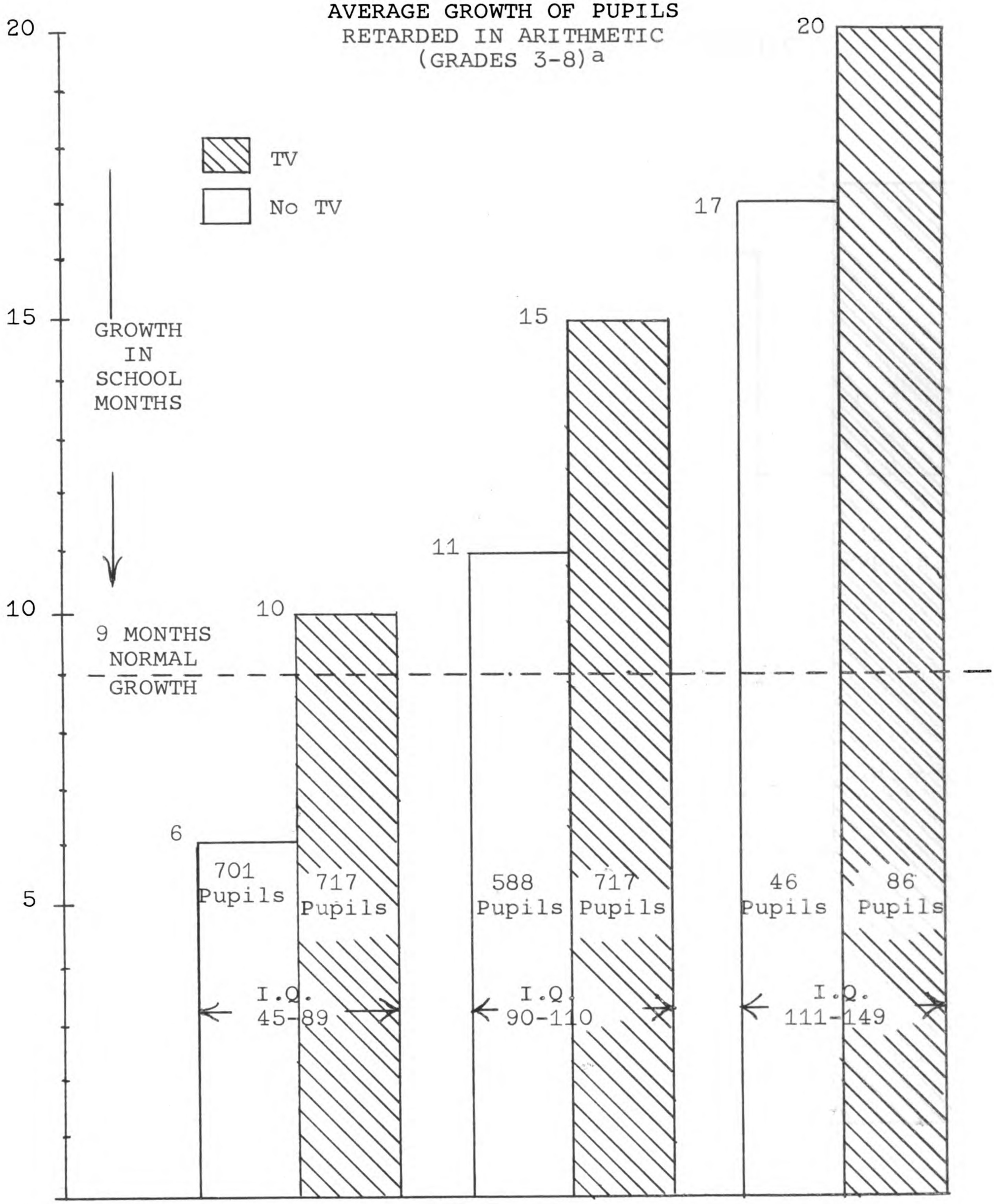
AVERAGE GROWTH, AND ACHIEVEMENT STATUS OF COMPARABLE GROUPS OF PUPILS IN SIXTH GRADE ARITHMETIC[a]



[a]Closed-Circuit Television (Teaching in Washington County 1958-1959) (Hagerstown: Washington County Board of Education, 1959), p. 26.

TABLE 4

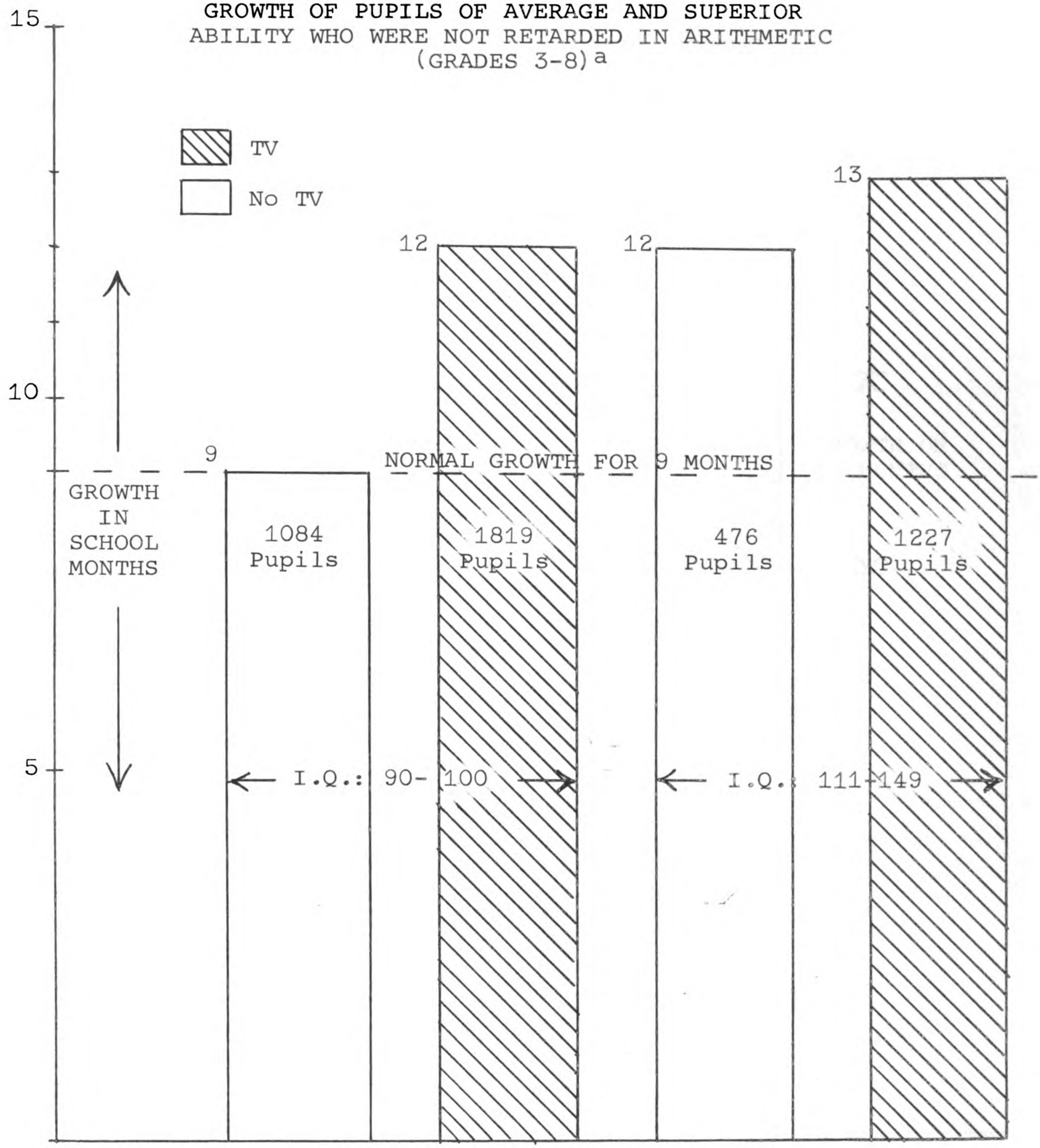
AVERAGE GROWTH OF PUPILS
RETARDED IN ARITHMETIC
(GRADES 3-8)[a]



[a]Ibid., p. 27.

