A COMPARATIVE STUDY OF THE EFFECTIVENESS OF TEACHING A COURSE IN REMEDIAL MATHEMATICS TO COLLEGE STUDENTS BY TELEVISION AND BY THE CONVENTIONAL METHOD

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

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* * * * * * *

The Ohio State University

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Approved by

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Advisor
Department of Education
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The writer wishes to thank the many people who willingly aided him in compiling information about television instruction in mathematics.

The love and understanding of his parents, Barbara J. and David A. King, and the encouragement of his dear friends, Doc, Lillie Mae, and Clarice Smith helped him achieve his goal.
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CHAPTER I

INTRODUCTION

Origin of the Study

When Dr. Richard Hull, Director of WOSU-Radio and WOSU-TV, first suggested the possibility of offering a college course by television, the Mathematics Department of The Ohio State University indicated interest. Although the university had never tried such a plan before, the Mathematics Department agreed to present a course with Dr. Leslie H. Miller, Associate Professor of Mathematics, acting as television instructor. After the idea was approved by the College of Arts and Sciences, Dr. Miller settled upon Mathematics 400, a remedial course in arithmetic and elementary algebra. The present study, organized during the early weeks of the Spring Quarter, 1958, is an attempt to determine some of the problems and values of teaching mathematics by television, focusing upon Mathematics 400 as it was presented during the Spring Quarter, 1958, at The Ohio State University.

Importance of the Study

Because college enrollments are increasing far more quickly than classroom space or competent instruction can be provided, it is in the best interest of each school in the country to consider
at least the possibility of using television for instructional purposes. In time, the use of this medium can not only facilitate providing many students with competent instruction, but can also lower the cost of such instruction by permitting kinescope recordings of lecture-demonstrations.

Statement of the Problem

The purpose of this study is to determine the effectiveness of television as a medium of instruction in Mathematics 400 as compared with conventional means of instruction. Specifically, the purpose is threefold:

1. To compare the achievement of students enrolled in Mathematics 400 as it was taught over television during the Spring Quarter, 1958, with the achievement of those students enrolled in the conventional course during the Winter Quarter, 1958.

2. To determine the reactions of the television-taught group to the use of television in teaching Mathematics 400.

3. To compare the reactions of the television-taught group to the course with the reactions of the conventionally taught group.

Limitations of the Study

This study concerns only the effectiveness of television in teaching Mathematics 400 as compared with the conventional method of teaching the same course. The study is limited to an investigation of one quarter’s teaching by each method. In this study, the
two groups are compared only with respect to their knowledge of mathematical facts and their ability to manipulate numbers. There has been no attempt to test either their retention of facts or their ability to generalize to basic mathematical principles.

Definition of Terms

Closed-Circuit Television — Television signals transmitted over a closed circuit for reception only by inter-connected receivers.

Conventional Class or Group — In this study, the words "conventional class" or "conventional group" shall mean any class taught in the usual manner, that is to say, with one teacher responsible for all phases of instruction, such as lecturing, answering questions and engaging in discussion with students, giving examinations, grading examination papers, and awarding course grades. The lectures of the teacher are, of course, delivered "live."

Conventional or Regular Method of Teaching — In this study these terms shall be terms applied to methods used in teaching the conventional class or group.

Television Class or Group — In this study when the words "television class" or "television group" are used, they shall refer to a class or group which receives its formal instruction in a course by television, with supplementary informal teaching, discussion and question answering, and examinations in other periods, variously called "quiz," "help," and "tutorial" periods.

Flip Card — A title card which is turned by hand mechanically.

Grade-Point Index — A grade point index is the ratio of the total number of grade points earned at any particular time to the number of hours accumulated at that time, where letter grades "A", "B", etcetera are converted into numbers for example, "A" may be 4 points, "B" 3 points, etcetera.

Live — Transmitted from the studio, in contrast to a film or video recording. Also, an open microphone.
Null Hypothesis — The logical contradictory of the hypothesis that one seeks to test. If the hypothesis can be proved false, its contradictory is thereby proved true. Since one exception can overthrow a generalization, it is usually easier to disprove the null than to prove the original directly. Hence, a common research design calls for a testing to see whether the null hypothesis can be denied or displayed.

Open-Circuit Television — Television signals transmitted over an open-circuit for reception by any audience with a television set when the frequency used is very high frequency. A special adapter is needed for open-circuit telecasting over UHF.

Television Teacher — Quiz Section Technique — The name given to the technique used at The Ohio State University in the Spring Quarter 1958 when Mathematics 400 was taught by television. The lectures for the course were delivered by television for three forty-eight minute periods a week. Two forty-eight minute periods a week were spent in "quiz" sections in which students asked questions concerning the lectures, homework, etcetera, and examinations were given.

Plan of the Remainder of the Study

Chapter II presents a detailed discussion of the study undertaken in this dissertation. Specifically, it consists of a description of the study, a statement of the assumptions underlying it and of the methods by which its purposes were achieved, and a description of the course Mathematics 400, on which the study is based, as well as a description of the classroom conditions of the two groups of students, and of the method by which they were selected and their similarity determined.

Chapter III is devoted to an analysis of the mathematical achievement of the contentionally taught and television-taught groups. It also includes comparisons of the achievement of the
two groups, an analysis of the reaction data of the television-taught students and a comparison of the reactions of the conventionally taught and television-taught students to the course and to the instructors.

Chapter IV presents conclusions drawn on the basis of this study, recommendations growing out of the study, recommendations for further studies, and inadequacies of the study in retrospect.
CHAPTER II

A Discussion of the Use of Television in Teaching a Course in Remedial Mathematics as Opposed to Conventional Methods at The Ohio State University

When the State University of Iowa transmitted by means of a mechanical scanning system a series of lecture courses in art, botany, and drama, instructional television began. From 1932 to 1939, about 400 of these programs were telecast.

After the perfection of television, the first college to teach formal, sequential courses by television was Western Reserve University, in Cleveland, Ohio. In 1950, Western Reserve offered courses for credit in general psychology and in world literature by television.

The first televised mathematics course was presented over Station WQED, Pittsburgh, Pennsylvania, in 1955, when twenty fifth-grade classes from ten schools were taught arithmetic five days a week for 178 days.

In the same year, North Carolina State College at Raleigh began to offer a college preparatory course in solid geometry for sixteen weeks intended primarily for prospective engineering students.