TABLE 5

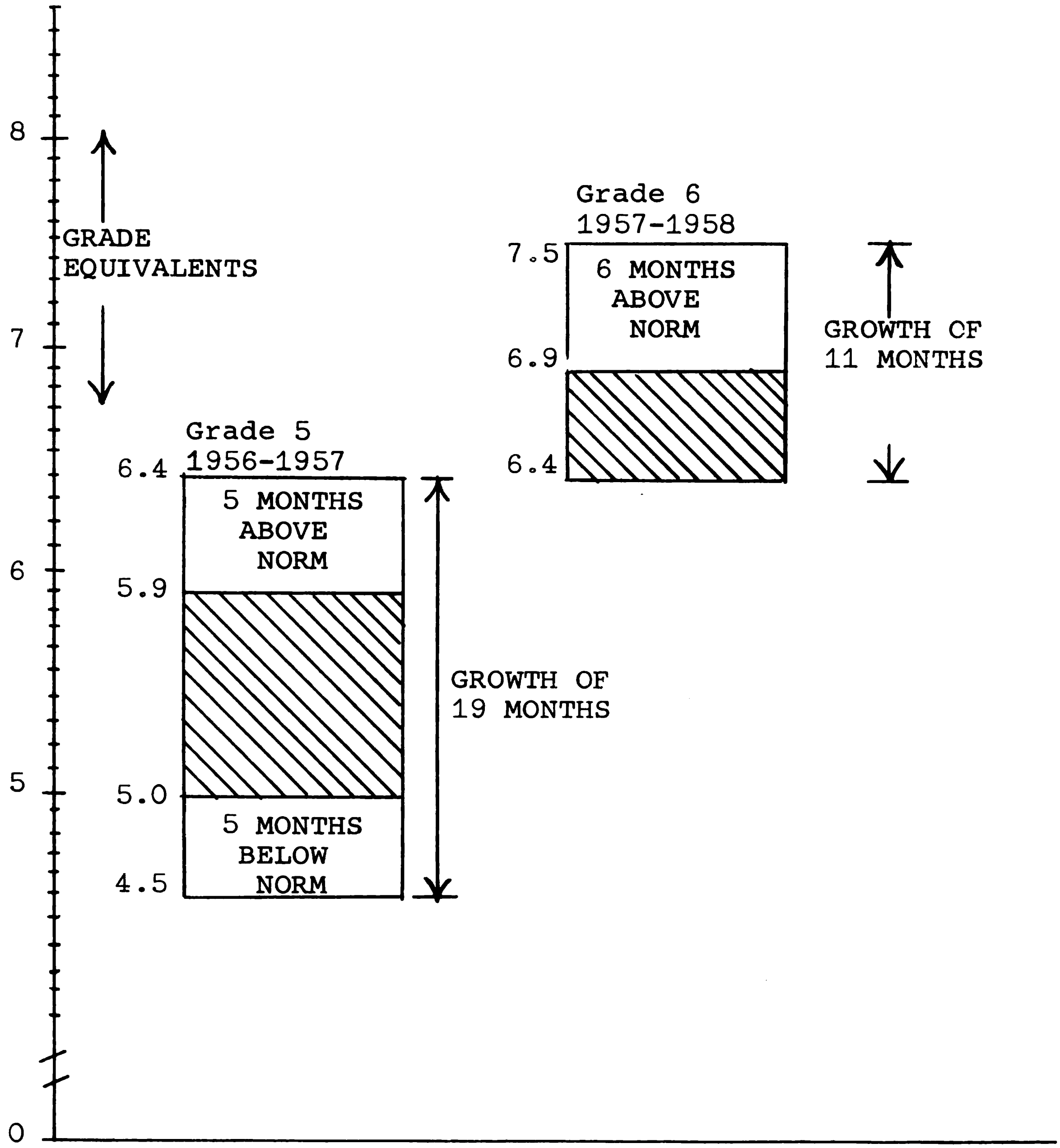
GROWTH OF PUPILS OF AVERAGE AND SUPERIOR ABILITY WHO WERE NOT RETARDED IN ARITHMETIC (GRADES 3-8)[a]



[a]*Ibid*., p. 28.

TABLE 6

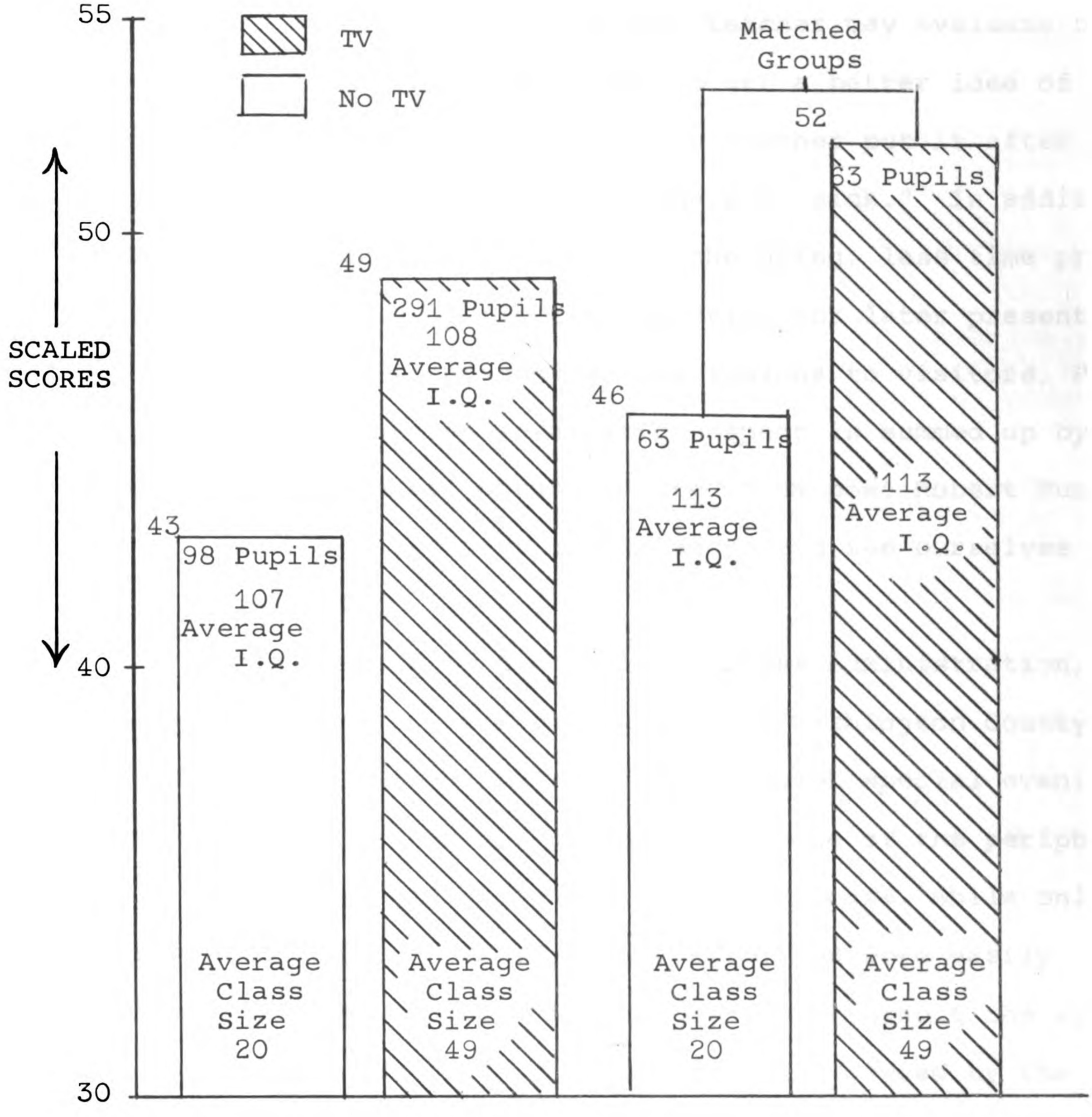
MEDIAN GROWTH OF 268 STUDENTS DURING TWO CONSECUTIVE YEARS OF TELEVISED ARITHMETIC (AVERAGE I.Q. 101)[a]



[a] *Ibid.*, p. 29.