The first televised mathematics course intended for college students was entitled, “The Teaching of Arithmetic,” and was offered by Iowa State Teachers College, Cedar Falls, Iowa.
Since those courses, numerous others have been offered by many schools, colleges, and universities. Twenty-four of them are summarized in Appendix B. Three of those courses which formed the bases for controlled studies on the possibility of using television in teaching mathematics are discussed in detail in Appendix C. The present study, like the three controlled studies discussed in Appendix C, compares the achievement of students taught by television with those taught conventionally.

Description of the Study

This study compares the achievement of two groups of students who were taught Mathematics 400 in two different quarters and in two different teaching situations. The students who studied Mathematics 400 during the Winter Quarter (January–March) 1958 in the conventional manner will be designated as the "conventional" group.¹ This group consisted of 208 students. The second group of students who took Mathematics 400 by television during the Spring Quarter (April–June) 1958, will be referred to in this study as the "television" group.² There were 107 students in this group.

¹During the Winter Quarter, 1958, 363 students completed Mathematics 400, only 208 of whom took Form G–2 of the Mathematics Placement Test twice. These 208 students are called the "conventional" group.

²Although, at the end of the Spring Quarter, 1958, 150 students were enrolled in Mathematics 400, only 107 of these students had taken Form G–2 of the Mathematics Placement Test twice. These 107 students are referred to, in this study, as the "television" group.
Basic Assumptions Underlying the Study

Essential to any study are some underlying assumptions, formulated prior to the study and relied on in the evaluation of the results of the study. The following are the five basic assumptions underlying this study:

1. The relative effectiveness of conventionally taught and television-taught college courses in remedial mathematics can be determined by the scores made by the groups on a common test at the end of the quarter.

2. Students who are approximately equal in mathematical aptitude and command of English and who follow a training program designed to develop these gifts or accomplishments can be compared according to their progress at the end of the training period.

3. The effectiveness of televised instruction can be evaluated validly by the same devices used in evaluating the effectiveness of conventional instruction.

4. If the television-taught students receive the same grades as those taught conventionally, then their achievement is also the same.

5. Through questionnaires, the reactions and attitudes of both groups of students to their respective courses can be determined.

Means of Achieving the Purposes of the Study

The Ohio State University Mathematics Placement Test, Form G-2, was given to each group before the course began and as a part of the final examination. The scores made by these two groups the second time the test was given provided a basis for comparing the mathematical achievement of the two groups. At frequent intervals
(weekly for the first six weeks of the quarter) the television-taught students were asked to fill out questionnaires, indicating their reactions to the course in which they were enrolled. During the tenth week of the quarter, these students were again requested to fill out another summarizing questionnaire; these were broken up into five groups on the basis of the students' final grades for the purpose of determining any relationship between the grades students received in the course and their reactions to it.

Finally, the Mathematics Department's "Teacher-Course Evaluation Questionnaire" was given to both groups to be filled out. Part of the purpose in analyzing the results was to determine whether the groups' ratings of their course and their respective instructors were skewed, that is to say, biased, by virtue of sheer difference in instructional conditions. 3

The Course Used in the Study

Description of Mathematics 400

Mathematics 400 is a remedial course in mathematics designed to give the student a knowledge of arithmetic and elementary algebra.

3 During the Winter Quarter, 1958, the instructors of Mathematics 400 administered The Ohio State University Mathematics Department's "Teacher-Course Evaluation Questionnaire" to their classes. It therefore occurred that the five participating quiz-section teachers had had previous, conventionally taught students evaluate them and the course. The conventionally taught students' evaluation of the people who later served as television quiz-section teachers were compared with the evaluations of those students enrolled in the television course.
It is described in the Bulletin of the College of Arts and Sciences of The Ohio State University as follows:

Mathematics 400: Arithmetic and Elementary Algebra. Five Credit hours. Five credit hours will be added to graduation requirements of any student taking this course. One quarter. Autumn, Winter, Spring. An additional fee ($10.00) will be charged. All instructors. The course consists of a review of arithmetic combined with topics from elementary algebra and geometry.4

The subject matter of Mathematics 400, like that of any other course, is determined by the person in charge of the teaching of remedial mathematics courses at the university. Needless to say, certain variations in course content occur from one quarter to another and from teacher to teacher. The following were the topics5 discussed in Mathematics 400 during the Winter and Spring Quarters, 1958:

I. Operating with Integers
II. Measurements
III. Common Fractions
IV. Decimal Fractions
V. Elements of Algebra
VI. Variation
VII. Formulas, Tables, Graphs

4Ohio State University, The Ohio State University Bulletin, College of Arts and Sciences, LXI, Number 20 (Columbus, The Ohio State University), 159.

5For a more detailed listing of the topics covered in the course see the "Lesson Schedule for Mathematics 400" in Appendix D.
The Objectives of the Course

The two objectives of Mathematics 400 are as follows:

1. To bring those entering students who fail The Ohio State University Mathematics Placement Test, Form G-2, up to and, if possible, beyond the level of mathematical competence required to pass the test.

2. To prepare students to take Mathematics 401 (elementary algebra) which, if passed, entitles students to enroll in regular college courses in mathematics at The Ohio State University.

Plan for Televising the Course

Although the Mathematics Department offered essentially the same course over television as it had offered conventionally in preceding quarters, the television-taught course relied more heavily upon visual materials. The television teacher assigned problems to television students and then paused briefly while they attempted to work them. He also reviewed previous work at the end of each lecture-demonstration period. The television instructor's presentation of new material was supplemented and often reviewed in the quiz sections which met twice weekly.

The following was the Mathematics Department's plan for teaching Mathematics 400 over WOSU-TV during the Spring Quarter 1958:

1. Dr. Miller would lecture on Monday, Wednesday, and Friday from 3:00 to 3:48 P.M. over open-circuit at WOSU-TV.
2. Quiz sections would be held on Tuesday and Thursday from 3:00 to 3:48 P. M. by as many teachers as there were quiz sections.

3. One of the quiz-section teachers would assist Dr. Miller in preparing visual material for the television lecture-demonstrations.

4. Dr. Miller and the personnel at WOSU-TV would work on the administrative and instructional problems connected with the course.

5. In addition, Dr. Miller would teach one of the quiz sections.

Teaching Aids for Mathematics 400

Fundamental Mathematics, by Dr. Miller, the television instructor, was written especially for the course and has been used at Ohio State University since the Fall Quarter, 1955. In addition to the text, the following visual aids were used for the televised course, Mathematics 400:

1. Wooden models of the polyhedra
2. Collapsible models of polygons
3. Blocks to illustrate principles of arithmetic addition, subtraction, multiplication and division
4. Flip cards
5. The flannel board, to exhibit data easily
6. The blackboard

Instruments Determining the Degree of Mathematics Proficiency of Entering Freshmen

When a student first enters The Ohio State University, he is required to take one of The Ohio State University Mathematics Placement Tests, either Form G-3 or Form G-2. The score he makes
on one of these tests determines whether or not he will be required
to take Mathematics 400.

The first of these tests — Form G-3 of The Ohio State Univer-
sity Mathematics Placement Test (which covers the subject matter
of arithmetic, elementary algebra, intermediate algebra, plane
gometry, and plane trigonometry) — is given only to those stu-
dents planning to take mathematics courses in college. Of the two
cutting scores, the first separates the students who are likely to
pass a college algebra course from those who are not. A student
in the more proficient group may enroll in the regular college
algebra course; one in the less proficient group must first enroll
in a remedial course in elementary algebra, Mathematics 401. The
second cutting score separates the students who demonstrate a
knowledge of high school mathematics up to, but not including,
elementary algebra from those who only demonstrate a knowledge of
arithmetic. A student in the more proficient group may enroll in
Mathematics 401; one in the less proficient group may enroll in a
remedial course in arithmetic and elementary algebra, Mathematics
400.

The second instrument is Form G-2 of The Ohio State Univer-
sity Mathematics Placement Test, which covers elementary algebra
and arithmetic. This test is given only to students who do not
plan to take any mathematics in college. There is only one cutting
score. A student who places above this score may enroll in Mathematics 401, elementary algebra, but he need not do so because he has demonstrated by his score sufficient mathematical knowledge to satisfy the mathematics entrance requirements at The Ohio State University. A student who places below this score is required to take Mathematics 400 sometime before he is permitted to graduate. Although they are used in computing the grade-point ratio of the student, the credits he earns in this course do not count toward a degree. This study is concerned, then, with those students who failed Form G-2 of the Mathematics Placement Test at The Ohio State University and those who demonstrated by the score which they made on Form G-3 of The Ohio State University Mathematics Placement Test that they were inadequately prepared in arithmetic and elementary algebra. Of the twelve sections of Mathematics 400 during the Winter Quarter, 1958, only nine were given The Ohio State University Mathematics Placement Test, Form G-2, as the second half of their final examination; and only these nine sections could be used in this comparative study. The group of television-taught students, 150 at the beginning of the study, was divided into five quiz sections of approximately 30 students each.

Discussion of Instruments Used in Determining The Homogeneity of the Two Groups

For this study, three instruments were used to determine the homogeneity of the two groups in respect to their ability in
mathematics and English and in their general academic capacity. Each of them will be discussed in the sections that follow.

As a means for determining the relative mathematical ability of the television-taught group and the conventionally taught group, a comparison was made of their respective scores on The Ohio State University Mathematics Placement Test, Form G-2. This particular test was chosen because it had been given to most of the students in each group, and because enough scores were therefore available for comparative purposes.

Students' "t-ratio test" run on these two sets of scores did not yield a critical value of t, that is to say, the difference in initial mathematical (arithmetic and algebraic) ability of the two groups was not statistically significant. The value of "t" was 0.9278. According to a t-distribution table with this value of "t" and 264 degrees of freedom, the critical value at the ninety-percent confidence level was 1.282. The students in either group, therefore, were approximately equal in mathematical ability at the beginning of the course.

The scores made by both groups on The Ohio State Psychological Examination were used to determine if the groups were approximately equal in general intelligence and verbal ability. The score on the OSPE is given as a percentile, and indicates how hard a student will have to work in order to succeed in college. It has
been found a reliable predictor of success in college at The Ohio State University. The "t-ratio" was .06174. According to the t-distribution table with this value of "t" and 284 degrees of freedom, the smallest critical value of "t" is 1.262 at the ninety-percent level of confidence.

Since the value of "t" is not statistically significant, it is safe to conclude that the two groups were about equal in general intelligence and verbal ability.

To determine whether the groups were about equal in general linguistic ability, their scores on The Ohio State University English Placement Examination were compared. The "t-ratio" was found to be .9278. According to the t-distribution table with 264 degrees of freedom, the smallest value of "t" was 1.282, corresponding to the ninety-percent confidence level. Therefore, t = .9278 is not a critical value of "t". It is safe to conclude, therefore, that the two groups were about equal in general linguistic ability.

As a means of studying the homogeneity of the two groups in other respects, the following tables were prepared. As can be

---

6 Not all students had O. S. P. E. scores. Only 192 of the conventionally taught and 94 of the television-taught students had taken the examination. The computation of "t" is based on these scores.

7 Not all students had English Placement Test scores. Of the conventionally taught students, 170 were available and 96 of the television-taught students. These scores were used in computing the "t-ratio."
### TABLE 1

**AVERAGE AGE, SEX, AND POINT-HOUR RATIO OF CONVENTIONALLY TAUGHT AND TELEVISION-TAUGHT STUDENTS**

<table>
<thead>
<tr>
<th></th>
<th>Average Age</th>
<th>Males</th>
<th>Females</th>
<th>Average Point-hour Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Group</td>
<td>20</td>
<td>N 100</td>
<td>108</td>
<td>2.0828</td>
</tr>
<tr>
<td>%</td>
<td></td>
<td>48</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>Television Group</td>
<td>20</td>
<td>N 47</td>
<td>60</td>
<td>1.9048</td>
</tr>
<tr>
<td>%</td>
<td></td>
<td>44</td>
<td>56</td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 2

**DISTRIBUTION BY COLLEGES OF CONVENTIONALLY TAUGHT AND TELEVISION-TAUGHT STUDENTS**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Group</td>
<td>N</td>
<td>24</td>
<td>29</td>
<td>85</td>
<td>56</td>
<td>1</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>%</td>
<td>%</td>
<td>12</td>
<td>14</td>
<td>41</td>
<td>27</td>
<td>5</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Television Group</td>
<td>N</td>
<td>5</td>
<td>19</td>
<td>39</td>
<td>40</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>%</td>
<td>%</td>
<td>5</td>
<td>18</td>
<td>36</td>
<td>37</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