TABLE 7

AVERAGE ACHIEVEMENT OF COMPARABLE GROUPS OF STUDENTS IN PLANE GEOMETRY[a]



[a] *Ibid.*, p. 30.

As Hagerstown has settled into the less hectic routine derived from experience, more of the secondary uses for its CCTV system are beginning to show. Recording now with video-tape, for example, the television teacher may evaluate his performance in privacy and come to get a better idea of how others see him. As one television teacher put it after seeing herself presenting a lesson, "I make me sick." In addition, tape allows for more convenient scheduling, less time pressure, the capture of fleeting material for later presentation, and the ability to present sample lessons to visitors, PTA groups, etc. The self-evaluation aspect is summed up by the television teachers' phrase adapted from poet Robert Burns: "now some Power the gift has given us--to see ourselves as others see us!"[1]

Co-sponsored by the Small Business Administration, the Hagerstown Chamber of Commerce and the Washington County Board of Education was a recent eight-week special evening program for businessmen, demonstrating one of the peripheral uses of the television system.[2] In this case, while only 100 persons were expected, 225 arrived and were easily accommodated in several viewing points throughout the system. The cost of this program was fully covered by the fifteen dollar per-person charge.[3]

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[1]Educational Screen and Audiovisual Guide, loc. cit.

[2]"Businessmen Learn via Hagerstown CCTV," The N.A.E.B. Journal, XXI (November-December, 1962), pp. 44-46.

[3]RCA Educational TV News, Issue No. 54 (Camden: Radio Corporation of America, November, 1961).

Summary

The foregoing examples on in-school television utilization are representative of the total experience with the medium. It may be concluded that the general experience with televised instruction has been as follows:

1. The quality of televised presentations may easily surpass that found in the conventional presentation. This is due largely to the possibility of using the best teacher available, refining the delivery, and making greater use of effective visual-aids.

2. Students taught by television almost invariably demonstrate learning equal to or better than that shown by students given the same material under conventional circumstances.

3. Television is most readily adaptable to cases where the subject material is presented largely or entirely in lecture fashion.

A great deal more could be said about both the strong and weak points of televised presentations as learned from the experiences of our nation's schools. For the present investigation, suffice it to say that the medium is in fairly wide-spread use, growing, and has been successful in meeting certain needs as noted. What has preceded strongly hints of the following general capabilities of television in teaching:

1. Each student has direct eye-contact with the instructor and a "front-row-center" seat.

2. Each student's attention is forced to only what the instructor wishes him to see and he may see close-ups of small items difficult to see in a normal classroom presentation.

3. Videotapes allow for convenient scheduling and the presentation of exactly the same material to later classes.

4. Costly duplication of effort may be avoided by a central facility coordinating the use of visual materials and structuring course content.

5. Large numbers of students and last-minute increases in enrollments may easily be accommodated.[1]

These points vary in their importance and validity according to the particular context. Nonetheless, their general validity seems strongly supported by the experiences found in these installations under study here.[2]

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[1]The reader interested in other sources of analytical information will find a helpful bibliography in: Lewis, op. cit. While more recent publications are available, much of the information published in the mid-1960's, for example, seems to be oriented more toward gaining publicity for bigger and better installations and less toward analysis and experimentation. It may well be that instructional television passed through most of its developmental stages in the 1950's and that today's reports reflect that the medium is in a stage of expansion based on these previously established principles.

[2]This contention is supported, and the listed points noted as applicable to such diverse fields as medicine, engineering, education, nursing, law and pharmacy in a letter to the writer from Dr. James B. Tintera, Professor and Director, Mass Communications Center, Wayne State University, Detroit, Michigan, June 14, 1965.

CHAPTER III

SURVEY OF THE EXISTING STATUS OF TELEVISION IN RELEVANT APPLICATIONS IN INDUSTRY AND OTHER AREAS

The Pattern of Development

Because so much of the development of instructional television has occurred in schools, it seems most beneficial to combine all non-school applications into one group. The following Chapter examines the applications and experiences found in non-school uses--that is, to use the term broadly, in 'industry.'

The general pattern of development in industry has been in other than instructional uses. In order to better understand the position in which industry finds itself at the present time, it is well to consider its current outlook on television as shaped by these non-academic uses. Such uses have come to be generally classified as "Industrial Television" and the medium has definitely gained acceptance in such functions as monitoring bank operations, viewing hotel lobbies (or railroad yards or factory gates) and even 'baby sitting.'[1] Several varying kinds of applications

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[1]"Closed-Circuit TV Advances," Radio-Electronics, XXXIII (May, 1962), p. 31.

might be mentioned in order to briefly describe the experiences not immediately related to the present concern but certainly helpful to total understanding. The following examples are illustrative of the applications in which television is being used:

1. Between wide-spread branches of a bank for document viewing and signature verification.[1]

2. On U. S. aircraft carriers to record landings for immediate play-back to pilots in training.[2]

3. On ships to aid the helmsman in 'seeing' the extremities of his vessel in manuevering in and out of berth.[3]

4. In target-towing aircraft as a 'rear-view mirror' to avoid fouling winched-in targets in the plane's tail assembly.[4]

5. By power-generation engineers for remote viewing of water levels, gauges, and furnace combustion chamber.[5]

6. In commercial photography to provide an immediate preview of portrait poses, and in side-stepping the need to process proof-prints by viewing negatives directly.[6]

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[1]"Closed-Circuit TV for Bank Branches," Engineer, CCVIII (December 11, 1959), p. 791.

[2]"Closed-Circuit Television," Industrial Electronics, I (March, 1963), p. 313.

[3]Ibid.

[4]"A Unique Use of Closed-Circuit Television," Engineering, CXCIV (September 14, 1962), p. 361.

[5]"Closed-Circuit Television," Power, CVIII (July, 1964), p. 155.

[6]"New Uses For Closed-Circuit TV," Radio-Electronics, XXXIII (March, 1962), p. 41.

As mentioned, these illustrations are far afield from the present concerns insofar as actual applications are concerned. What is important to the characterization of the current context is that such installations are most typical of today's industrial applications; there are, in fact, very few exceptions to this trend. This tendency is illustrated by one company's survey of industrial uses which listed production control, material handling, dangerous viewing, silent paging, security monitoring, announcements, and training.[1]

Television's obvious technical abilities have been the forces behind many of the uses mentioned. Television has the ability to communicate immediately (as illustrated by the use of televised arrival-departure boards in rail and air terminals[2]), and the ability to perform where man cannot (as illustrated in its use where something is too hot, too inconvenient or too dangerous for man[3]). But more than doing jobs which man alone simply could not, the medium allows man to perform more efficiently. The Hughes Aircraft Company's El Segundo California factory, for example, has installed a plant-wide television system which it claims has been instrumental in drastically reducing paper work.

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[1]"Closed-Circuit TV Grows with its Uses," Engineering, CXCI (May 12, 1961), p. 650.

[2]"Television in Industry," Industrial Electronics, I (October, 1963), p. 3.

[3]"Closed-Circuit Television For Industrial Application," Iron and Steel Engineer, XXXVII (July, 1960), pp. 78-81.

The Company states that more than $50,000 was saved in the first sixteen months of operation.[1] Convair engineers have reported that when they installed television for the inspection of large missile and aircraft parts they cut inspection time of various parts from 40% to 70%.[2] Perhaps the nature of television as a potential efficiency-booster is best typified by an operation of the Ford Motor Company stamping plant in Buffalo where a single operator, using television, is now able to collect large quantities of scrap, bale it, transport it, and load it on gondola-cars.[3]

General Survey of Military Applications

Industrial applications have not, however, been completely on the non-instructional side. Two primary sources of experience exist in the broad category of 'industry' applications--the military, and private business. Again, while great quantities of information could be gained from the many past experiments (especially in the military), it seems most advantageous to consolidate much of the information and concentrate on a single experience or two which typify the military experience. In the case of private business, several situations will be touched upon in brief

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[1]"New Roles for Industrial TV," Supervision (May, 1964), pp. 20-22.