8 These average point-hour ratios are computed on the basis of 167 point-hour ratios of the control group and 67 point-hour ratios of the experimental group. These were the only ones available.
TABLE 3

DISTRIBUTION BY RANK OF CONVENTIONALLY TAUGHT AND TELEVISION-TAUGHT STUDENTS

<table>
<thead>
<tr>
<th></th>
<th>Freshmen</th>
<th>Sophomores</th>
<th>Juniors</th>
<th>Seniors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Group</td>
<td>N    = 163</td>
<td>27</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>%    = 78</td>
<td>13</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Television Group</td>
<td>N    = 90</td>
<td>9</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>%    = 84</td>
<td>8</td>
<td>6</td>
<td>2</td>
</tr>
</tbody>
</table>

readily seen, the average age of the two groups is the same; the average grade point ratios vary by only .2 of a point, in favor of the conventionally taught group. The relative number of men and women is about equal. Finally, most of the students in each group were freshmen and the percentage of juniors and seniors was about the same in each group.

Instructors and Classroom Conditions of The Conventionally Taught and Television-Taught Groups

Instructors of the Conventionally Taught Group

The nine instructors of the conventionally taught group were one member of the Mathematics Department's regular staff (the television instructor during the Spring Quarter), one professor and one associate professor of education, three assistant instructors of mathematics, part-time, and three undergraduate student assistants. Five of these nine instructors of the conventional group also
served as quiz-section instructors during the Spring Quarter when Mathematics 400 was offered by television.

Instructors of the Television-Taught Group

Dr. Miller, the television instructor also served as one of the five quiz section instructors and selected the other four, all of whom had worked with him during the Winter Quarter, 1958. Some of these people had taught Mathematics 400 in the conventional manner not only during the Winter Quarter, 1958, but several times before.

Description of the Duties of The Television Instructor and His Assistant

The television instructor, Dr. Leslie H. Miller, Associate Professor of Mathematics, who is in charge of all remedial work in mathematics at The Ohio State University, had taught Mathematics 400 three times before, including once during the Winter Quarter, 1958. He planned all the lecture-demonstrations with the help of his assistant, who herself was one of the other four quiz-section teachers. Although his assistant prepared much of the visual material for the television presentations, Dr. Miller also assisted with this phase of the work. Along with his other duties, Dr. Miller also had to —

1. Select quiz-section instructors
2. Acquaint the other four quiz-section instructors and their students with the peculiarities of teaching and studying Mathematics 400 by television
3. Call meetings of quiz-section instructors
4. Prepare television lecture-demonstrations
5. Deliver television lecture-demonstrations
6. Approve and often mimeograph tests drawn up by quiz-section instructors
7. Make all announcements relative to the course on television
8. Approve questionnaires and tests given by this writer who was doing an evaluative (Doctoral) study of the presentation
9. Confer with students
10. Arrange for quiz-section teachers as well as Dr. John R. Kinzer of the Psychology Department at The Ohio State University to appear on one program
11. Act as liaison agent between quiz-section teachers and the Mathematics Department
12. Act as liaison agent between Station WOSU-TV and the Mathematics Department
13. Teach a quiz section
14. Make up and distribute student assignment sheets to quiz-section teachers

Dr. Miller's assistant was expected to —

1. Assist the television instructor in preparing flip cards, printed announcements, and other teaching materials
2. Hold regular conferences with the television instructor concerning the planning of lecture demonstrations
3. Extend advice and criticism to the television instructor
4. Accompany the television instructor to the station when he lectured, to turn flip cards, erase the board, and give moral support
5. Act as liaison agent between director, crew men, and television instructor
6. Work with other three quiz-section teachers in preparing their reviews preceding the last three examinations in the course
7. Act as television instructor if the instructor himself was unable to appear

**Classroom Conditions of the Conventionally Taught Group**

**Lecture-Demonstrations** — Nine sections of conventionally taught students were headed by nine different instructors. Meeting at different hours during the day, the conventional classes received five forty-eight minute lecture-demonstrations per week.
Provisions for questions and discussion — Students could ask questions before or after class about anything covered in the lectures, homework, or examinations. Students could also interrupt the instructor's lecture on the day's lesson to clear up points that were not clear to them. Besides, a student could find some help in Room 316, University Hall, The Ohio State University, a conference room maintained by the Mathematics Department and staffed by graduate assistants in mathematics. This provision was made especially for first and second year mathematics students at the university. Graduate assistants are available for conferences six or seven hours daily. A student could, if he wished, make an appointment with his instructor.

Provisions for homework — Most of the instructors required that homework be done, although many did not collect this homework for marking. Some instructors marked the homework and allowed some credit for it in computing the student's final grade. Several teachers assigned homework problems and either worked them in class at the next meeting or had students do so.

Provisions for examinations — Each teacher gave the number of examinations during the quarter which he thought necessary. (As a rule, four examinations are given during the quarter when Mathematics 400 is taught conventionally.) Each instructor gave a two-hour final examination. The nine sections of conventional students were given The Ohio State University Mathematics Placement
Test, Form G-2, as one-half of their final examination. This was the only uniform examination given to these nine sections during the quarter.

Classroom Conditions of the Television-Taught Group

Lecture-Demonstrations — The students who took Mathematics 400 in the Spring Quarter, 1958, viewed televised lectures three times a week, Monday, Wednesday, and Friday, from 3:00 to 3:48 P.M. They assembled in an auditorium on the second floor of Mendenhall Laboratory for the first few meetings. Then the meeting place was changed to the first floor auditorium in the Botany and Zoology building. Students could watch the telecast in this auditorium, at home, in their dormitories, or in their sorority or fraternity houses. Three of the teachers of the quiz sections attended these meetings.

Provisions for questions and discussion — The quiz sections were to give students the opportunity to ask questions and to participate in discussions concerning previous television lecture-demonstrations. A student could also make appointments for conferences with his quiz-section teacher. Students could come early to the quiz-section meetings or remain afterward to ask questions of their teachers. The television-taught students could also ask help in Room 316, University Hall, The Ohio State University.
Provisions for homework — Every two weeks an assignment sheet was distributed to the students. In other respects, however, the handling of homework was not uniform. Some instructors collected, marked, and returned homework, allowing some credit for it in computing final grades; some did not collect homework, but had students work problems at the blackboard during the quiz-section periods.