[2]Ibid.

[3]Ibid.

inasmuch as no single suitable documented case presently exists.

Perhaps the largest single installation of instructional television in the military is at the Lowry Technical Training Center, Denver, Colorado. The initial impetus for the use of instructional television came from considerations of staff efficiency in conventional classroom presentations. Studies conducted at Lowry indicated that, at any given moment, some 20% of the instructors were fully qualified by military standards, while the remaining 80% were somewhere between the extremes of being newly-assigned and nearly-qualified. Because of the continuous turnover of military instructors, this ratio held relatively constant in spite of continuous and extensive instructor cross-training programs. The obvious problem, then, was how to best utilize the available highly qualified 20% of the faculty. Instructional television seemed to offer possible solutions.[1]

Anyone fairly familiar with the dilemmas of modern education might easily imagine what occurred to the Lowry planners at this point. It was presumed that if the fully qualified 20% of the teaching staff could be placed in a television studio, there would be virtually no limit to the numbers of students that they could then reach; in effect they could do 100% of the teaching job while freeing the remaining

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[1]United States Air Force Air Training Command, Technical Training by Televised Instruction (Denver: Lowry Technical Training Center, October, 1964), p. 2.

80% to work with students in the classrooms and carry out the normal and relatively routine duties of administration. It was hypothesized at this time that such an action would have the effect of stabilizing training quality and raising it to the highest level. It had been the practice to accept the conventional variance in quality and the resultant lower norm.[1]

As Lowry approached its initial stage of controlled experimentation, planners noted that there exist two important aspects of communication in technical training: the transmission and inculcation of knowledge and of skills. It was found that television presentations were primarily efficient in the presentation of knowledge, while the laboratory work was primarily skill-oriented and best left to methods where the student is actively doing the work. A further premise in development had been that the demonstration aspects of technical training would greatly benefit from the use of television. This was proven to indeed be the case, and to this end Lowry's approach to television was to use a full 'production' set-up in which full use could be made of close-ups, fades, superimpositions, etc.[2] Television at Lowry was not used simply to enlarge or supplement by placing a single camera in front of a rigidly-placed

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[1] Ibid.

[2] Ibid., p. 3.

instructor, but to replace a portion of the instruction with what was felt to be a more effective method. Certain results became apparent:

1. TV students learned more and learned more thoroughly.

2. TV students were better prepared to begin their laboratory periods, and made more effective use of them.

3. TV produced savings in the total training time required; the TV students learned faster and the TV method saved time.[1]

In one example of Lowry's operation, the Department of Bomber Training televised all of a complex technical course in their curriculum. Test results indicated that the average television-trained student retained about 8% more of the course materials than the conventionally-trained student. In obtaining these results the best possible instructors available were used in the conventional classes (a situation which does not normally exist). Lowry authorities concluded that, with television, teaching is made easier and the learning process speeded. Colonel J. W. Hughes, Center Operations Officer, has said: "The fact that television can be effectively used for teaching has already been proven many times. Our purpose is to measure how much better it is than conventional methods, and to use it to improve the quality of our graduates."[2]

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[1] Ibid., p. 4.

[2] "How Lowry Air Force Base Uses Closed-Circuit Television To Improve Its Technical Training," Broadcast News, CV (September, 1959).

Before moving on to consider applications in private enterprise, some other pertinent military applications should be mentioned. For example, closed-circuit television is the nucleus of a comprehensive management plan conceived by the Air Force Systems Command (AFSC) to establish a 'real-time' communications link between AFSC Headquarters near Washington, D. C., and the Command's thirteen divisions and centers throughout the Country. The purpose of the link is to expedite the decision-making process by presenting current information with modern television techniques and equipment. This is virtually 'conference television' and incorporates means to ensure security. To quote General Schriever, AFSC Commander: "This real-time system will provide us with much better management control throughout the Command. And I think it will produce one other thing as far as the individuals in the Command are concerned, and that is a sense of participation in what goes on in our wide-spread organization. I think we will go a long way toward cementing the Command as an entity rather than a group of separate empires."[1] Basically, the AFSC uses their television system in the following functions:

1. As a management aid in presenting current information and data to the decision-making staff level.

2. As part of a video tape network between major air commands and Headquarters, USAF.

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[1]"Management TV at Air Force Systems Command," Broadcast News, CXIX (February, 1964).

3. As an aid to administrative and training activities.

4. As a production source and library for current and past briefings on TV tape.

5. As a means of enhancing briefings.

6. As a method of extending the audience.

7. As a centralized briefing facility using live and taped presentations.[1]

In another operation, the Omaha headquarters of the Strategic Air Command uses six program channels in briefing the staff on weather conditions, deployment of aircraft and other information vital to making necessary decisions.[2] One operational briefing is scheduled early each morning giving deployment of aircraft, weather information, training mission details and other information. Air intelligence briefings on enemy aircraft movement and other classified material are given once daily. The system also rebroadcasts some commercial programs of relevance such as "Today" (NBC), received from an Omaha commercial station.[3]

A common touchstone to both the military and private enterprise is that of financial economies. The military viewpoint was expressed by Major J. F. Sublette, Chief of the Tele-presentations Branch of the Air Force Systems Command, who said: "Where TV is used in education and training,

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[1] *Ibid.*, p. 10.

[2] *Strategic Air Command Uses RCA Color TV for Vital Briefings* (Camden: Radio Corporation of America, undated pamphlet).

[3] *Ibid.*

economies brought about by mass communications alone are real, even measurable. Undoubtedly, TV achieves savings in personnel time, in travel, in the number of trips, and in the costs of repeated briefings."[1] Major Sublette goes on to mention that these factors apply quite apart from the additional advantages possible in educational quality alone. Several experiments, including one at Lowry, indicate that one form of savings may be realized through a reduction in teaching time. Lowry, for example, shortened their course length by 20% while actually producing students demonstrating a level of knowledge superior to that of the students conventionally taught for the full period.[2]

Non-military Applications

Training programs in business, as in the military, are concerned with economies of operation. Business training may be said to itself be big business. Estimates indicate that the cost of corporate training programs in the U. S. will be $4.5 billion in 1965, and rising 5% to 6% per year.[3] Although most business training consists of informal on-the-job teaching, trends indicate that more and more is going into formal programs. Overall, surveys by the Labor

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[1]"Management TV at Air Force Systems Command," Broadcast News, p. 9.

[2]U. S., United States Air Force Air Training Command, op. cit., p. 4.

[3]The Wall Street Journal (New York), February 26, 1965, p. 1.

Department and Princeton University indicate that corporate expenditures for formal training alone have risen some 80% in the past nine years.[1]

Corporate training needs have been summarized as being a reduction in the requirements for instructors, classrooms and time off the job. This need is partly illustrated by the fact that the cost of training a corporation student can easily outrun the cost of educating a non-corporation pupil when salary costs are considered. A six-week course given to engineering managers at General Electric, for example, cost roughly the same per individual ($6,000) as the cost to the taxpayers of a youngster's twelve years of public schooling.[2]

It would seem obvious that television has the potential to reduce training expenditures and that this would make the medium popular in the face of rising industrial training costs. The growth which might therefore be expected, however, has not occurred to any great extent. To be sure, some companies are making use of the medium in training; their number, however, is small. Perhaps this fact is best illustrated or implied in a recent article expounding the virtues and growth of television (in general) in the business application. While the article mentioned several kinds of

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[1]Ibid.

[2]Ibid.

applications, it cited no specific examples in the area of training and stated only that: "A few companies, like schools, have begun using television for instructional purposes."[1]

As noted earlier, much of the justification for the utilization of television rests in its ability to achieve appreciable savings by reaching a large number of people at one time. This simple economic fact may explain why only the very large companies, or associations of smaller companies, have even come to consider instructional television installations of their own. In South Carolina, for example, businessmen found themselves intrigued by the advantages of televised training but, individually, without the justification for its use. From this dilemma there grew an association of businessmen utilizing the existing state-wide television distribution network to present courses of common interest.[2] At present, a company's employes gather at existing receiving points established for regular public-school use. Several of the participating companies (including Chemstrand Corporation and Du Pont) are considering the installation of receiving equipment in their own plants. The system depends upon a paying attendance of between 3,000

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[1]"Can Your Company Use Closed-Circuit Television?" Business Management (September, 1964), p. 54.

[2]"TV Teachers: Training Plant Bosses Statewide," Business Week, August 29, 1964, pp. 64-65.

and 5,000; an early presentation, "The Role of the Supervisor," drew some 3,300. Future subjects include cost control, creativity, trends in research and development, and merchandising. Costs are said to run between $12,000 and $18,000 per course, with production costs alone (including necessary art work) being about $1,000 for each half-hour tape.[1]

Of the relatively few companies presently involved at all in the use of television in technical training, most have chosen the path of relying on the facilities of existing production and distribution organizations rather than becoming involved in this area themselves. Seven southern California companies have taken this approach by utilizing a professor from the University of California at Los Angeles to teach engineering subjects which are transmitted over a local commercial station three times a week and viewed in plant classrooms.[2] The companies bear the costs of the half-hour lectures which precede the final examination and lead to University credit for the 500 participating engineers. Both the companies and the University are said to be enthusiastic about the program and believe that the televised courses will prove far superior to regular company classes because:

1. One top-flight teacher can reach a large audience.

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[1]Ibid.

[2]"Engineers Learn by Viewing," Iron Age, CLXXXV (February 25, 1960), p. 45.

2. TV effects help students get more out of experiments and complex blackboard diagrams.

3. Busy engineers won't waste time driving to campus and will save energy and gas.[1]

Another approach which has recently been taken involves an idea originated by Thomas L. Martin, Jr., dean of engineering at the University of Florida. A $1.5 million closed-circuit network linking the University with Cape Kennedy, Melbourne, Daytona Beach, Orlando and Gainesville has been designed to present classes to keep scientists and engineers up-to-date with technological advances while leading to masters and doctoral degrees with as much as 30% of the instruction given via television.[2]

North American Aviation, Incorporated, has its own television network. This network is probably the most elaborate privately-owned, company-financed operation in existence at this time. The operation had its birth when two large Apollo spacecraft contracts in November of 1961 created a work-force growth from 8,000 to 31,000 in two years. The work-force was scattered through several southern California plants, and in three out-of-state locations. The problem facing the Company's management then became one of indoctrinating the swollen work-force in the problems and techniques of the space age; the Space and Information Systems Division

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[1] _Ibid._

[2] "Closed-Circuit Ph.D.s," _Electronics_, XXXVII (August, 24, 1964), p. 30.

decided on an extensive closed-circuit television system to handle this training program. Only three years later, the Space and Information Systems Division had a network which covered the Downey, California plant, connected by microwave with their other plants in California, and communicated audio to Cape Kennedy, White Sands, New Mexico, and Tulsa, Oklahoma. Downey itself has some sixty miles of cable and 600 combination viewing and originating rooms, and originates most of its own programming with seventy-three men in three departments: technical operations, programming, and systems design.[1]

In North American's operation, viewing rooms are located so as to place all workers within a minute of a television lecture. While some of the presentations are on film (e.g., "How to Deal with Labor Unions," "How to Procure Tools," and "How to Recruit Personnel"), most are live or video-taped. Examples of these include, "High Pressure Systems and Safety," "Accounting for Labor Cost," and various briefings on systems and organizational control for upper management. Quite often, on-site viewing of laboratory tests for the engineering staff will run throughout the night and is scheduled as the need arises. Most of the presentations revolve about the technical arts including subjects like cryogenics, the use of high-pressure equipment and configuration management. Workers,

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[1]"TV Teachers: Leading a Company Into Space," Business Week, August 29, 1964, p. 60.

incidentally, are allowed to view presentations only with admission tickets which are distributed by supervisors.

According to the Company, much of their system's value is as a management tool that is used to keep every top person in the Apollo program up-to-date. While the Company will not give out over-all figures on costs, it claims that the system has paid for itself in less than three years. In one study, where the Company considered the cost of training 1,000 employes in a particular subject, the cost came out as $.55 per employe with closed-circuit television and $2.25 by the conventional teacher-and-classroom method. Costs aside, the Company feels that its experience has shown television to be a top technique for training workers and a top management communications system, and has expanded the experience of their engineers.[1]

Summary

Certain general truths seem to have emerged in the field of television in its industrial applications:

1. The medium is used most often in applications other than training. In training situations, economic feasibility is largely dependent upon audience size.

2. Training applications are found both more often and more extensively in the military than in private commercial operations.

3. The medium has been successful in the communication of relatively complex technical subjects.

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[1]Ibid.

4. Very few companies operate their own internal production and distribution system.

These are most certainly broad and brief summations of the existing facts. Primary concern here, however, is with the identification of the unquestionable truths and the emission of peripheral points as the necessary and sufficient grounds for sound management decisions. As was concluded from the in-school cases, it appears that television can be utilized effectively in meeting certain needs as noted.

CHAPTER IV

ADAPTATION TO THE FORD MOTOR COMPANY TECHNICAL TRAINING PROGRAM

Applicability to Existing Technical Programs

As mentioned earlier, virtually all of Ford's technical training is aimed at employes holding enigneering degrees and involved in work with one of the Product Engineering offices or Engineering Staff. Fortunately, this places practically all of the Company's product-oriented engineers in rather close geographical proximity. This fact makes television initially feasible from the standpoint of signal distribution. It is this same fact which allows for centralized control and presentation of engineering training as it presently exists. This situation is perhaps unusual, as many companies, while employing large numbers of engineers, align their functions so that engineers are scattered geographically. This makes it practically impossible for a company to sponsor regularly scheduled engineering courses at a central location.

The analysis to follow assumes that there exists a need to justify any television installation at Ford on a financial basis. From what has been said, it appears that such a justification depends heavily upon the quantities involved--

audience size and frequency of course presentations. That is, it is desirable to have some form or pattern to the course schedule; there should be something more than an occasional presentation of a course with varying content. Finances aside, of course, the medium itself is not incapable of delivering information which is part of a non-structured 'curriculum' or program.

Ford, as mentioned, does possess the fortunate combination of elements which has made it possible to present a regularly-scheduled series of courses at a central location. While any television would undoubtedly be put to additional uses, this analysis considers only the eleven current courses of the Engineering Technical Education program because of their 'school-style' structuring and scheduling. Some future considerations might include, however, the new-employe orientation program or some of the management seminars which are presented from time to time. Several additional possibilities are mentioned later in relation to the needs of system design. Such additional functions, however, will here be considered as 'extras,' with the total cost justification made solely on the basis of the Engineering Technical Education courses.

For purposes of analysis, one sample course has been chosen. This course, "Instrumentation and Measurements," is typical of the remaining ten courses in its general format and method of presentation. The course is designed to acquaint engineers with the various means by which physical variables may be accurately measured in an operating device or machine. Such measurements as displacement, velocity, stress, acceleration and pressure may be measured even while rapidly changing in value. This measurement is accomplished through the conversion of the variable element to an electrical voltage. This voltage may be designed to be directly proportional to the variable which it measures and thus may be converted to a measure of the value of the variable element itself. Such values are of obvious utility to the engineer in need of knowing the exact reaction of any given device or system within an automobile.

The course is structured in a specially prepared text of four chapters, the first of which reviews the basic laws and circuits with which the engineer must be familiar. The following chapters acquaint the student with the theory and operation of the numerous devices and the many techniques of applying them to various kinds of problems. Copies of the table of contents pages from the text are presented in the appendix and may serve to clarify the nature and format of the course.