Provisions for examinations — Four forty-eight minute examinations were given during the quiz-section meetings throughout the quarter. These examinations were the same in all five quiz sections and as nearly as possible were uniformly graded. The same final examination was given to all sections. Before each examination a sample examination was distributed to the quiz-section students to be reviewed in class the day before the regular examination. In addition to the sample examinations, a review preceded each of the last three examinations. They were conducted by the television instructor himself over television. The three television programs during the last week of school were devoted to review of the entire course.

Copies of these examinations as well as sample examinations may be found in the office of Dr. Nathan Lazar, Department of Education, The Ohio State University, Columbus, Ohio.
CHAPTER III

A COMPARATIVE ANALYSIS OF THE ACHIEVEMENT OF
CONVENTIONALLY TAUGHT AND TELEVISION-TAUGHT STUDENTS
AND OF THEIR REACTION TO MATHEMATICS 400

A Comparative Analysis of the Mathematical
Achievement of the Conventional and Television Groups

The Ohio State University Mathematics Placement Test, Form G-2, described earlier in this study, was used as the scale for measuring the degree of mathematical growth of the conventional and television groups. This test was given at the end of the quarter as one-half of the final examination to all of the television students completing the course Mathematics 400 in the Spring Quarter and to a majority of the conventional students who took the course during the Winter Quarter, 1958.

Students' t-ratio test was used on the second Ohio State University Mathematics Placement Test scores of the conventional and television students. The value of t found was \( t = 2.6142 \). According to a t-distribution table with \( N_1 + N_2 - 2 = 223 + 107 - 2 = 328 \) degrees of freedom, \(^1\) this value of t was not critical, that is to say, not statistically significant. Thus, at the end of the quarter's training, the mathematical (arithmetic and elementary algebraic) achievement of the two groups was similar, at least to the extent that the difference was statistically insignificant.

\(^1\) Note that \( N_1 \), the number of cases in the conventional group is taken to be 223 instead of 208. All of the available Second G-2 scores were used.
The following table shows the distribution of the grades of all Mathematics 400 students during the Winter Quarter, 1958, and the Spring Quarter, 1958.

**TABLE 4**

**DISTRIBUTION OF FINAL GRADES FOR MATHEMATICS 400 STUDENTS DURING THE WINTER AND SPRING QUARTERS, 1958**

<table>
<thead>
<tr>
<th>Winter Quarter Grades</th>
<th>Grade</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F^2</th>
<th>Inc</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td></td>
<td>45</td>
<td>91</td>
<td>123</td>
<td>65</td>
<td>32</td>
<td>5</td>
<td>2</td>
<td>363</td>
</tr>
<tr>
<td>Percent</td>
<td></td>
<td>12.40</td>
<td>25.07</td>
<td>33.88</td>
<td>17.91</td>
<td>8.82</td>
<td>1.38</td>
<td>.55</td>
<td>100.01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spring Quarter Grades</th>
<th>Grade</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F^2</th>
<th>Inc</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td></td>
<td>21</td>
<td>30</td>
<td>46</td>
<td>22</td>
<td>24</td>
<td>7</td>
<td>0</td>
<td>150</td>
</tr>
<tr>
<td>Percent</td>
<td></td>
<td>14.00</td>
<td>20.00</td>
<td>30.67</td>
<td>14.67</td>
<td>16.00</td>
<td>4.67</td>
<td>0.00</td>
<td>100.01</td>
</tr>
</tbody>
</table>

^2 F indicates that the student dropped the course before the end of the quarter.
A Discussion of the Reactions of Television-Taught Students to the Method

For the purpose of this study, it is as important to know something about the reactions of television-taught students to television as a medium of instruction, as it is to know about their relative achievement. Five questionnaires were, therefore, given to the television-taught students during the first six weeks of the Spring Quarter, 1958; in addition, a summarizing questionnaire was given during the tenth week of the quarter.

On Questionnaire Number I, which was unstructured, students were asked to list the places where they watched the Mathematics 400 telecasts. No comments on the course were elicited.

Questionnaires Number II, III, and IV, also unstructured, sought the opinions of the students concerning the presentation of the course. It also elicited suggestions for improvement of the presentation. This information was to be placed in spaces marked "favorable comments," "unfavorable comments," and "suggestions for improvement."

Questionnaire Number V, the only structured questionnaire administered during the first part of the quarter, asked questions concerning the presentation of the course.

---

A copy of this questionnaire as well as the other questionnaires administered during and before the present study are found in Appendix D.
### TABLE 5

SYNOPSIS OF THE FIRST FOUR QUESTIONNAIRES

<table>
<thead>
<tr>
<th>Number of Students Completing Questionnaire</th>
<th>Number of Comments</th>
<th>Number and Percentage of Favorable Comments</th>
<th>Number and Percentage of Unfavorable Comments</th>
<th>Number and Percentage of Students Commenting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questionnaire Number I-143 April 15, 1958</td>
<td>72</td>
<td>36</td>
<td>50 percent</td>
<td>79%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 percent</td>
<td>50 percent</td>
<td>55%</td>
</tr>
<tr>
<td>Questionnaire Number II-78 April 22, 1958</td>
<td>85</td>
<td>31</td>
<td>54</td>
<td>56%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>36 percent</td>
<td>64 percent</td>
<td>72%</td>
</tr>
<tr>
<td>Questionnaire Number III-87 April 29, 1958</td>
<td>111</td>
<td>48</td>
<td>63</td>
<td>87%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>43 percent</td>
<td>57 percent</td>
<td>65%</td>
</tr>
<tr>
<td>Questionnaire Number IV-65 May 6, 1958</td>
<td>79</td>
<td>37</td>
<td>42</td>
<td>71%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>47 percent</td>
<td>53 percent</td>
<td>54%</td>
</tr>
</tbody>
</table>

The Summarizing Questionnaire, Number VI, was structured.

**Questionnaires Number I, II, III, and IV**

In Table 5 the Questionnaires Number I, II, III, and IV administered during the first six weeks of the quarter are summarized.

The other seven comments pertained to the reception of the television receivers.
Some of the most frequent favorable comments were: "The course is clearly and well presented," "The use of visual aids enhances the presentation," "The fact that so many students can be exposed to instruction by an excellent teacher is an asset of the method."

The most frequent unfavorable comments were: "The pace of the television teacher is too fast," "The fact that discussion cannot be engaged in and questions cannot be asked during the telecast is a serious limitation of the method," "Too many simple and not enough difficult problems are worked by the television instructor."

The following are the recurrent suggestions for improvement made on Questionnaires Number II, III, and IV:

1. Slow the pace of presentation of the television teacher. (3)
2. Return to the conventional method of teaching. (3)
3. Provide more time for note-taking. (3)
4. Allow more time for working problems assigned by the television teacher during his lecture-demonstrations. (3)
5. Provide more individual help for students (or some variant of this suggestion). (3)
6. Use a representative studio class in the television studio during the television lecture-demonstrations to ask questions and engage in discussion with the television teacher. (2)

Suggestions for Improvement were not asked for on Questionnaire Number I.

The numbers in parentheses indicate the number of questionnaires on which the particular suggestion appeared. There were only three questionnaires.
7. Spend more time in working difficult problems on television. (3)
8. Provide more quiz section meetings. (3)
9. Make more provisions for questions and discussion immediately following the television lecture-demonstrations. (2)

Questionnaire Number V

Questionnaire Number V, given on May 13, 1958, was the only structured one given during the first six weeks of the quarter. In each question the student had a choice of five possible reactions, ranging from very favorable to very unfavorable. Some of these questions and similar ones were asked the students on the Summarizing Questionnaire given during the tenth week of the Spring Quarter. No suggestions for improvement of the course were requested on Questionnaire Number V. A copy of Questionnaire Number V, on which the number and percentage of the students answering each question in a particular way are indicated, is found below.

Questionnaire — May 13, 1958

Please read the following questions carefully and check the blank under the phrase which most adequately expresses your feelings about the question asked.

1. How do you rate the clearness of presentation?

<table>
<thead>
<tr>
<th>Very Confusing</th>
<th>Rather Confusing</th>
<th>Not Sure</th>
<th>Fairly Clear</th>
<th>Very Clearly Presented</th>
</tr>
</thead>
<tbody>
<tr>
<td>4(3%)</td>
<td>25(20%)</td>
<td>13(11%)</td>
<td>55(45%)</td>
<td>26(21%)</td>
</tr>
</tbody>
</table>
2. How would you rate the speed of presentation?

<table>
<thead>
<tr>
<th>Speed</th>
<th>Much too Slow</th>
<th>Too Slow</th>
<th>About Right</th>
<th>Too Fast</th>
<th>Much too Fast</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1(1%)</td>
<td>4(3%)</td>
<td>65(57%)</td>
<td>39(32%)</td>
<td>9(7%)</td>
</tr>
</tbody>
</table>

3. How would you rate the use of charts and other visual aids?

<table>
<thead>
<tr>
<th>Aid</th>
<th>Much too Few</th>
<th>A Little too Few</th>
<th>About Right</th>
<th>A Little too Many</th>
<th>Much too Many</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1(1%)</td>
<td>12(10%)</td>
<td>92(76%)</td>
<td>14(12%)</td>
<td>2(2%)</td>
</tr>
</tbody>
</table>

4. How much do you miss being able to participate in discussion and ask questions during the televised lectures?

<table>
<thead>
<tr>
<th>Miss</th>
<th>Very Much</th>
<th>Quite a Bit</th>
<th>Somewhat</th>
<th>Very Little</th>
<th>Not at All</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20(17%)</td>
<td>42(35%)</td>
<td>31(26%)</td>
<td>16(13%)</td>
<td>11(9%)</td>
</tr>
</tbody>
</table>

5. How interesting do you find the course?

<table>
<thead>
<tr>
<th>Interest</th>
<th>Very Boring</th>
<th>Boring</th>
<th>Variable</th>
<th>Interesting</th>
<th>Very Interesting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7(6%)</td>
<td>12(10%)</td>
<td>58(47%)</td>
<td>37(30%)</td>
<td>9(7%)</td>
</tr>
</tbody>
</table>

6. Would you recommend the course to a friend were it offered again via television and by the regular classroom method at the same time?

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Never</th>
<th>Probably Not</th>
<th>Doubtful</th>
<th>Probably Yes</th>
<th>Certainly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>11(9%)</td>
<td>19(16%)</td>
<td>29(24%)</td>
<td>52(45%)</td>
<td>10(8%)</td>
</tr>
</tbody>
</table>

Please indicate below where you watched the telecasts on the dates indicated.

Wednesday, May 7_________ Friday, May 9_______ Monday, May 12_______

Name______________________________
The Summarizing Questionnaire, VI

After Questionnaire Number V, it seemed advisable to give no more to students lest such activity become perfunctory and the results, therefore, of little use.

During the tenth week of classes in the Spring Quarter, the following questionnaire was given to the television-taught students. The number and percent of students checking each answer are given under each question. Since a detailed statistical analysis was made of these questionnaires after they had been divided into five groups based upon the students' grades, the questionnaires will not be discussed in detail in this section of the study.

Questionnaire, VI

Please read each question carefully and put a check before the word, phrase, or statement which most adequately expresses your answers to the question.

1. How would you rate the TV course in mathematics 400?

<table>
<thead>
<tr>
<th>Rating</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Too difficult</td>
<td>38(29%)</td>
<td></td>
</tr>
<tr>
<td>About right</td>
<td>90(68%)</td>
<td></td>
</tr>
<tr>
<td>Too easy</td>
<td>4(3%)</td>
<td></td>
</tr>
</tbody>
</table>

2. What is your opinion of the pace of the TV teacher?

<table>
<thead>
<tr>
<th>Pace</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Too fast</td>
<td>48(37%)</td>
<td></td>
</tr>
<tr>
<td>About right</td>
<td>47(59%)</td>
<td></td>
</tr>
<tr>
<td>Too slow</td>
<td>5(4%)</td>
<td></td>
</tr>
</tbody>
</table>

3. How would you rate the explanatory materials in the text?

<table>
<thead>
<tr>
<th>Rating</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>18(13%)</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>89(66%)</td>
<td></td>
</tr>
<tr>
<td>Inadequate</td>
<td>27(20%)</td>
<td></td>
</tr>
</tbody>
</table>
4. How well does your assignment sheet serve you?