The lecture material follows a format quite similar to that of the very successful Michigan State University televised accounting course with which the writer is familiar. That is, certain basic laws are learned initially and applied to relatively simple situations. From this point, additional variables are added so that the basic laws become applied in an ever-widening variety of ways. In the case of "Instrumentation and Measurements," the additional variables come in the form of the various types of transducers.[1]

To convert such a format to television would appear to present no major problems, judging by the experiences of others. Television would, in addition, enable the instructor to elaborate on certain points. For example, current classroom arrangements force the instructor to describe actual applications through chalk-board drawings and textbook sketches. With television, it would be feasible to set up equipment in the studio to show actual measurements taken from operating devices. The theory governing the operation of a differential transformer, for example, is quite readily explainable by an instructor either in the classroom or on television. To actually mount the device on an operating automobile engine, however, is quite impossible in the classroom. With television, such a demonstration could be videotaped from an established engine test cell. Engines, as well as other components of an automobile, could also be operated in the television studio itself.

The experiences of Hagerstown, North American Aviation and others strongly indicate that courses such as "Instrumentation and Measurements" could be very successfully converted

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[1]Transducers are the devices which actually convert mechanical variables to electrical voltage. A phonograph pickup, for example, is a transducer which converts the wavy impressions on the record into electrical signals which may then be amplified and made audible.

to television. There would appear to be nothing in the format or subject of such a course to preclude such a conversion. There are indications that the course would be improved because of the increased ability to demonstrate. Such televised presentations would also take advantage of the medium's abilities to direct the viewer's attention, provide close-up views, etc. It seems reasonable to say that there is no technical (educational) impediment to the ready adaptation of this program to televised presentation, and every reasonable expectation that the existing qualitative level will, at the very least, be maintained.

System Requirements

The single remaining consideration is that of the economic feasibility of a television system within the context of a specific application. That is, accepting the ability of the medium to equal or surpass existing methods in qualitative terms, can it be shown to be economically sound? Only an analysis of the individual case will supply a suitable answer to this question.

As noted, the Engineering Technical Education Program courses are presented entirely by the lecture method. Experience has been that questions from the students are almost always anticipatory and would have been answered shortly in the normal course of the presentation. It appears, therefore, that no necessary educational objective is provided or met by the limited quantity of discussion generated during the actual classroom presentation.[1] This point is important at this juncture in that it immediately removes the need to provide for two-way communications in the televised adaptation of the courses and supports the possibility of utilizing recorded presentations.

While the present considerations are limited to a single Company educational program in the interest of simplicity and for the structuring of a sound basis for management decisions regarding the use of television, it should be mentioned that several subsidiary uses for the medium suggest themselves. These points may be particularly useful in indicating the direction of possible future growth of a television system, and are important to a minor extent in later considerations of equipment costs. Some possible auxiliary uses are:

1. Management briefings.
2. Engineering testing operations where remote or close-up viewing by a large group is necessary.
3. Visual display of announcements placed in areas of high employe traffic (cafeterias, etc.).
4. Presentation of all or portions of various other Company training programs.

While the preceding facts and conclusions would seem to indicate that an immediate and full-scale implementation might be justifiable, the following data utilize a dual approach in which a pilot program is compared with the full

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[1]This conclusion is based upon the writer's conversations with several of the instructors involved in technical training with Ford.

installation. In this fashion, certain advantages become available to management:

1. The effectiveness of the medium can be analyzed under the particular conditions of the Ford application.

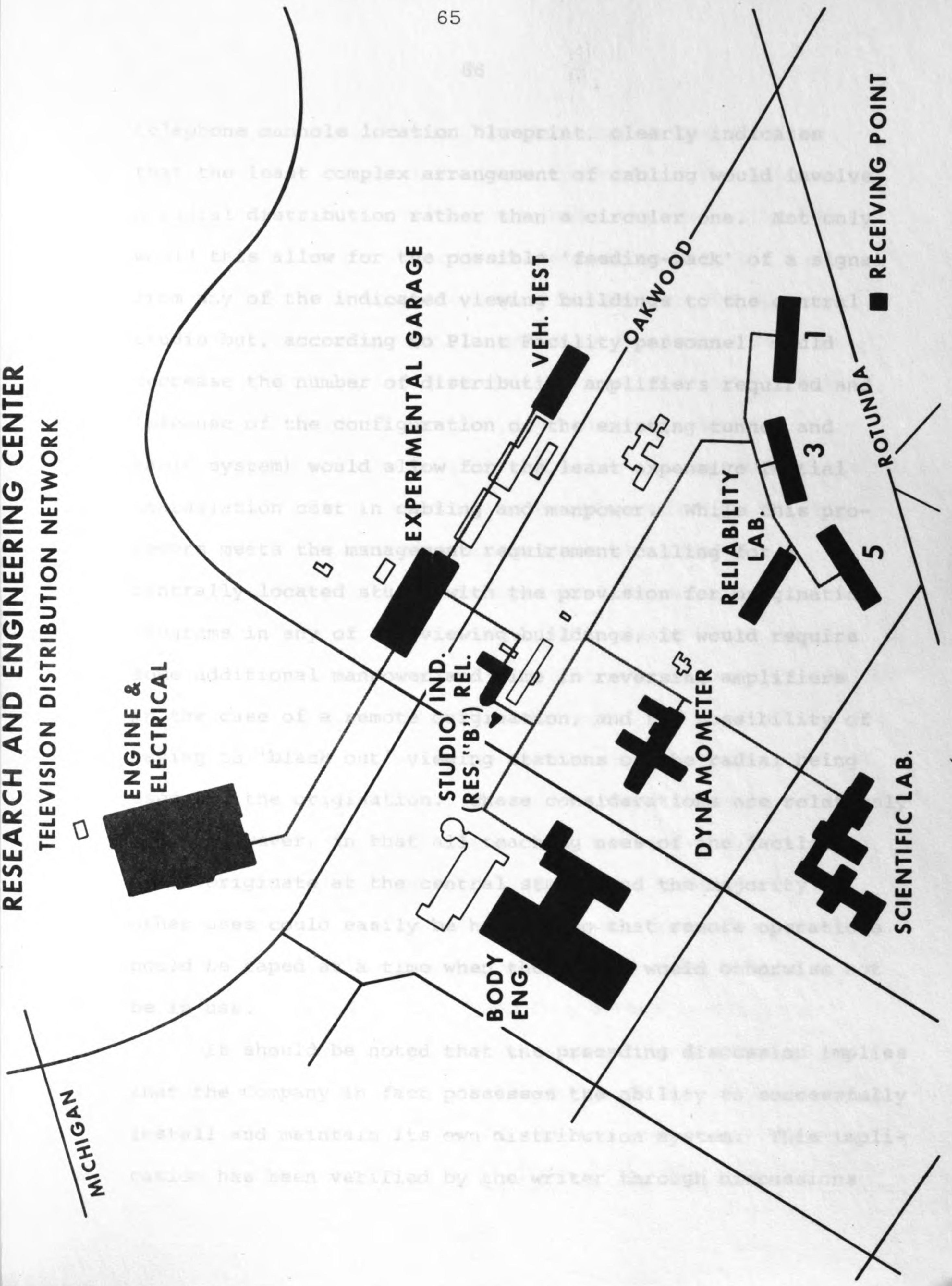
2. The total process of adapting lectures to television (organization of material, use of visual aids, instructor adaptability to the medium, recording techniques, etc.) can be experienced and tested before commitment to a full schedule of subjects.

3. Experience in the use and maintenance of equipment can be gained.

Initial considerations for the Company (assuming a reasonable assurance of the retention of existing quality) fall into three general areas: (1) distribution system, (2) studio equipment, (3) operating expenses. This form of break-down happens to be convenient because of the manner in which responsibilities are structured within the Company. There is no reason, however, why other break-downs could not be used. Since Company requirements are prime factors in structuring any workable implementation, several such requirements will be noted in relation to the above three areas. These factors are derived from the author's familiarity with the initial criteria set forth by Ford management personnel and are not presented as being necessarily exemplary.

Figure 2 is a map of the Research and Engineering Center, indicating those buildings which would have to be served in order to provide viewing facilities for at least 100 students at any given moment. An analysis of building placement, as well as of the appropriate electrical and

FIGURE 11


RESEARCH AND ENGINEERING CENTER
TELEVISION DISTRIBUTION NETWORK
MICHIGAN
ENGINE &
ELECTRICAL
BODY
ENG.
STUDIO
(RES. "B")
IND.
REL.
EXPERIMENTAL GARAGE
VEH. TEST
DYNAMOMETER
OAKWOOD
RELIABILITY
LAB.
SCIENTIFIC LAB.
3
5
1
ROTUNDA
RECEIVING POINT

telephone manhole location blueprint, clearly indicates that the least complex arrangement of cabling would involve a radial distribution rather than a circular one. Not only would this allow for the possible 'feeding-back' of a signal from any of the indicated viewing buildings to the central studio but, according to Plant Facility personnel, would decrease the number of distribution amplifiers required and (because of the configuration of the existing tunnel and cable system) would allow for the least expensive initial installation cost in cabling and manpower. While this procedure meets the management requirement calling for a centrally located studio with the provision for originating programs in any of the viewing buildings, it would require some additional manpower and time in reversing amplifiers in the case of a remote origination, and the possibility of having to 'black out' viewing stations on the radial being used for the origination. These considerations are relatively minor, however, in that all teaching uses of the facility would originate at the central studio and the majority of other uses could easily be handled so that remote operations could be taped at a time when the system would otherwise not be in use.

It should be noted that the preceding discussion implies that the Company in fact possesses the ability to successfully install and maintain its own distribution system. This implication has been verified by the writer through discussions with appropriate Plant Facility personnel. The one-time installation costs which would be incurred if the Company is to install its own system have been compared with the lease (annual) costs for comparable service from the Michigan Bell Telephone Company. The cost to the Company would be approximately $8,000 annually for leased services.[1] This yearly cost is the same as the total cost of the cable installation required for the pilot program. Additions to bring the pilot system to full operation (comparable to the Bell installation), however, would add another $12,000 for a final cable and installation cost to the Company of $20,000. Obviously, the Company installation would 'pay for itself' in two and one-half years if compared to the Bell installation. That is, the total cost of the 'self-installed' distribution system ($20,000) would equal the cost of leasing ($8,000 annually) in two and one-half years. Bell would not sell their installed lines at a later time, however, if the Company should decide to operate its own system (according to statements made to the writer by Bell representatives). It would seem, then, that the initial $8,000 risk is justifiable as an investment toward the expected expansion of the system to serve all of the points indicated in Figure 2.

The remaining distribution possibility is that of an open-circuit system in which the studio is equipped with a

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[1]Letter from Mr. N. C. Youngs, Sales Manager, Marketing Department, Michigan Bell Telephone Company, Detroit, Michigan, November 2, 1964.

2500 megacycle transmission apparatus and each receiving building with appropriate reception facilities. Such a system was estimated by a representative of the General Television Network to cost approximately $28,000 and is therefore more costly than a Company-installed system ($20,000) and is roughly equivalent to the cost of three and one-half years of leasing a wired system (at $8,000 per year).[1] In addition to these considerations, management requirements for transmission security and the restriction of 'unsightly' antennae equipment on the buildings in the Center make such a distribution system impossible.

Management requirements regarding equipment provide that expenditures be held to the minimum consistent with a reasonable level of transmission quality and reliability, and that provision is made for the ability to record all program material. A further factor affecting equipment is management's requirement to restrict the number of staff additions for television operation to three individuals.

Regarding the latter consideration, it has been suggested that such requirements would require the use of remote-control cameras and that, given the adaptation of existing lecture courses to television, such cameras would function adequately under the direction of a competent educational television producer-director. Further

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[1]Letter from Mr. R. Randolph Hippler, General Television Network, Ferndale, Michigan, August 28, 1964.

conversations with several television engineers have indicated in addition that, given the extensive and continuing use of television tape, the use of a quadruplex recording device[1] would be a practical necessity. The latter factor has a considerable financial effect in that a machine of the type mentioned will cost approximately twice as much as the least expensive machines on the market today. It was the stated feeling of the engineers mentioned that the less expensive or 'slant-track' machines would not perform with an acceptable level of picture quality or reliability in a system where machine utilization, as proposed, would approach 1,000 hours annually.

Management requirements for staffing of such an installation provide for a 'System Administrator' to provide overall direction for the operation and, to borrow from a North American Aviation executive, ". . . to prevent overuse of the network by ambitious department heads who (might) wish to sell their own pet programs."[2] Given the obvious need for

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[1]The term "quadruplex" refers to the recording head mechanism which, in effect, puts the picture information on to the tape. The quadruplex system ultimately affects the design of the entire recorder including both the mechanical transport and electronic processing of the signal. The quadruplex system has reached a state of high quality and reliability partially due to the fact that it is the system in which television tape recording has 'grown up' and is virtually the sole system used by commercial networks; it is, however, inherently much more expensive than the new "slant-track" system which is in its infancy by comparison.

[2]Business Week, loc. cit., p. 61.

an engineer to operate and maintain equipment, the remaining staff member must be an individual with the ability to provide the producer-director function in adapting the instructor and his material to the medium.[1]

The proposed pilot operation would utilize a single leg of the distribution network connecting the studio with buildings one, three and five (see Figure 2) providing a total viewing capacity of approximately 100 individuals. In the absence of a permanent staff, the production facilities of Wayne State University would be utilized to tape the several sessions of the course "Engineering Materials," one of the courses of the Engineering Technical Education Program.

Cost Analysis

Given the indicated needs and conclusions, then, Tables 8, 9 and 10 show a specific analysis of the total costs to the Company for both the pilot installation and the full system. These statistics assume that the first year of operation would include the total acquisition of equipment and facilities and provide for the conversion of all of the courses of the Engineering Technical Education Program. Equipment designations and charges are for RCA equipment

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[1]The feasibility of this staffing arrangement was verified by at least two sources in conversations between the writer and administrative personnel of the closed-circuit television operations of Michigan State University and Wayne State University.

TABLE 8

SYSTEM EQUIPMENT COSTS

	Vendor Items	Purchase $	Lease $
Cameras	PK 302 Camera (2)	5700	2850
	25-150 RC Zoomar (2)	2100	1050
	Zoom control (2)	300	150
	Auto pan-tilt (2)	900	450
	Pan-tilt control (2)	374	187
	TD-10 tripod (2)	1250	625
Terminal Equipment	Control console	1600	800
	TS 5A switcher	620	310
	Switcher power supply	866	433
	Scope switcher	264	132
	TM 9N monitors in racks (2)	596	298
	Conrac rack mount	54	27
	527 Tektronics scope	1064	532
	TM 1 9N 8" monitor	674	337
	TG-3 sync generator	4150	2075
	Miscellaneous cabling	500	250
	TA-33 distribution amplifiers (2)	650	325
	Pulse distribution amplifier	350	175
	Module frame for amplifiers	76	38
	Sync-adding amplifier	394	197
	RF distribution amplifier	400	200
	23" receivers with stands (6)	1036	518
	Monitran	1012	506
Recorder	TR-5	24500	12250
	Spare head	1700	850
Audio Equipment	4 channel mixer	664	332
	Chest microphones (2)	174	87
	Microphone desk stand	16	8
	Turntable	150	75
	Cabinet	94	47
	Arm	18	9
	Cartridge and stylus	20	10
	Speaker	60	30
	Audio amplifier	280	140
	Headset	8	4
Test Equipment	Resolution chart	10	5
	535A scope	1610	805
	Dual trace amplifier	300	150
	Scope dolly	126	63
	WV 77E VTVM	44	22
	WV 38A multimeter	44	22

TABLE 8--Continued

	Vendor Items	Purchase $	Lease $
Lighting	Miscellaneous	2000	1000
Installation	Miscellaneous	1000	500
	Total Vendor Items	57748	28874
	Plant Engineering Items		
Cable	Installation	3000	3000*
Studio	Lighting, wiring, backdrape	5000	5000*
	Total Plant Engineering Items	8000	8000*
	TOTAL SYSTEM EQUIPMENT COSTS	65748	36874

*Although Plant Engineering items cannot actually be leased, the costs are carried as "lease" expenses also inasmuch as the money would in no case be recoverable.