<table>
<thead>
<tr>
<th></th>
<th>Very well</th>
<th>Satisfactorily</th>
<th>Inadequately</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 134</td>
<td>74(55%)</td>
<td>55(41%)</td>
<td>5(4%)</td>
</tr>
</tbody>
</table>

5. How much of the assigned homework do you do?

<table>
<thead>
<tr>
<th></th>
<th>Over 2/3</th>
<th>From 1/3 to 2/3</th>
<th>1/3 or less</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 134</td>
<td>89(66%)</td>
<td>34(25%)</td>
<td>11(8%)</td>
</tr>
</tbody>
</table>

6. How do you feel about the TV teacher's use of charts and other visual aids?

<table>
<thead>
<tr>
<th></th>
<th>Use more</th>
<th>About right</th>
<th>Use fewer</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 133</td>
<td>20(15%)</td>
<td>102(77%)</td>
<td>11(8%)</td>
</tr>
</tbody>
</table>

7. As the quarter progressed, how well did the TV lessons maintain your interest?

<table>
<thead>
<tr>
<th></th>
<th>Very well</th>
<th>Moderately</th>
<th>Very little</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 134</td>
<td>25(19%)</td>
<td>81(60%)</td>
<td>28(21%)</td>
</tr>
</tbody>
</table>

8. How do you feel about your TV teacher's use of guest teachers?

<table>
<thead>
<tr>
<th></th>
<th>Use more</th>
<th>About right</th>
<th>Use fewer</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 130</td>
<td>43(33%)</td>
<td>67(52%)</td>
<td>20(15%)</td>
</tr>
</tbody>
</table>

9. How well does your TV teacher anticipate and answer your questions?

<table>
<thead>
<tr>
<th></th>
<th>Almost always</th>
<th>Sometimes</th>
<th>Seldom</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 131</td>
<td>14(11%)</td>
<td>92(70%)</td>
<td>25(19%)</td>
</tr>
</tbody>
</table>

10. Do you take notes during the TV lesson?

<table>
<thead>
<tr>
<th></th>
<th>Almost always</th>
<th>Sometimes</th>
<th>Seldom</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 133</td>
<td>71(53%)</td>
<td>44(33%)</td>
<td>18(14%)</td>
</tr>
</tbody>
</table>

11. Do you learn as effectively by TV as you have in other classrooms?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Not sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 134</td>
<td>36(27%)</td>
<td>65(48%)</td>
<td>33(25%)</td>
</tr>
</tbody>
</table>
12. In your opinion, how much do you miss not being able to participate in class discussion and ask questions during the telecasts?

<table>
<thead>
<tr>
<th></th>
<th>A great deal</th>
<th>A little</th>
<th>Not at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 134</td>
<td>65(48%)</td>
<td>48(36%)</td>
<td>21(16%)</td>
</tr>
</tbody>
</table>

13. Were this course offered both in the regular manner and also by television during the same quarter and at the same time (hour in the day), would you recommend that a friend take the course by television?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Undecided</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 133</td>
<td>40(30%)</td>
<td>61(46%)</td>
<td>32(24%)</td>
</tr>
</tbody>
</table>

14. Which combination of televised lectures and quiz sections do you feel would yield best results in mathematics 400?

<table>
<thead>
<tr>
<th></th>
<th>a)</th>
<th>b)</th>
<th>c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 129</td>
<td>Two television lectures and three quiz sections weekly? 61(47%)</td>
<td>Three television lectures and two quiz sections weekly? 41(32%)</td>
<td>One half-hour television lecture and one half-hour quiz sections daily? 27(21%)</td>
</tr>
</tbody>
</table>

15. If each telecast were repeated on the same day before you attempted doing your homework, do you feel that you would get a better grasp of the material?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>Probably</th>
<th>No</th>
<th>Uncertain</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 133</td>
<td>35(26%)</td>
<td>51(41%)</td>
<td>19(14%)</td>
<td>24(18%)</td>
</tr>
</tbody>
</table>

16. Would it help you to be able to see a film of the telecast on the day following the initial telecast after you had attempted doing your homework?

<table>
<thead>
<tr>
<th></th>
<th>Very much</th>
<th>Somewhat</th>
<th>A little</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 131</td>
<td>22(17%)</td>
<td>68(52%)</td>
<td>41(31%)</td>
</tr>
</tbody>
</table>

17. Which would you have preferred?

<table>
<thead>
<tr>
<th></th>
<th>a)</th>
<th>b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 127</td>
<td>Quiz sections which meet formally and regularly 97(76%)</td>
<td>Conference periods staffed by teachers of mathematics, arranged especially for math 400 students, and extending over the entire school day, which you would attend only if you felt you needed to. 30(24%)</td>
</tr>
</tbody>
</table>
18. How much did you study the text in preparation for listening to the TV lecture?

<table>
<thead>
<tr>
<th>A great deal</th>
<th>Moderately</th>
<th>Not at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 133</td>
<td>33(25%)</td>
<td>89(67%)</td>
</tr>
</tbody>
</table>

19. How often should tests be given?

N = 131
a) More often than this term? 8(6%)
b) About the same as now? 113(86%)
c) Less often than this term? 10(8%)

20. From the point of view of the help you received in learning the material of the course, rank each of the following parts (number them 1,2,3,4 in order of the amount of help received, the most helpful part being numbered "1")

<table>
<thead>
<tr>
<th>TV lectures</th>
<th>Tests</th>
<th>Quiz Sections</th>
<th>Text Book</th>
</tr>
</thead>
<tbody>
<tr>
<td>1— 28(26%)</td>
<td>1— 7(6%)</td>
<td>1— 44(38%)</td>
<td>1— 36(32%)</td>
</tr>
<tr>
<td>2— 31(28%)</td>
<td>2— 25(22%)</td>
<td>2— 30(26%)</td>
<td>2— 24(21%)</td>
</tr>
<tr>
<td>3— 22(20%)</td>
<td>3— 32(28%)</td>
<td>3— 31(27%)</td>
<td>3— 32(28%)</td>
</tr>
<tr>
<td>4— 28(26%)</td>
<td>4— 50(44%)</td>
<td>4— 10(9%)</td>
<td>4— 21(18%)</td>
</tr>
<tr>
<td>N = 109</td>
<td>N = 144</td>
<td>N = 115</td>
<td>N = 113</td>
</tr>
</tbody>
</table>