TABLE 9

TOTAL COST COMPARISONS:
PILOT PROGRAM--FIRST YEAR--SUBSEQUENT YEARS
(Dollars in Thousands)

		Pilot			
		Purch.	Lease	1st Yr.	Sub. Yrs.
Equipment Costs	Pilot Program				
	Studio electronics	57.8	28.9	57.8	---
	Cable and studio preparation	8.0	8.0	8.0	---
		65.8	36.9	65.8	---
	Second Six Months				
	Additional cable	---	---	12.0	---
	Additional RF amplifiers	---	---	1.0	---
	Additional receivers (24)	---	---	4.2	---
	Additional channel equipment	---	---	1.0	---
		---	---	18.2	---
	Equipment Sub-Total	65.8	36.9	84.0	---
Operating Costs	Pilot Program				
	Six month service contract	1.0	1.0	1.0	---
	Tapes (29)	3.5	3.5	3.5	---
	W.S.U. ($125/hour)	4.8	4.8	4.8	---
	Course material and art	5.5	5.5	5.5	---
	Special projects	10.0	10.0	10.0	---
		24.8	24.8	24.8	
	Second Six Months				
	Tapes	---	---	49.6	---
	Art	---	---	5.0	---
	Special projects	---	---	6.0	---
	Adapt and record courses	---	---	40.0	---
		---	---	100.6	---
	Subsequent Years				
	Additional tapes (10)	---	---	---	1.2
	Art	---	---	---	6.0
	Special projects	---	---	---	6.0
	Adapt and record courses	---	---	---	17.3
					30.5
	Operation Sub-Total	24.8	24.8	125.4	30.5
	TOTALS	90.6	61.7	209.4	30.5

TABLE 10

COURSE PREPARATION AND PRESENTATION
COSTS--TELEVISION vs. DIRECT TEACHING
(Dollars in Thousands)

	DIRECT TEACHING	1st TV PRESENTATION	2d TV PRESENTATION
Lecture and notes	3.00	---	---
Home problems and exams	0.52	0.15	0.15
Adaptation for TV (Initially)	---	3.00	---
W.S.U. charges (Initially)	---	4.80	---
Tape cost (Initially)	---	2.93	---
Revision preparation	---	---	0.37
Revision recording	---	---	0.60
Revision tape	---	---	0.12
Time lost from job	4.00	6.25	6.25
TOTAL	7.52	17.13	7.49
*COST PER STUDENT	$150.50	$171.30	$74.90
*COST PER STUDENT-HOUR	$4.70	$6.60	$2.90

*Read conventionally in dollars and cents.

and based on a conversation between the writer and an RCA representative. Under the lease arrangement, RCA would accept the return of all equipment after six months (the duration of the pilot program) and return 50% of the original cost to Ford. The tables do not consider the factors of personnel costs other than those involved in employing a studio engineer on a part-time basis for the period of the pilot program. Specific references to staff salaries are omitted at the request of the Company, although such costs may readily be added to the "Operating Costs" and the results modified accordingly. The subject of staff salaries and amortization will be mentioned at a later point. The functions of the two administrative employes mentioned earlier would be served by existing Personnel Planning Department employes for the duration of the pilot program.

Table 9 indicates that the minimum cost of the pilot program would be $61,700 even if the entire project were to be scrapped at that point. Were the project to be accepted and continued beyond the first six months, the pilot program would reach a cost of $90,600. The additional equipment and operating costs (less salaries) of the second six months of the first year would add $118,800 for a total first year expenditure of $209,400. As indicated, each subsequent year of operation would cost an additional $30,500 in operating costs (less salaries).

Table 10 presents cost figures on the basis of cost-per-student and cost-per-student-hour. Again, comparisons utilize the course "Engineering Materials" as an example and are based upon the following premises:

1. Televised courses would consume 20% less time.[1]
2. The average hourly rate of the students is based on the current average of those salary grades applicable to the course involved.
3. Televised courses would serve no less than 100 students simultaneously.
4. Direct teaching costs are based upon current figures.
5. "1st TV Presentation" includes recording costs.
6. "2nd TV Presentation" presumes minimum revision to the original tapes.

In the utilization of such a closed-circuit television system it is obvious that it becomes quite impossible to offset the initial expense with savings accrued due to an increase in efficiency over the present conventional system of presentation. A major saving, however, is realized in serving a much larger student body while incurring the expenses of production only once and presenting future sessions of the same course via video tape. This factor accounts for the sharp drop in annual costs beginning with the second year of presentations as indicated in Table 10.

The ultimate examination of cost is based not upon a single course or upon a specific year but upon the total

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[1]This was verified as being a reasonable expectation in a telephone conversation with Dr. Tintera, June 10, 1965.

cost of equipping and operating the system (including maintenance and staff) as it appears when spread out over an amortization period. This analysis is based solely upon the entire Engineering Technical Education Program to the exclusion of all other applications of the system. This may appear to be somewhat of a pessimistic view in that the system would undoubtedly be put to other uses and thereby cause the costs to spread over a much greater area. Nonetheless, this view will provide a realistic figure which may be used with confidence. Mention of the exact period of amortization is not made due to the inclusion of salary figures in the results. Even so, the results become meaningful in this specific application and serve to illustrate the process which could be applied to any given application.

Over the entire period of amortization, the analysis indicates that the cost-per-student would be $150.00 with direct teaching and $90.91 with television; the cost-per-student-hour would be $5.00 with direct teaching and $3.64 with television. Television would, however, require an additional $17,500 annually over the present direct teaching costs. This would provide for the doubling of the present number of students taught and result in a total increase of 110,000 student-hours over the period of amortization. To accomplish the same increase through an expansion of the present system would require several times this amount or over half again the total cost of the entire television operation over the amortization period. It should be noted that the television system is conservatively noted as doubling present student capacity whereas it is ultimately capable of handling as many as ten to twenty times the current load. This calculation (of doubling capacity) is used inasmuch as applications for current courses are approximately double the number of openings available.

CHAPTER V

CONCLUSION

It has been attempted here to broadly outline the educational background and merits of televised instruction in schools and industry and to place the medium in the context of a specific industrial training application for a final consideration of its economic feasibility at the Ford Motor Company. While any such project should be cautiously implemented, the facts indicate that there is no technical impediment to the adaptation of advanced engineering courses--particularly when such courses consist entirely of lecture material and are viewed by students who, having engineering degrees, may be presumed intellectually capable of the absorption of the material.

Experiences in the nation's schools run the entire route from elementary to advanced levels and indicate general success wherever the medium is used within the limits of its capabilities. Experience with television in 'industry' (private enterprise and the military) has largely been in the area of passive monitoring devices and in other 'other-than-training' applications. The military has been the source of much experimental information to substantiate the hypothesized abilities of televised training. Private enterprises, while showing a continuing growth in and concern for training, seldom have training needs in proportion to the costs incurred in the establishment and operation of a company-owned system.

The Ford Motor Company situation seems to provide the type of climate most suitable for the ready use of a television system in its training activity. The economic conditions demanded by a television installation seem to be met by Ford's large numbers of engineers who are located in a rather consolidated fashion and currently enrolled in large numbers in existing classroom-taught lecture courses. Given the sound educational abilities of the television medium, the question of economic feasibility remains the only possible block to its utilization. As indicated, given the desire to increase student coverage, television will provide a 35% saving on a cost-per-student basis and a 27% saving on a cost-per-student-hour basis in a continuing program, with increasing savings possible as the size of the student body surpasses twice the current number.

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