21. How do you think your final course grade will be?

N = 126
a) Better than in a non-TV class? 23(18%)
b) No expected difference? 42(33%)
c) Not as high as in a non-TV class? 61(48%)

22. How was the ventilation in the TV lecture room?

N = 124
Too much 3(2%)
About right 78(63%)
Too little 43(35%)

23. How conveniently could you have followed the mathematics 400 telecasts if they had been offered in the evening hours between:

a) 4 and 5?
Conveniently 31(26%)
With difficulty 42(36%)
Impossible 45(38%)

N = 118

b) 7 and 8?
Conveniently 32(28%)
With difficulty 38(34%)
Impossible 43(38%)

N = 113
24. If required courses in other subjects are offered both by television and in the regular manner next term, will you enroll in the television section?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Undecided</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 131</td>
<td>32 (24%)</td>
<td>67 (51%)</td>
<td>32 (24%)</td>
</tr>
</tbody>
</table>

25. Have the tests been fair?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Undecided</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 129</td>
<td>103 (80%)</td>
<td>5 (4%)</td>
<td>21 (16%)</td>
</tr>
</tbody>
</table>

26. What topics in the course should be eliminated?

1. No reply (41)  
2. None (22)  
3. I really don't know (1)  
4. Some of the simple arithmetic (1)  
5. Number systems and other than the decimal (33)  
6. Chapters 6 and 9 (1)  
7. Program on "How to Study" (1)  
8. Word Problems (1)  
9. Geometry (1)  
10. Sections on variations (8), graphs (8), and volumes and areas (3)  
11. Simultaneous equations (1)  
12. All sections on algebra (1)  
13. Fractions (1)

Many students did not answer this question at all. It is not surprising that more students voted to eliminate "number systems other than the decimal" than any other topic. Students seem to have more difficulty understanding the use of the number bases than almost any other topic, at least among those included in the arithmetic part of the course.

27. What other changes not mentioned in this questionnaire would you recommend?

1. No reply (56)  
2. None (23)

---

7 The number in parentheses indicates the number of students listing the item.
Question Number 27 continued:

3. The use of questionnaires should be discontinued.
4. The use of television in teaching Mathematics 400 should be discontinued because questions cannot be asked during the television lectures.
5. Homework should be required after the material which it covers has been discussed in the quiz sections.
6. Less time should be spent on arithmetic and more time given to materials beginning with proportions, variation, formulae and verbal problems.
7. The television lectures should follow the text more closely.
8. More time should have been spent on algebra.
9. The course should be made more elementary.
10. Another textbook, containing more sample examples, should be used.
11. This course should not be a required course.
12. Students' questions should be presented to Dr. Miller to be answered on television.
13. The seating arrangements in the television lecture room should be improved.
14. More emphasis should be given to practical arithmetic, leaving out some of the more advanced topics.
15. There should be better discipline in the television lecture room.
16. More quiz sections and fewer television lecture sections should be used.
17. Slow the pace of the television teacher.
18. Too much material is covered in one quarter.
19. The course should be changed to a three-hour course.
20. More difficult problems should be worked on television.
21. Conference hours should be set up for Mathematics 400 students as well as for the quiz sections.
22. There should be an accelerated section of Mathematics 400 for the students who are able to go faster.
23. Grading standards should be the same in the quiz sections.
24. Good job by all concerned with the program.

Table 6 provides a basis for comparing the answers given to questions on the Summarizing Questionnaire with those to the same questions included on Questionnaire Number V, in terms of the percents of students answering a question in a certain way. The
TABLE 6

NUMBER AND PERCENTAGE OF STUDENTS ANSWERING THE FOUR QUESTIONS WHICH APPEARED ON BOTH QUESTIONNAIRE NUMBER V AND ON THE SUMMARIZING QUESTIONNAIRE

<table>
<thead>
<tr>
<th>Question</th>
<th>Possible Answers</th>
<th>Number and Percentage of Students: May 13</th>
<th>Number and Percentage of Students: June 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>How would you rate the speed of presentation?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Too Slow</td>
<td>5 (4%)</td>
<td>5 (4%)</td>
<td></td>
</tr>
<tr>
<td>About Right</td>
<td>69 (57%)</td>
<td>76 (59%)</td>
<td></td>
</tr>
<tr>
<td>Too Fast</td>
<td>48 (39%)</td>
<td>48 (37%)</td>
<td></td>
</tr>
<tr>
<td>N = 122</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How would you rate the use of charts and other visual materials?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Too Few</td>
<td>13 (12%)</td>
<td>20 (15%)</td>
<td></td>
</tr>
<tr>
<td>About Right</td>
<td>92 (76%)</td>
<td>102 (77%)</td>
<td></td>
</tr>
<tr>
<td>Too Many</td>
<td>16 (14%)</td>
<td>11 (8%)</td>
<td></td>
</tr>
<tr>
<td>N = 121</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How much do you miss being able to participate in discussion and ask questions during the television lectures?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very Much</td>
<td>62 (52%)</td>
<td>65 (48%)</td>
<td></td>
</tr>
<tr>
<td>Very Little</td>
<td>47 (39%)</td>
<td>48 (36%)</td>
<td></td>
</tr>
<tr>
<td>Not at All</td>
<td>11 (9%)</td>
<td>21 (16%)</td>
<td></td>
</tr>
<tr>
<td>N = 120</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Would you recommend the course to a friend if it were offered again by the television and by the regular classroom method at the same time?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>62 (53%)</td>
<td>40 (30%)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>30 (25%)</td>
<td>61 (46%)</td>
<td></td>
</tr>
<tr>
<td>Undecided</td>
<td>29 (24%)</td>
<td>32 (24%)</td>
<td></td>
</tr>
<tr>
<td>N = 121</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

37
principal purpose of such a comparison is to determine whether
the class responded differently to the same question on the Fifth
and the Summarizing Questionnaires.

In the preceding table, the answers to the questions included
in Questionnaire, V on either side of the centrally located answer,
were combined; for example, "Much too Few" and "A Little too Few"
were combined, simply, to read "Too Few" in the table.

Statistical Analysis of Answers to Questions
On the Summarizing Questionnaire, VI

The set of completed Summarizing Questionnaires of the tele­
vision-taught students was divided into five groups on the basis
of the grades the students received in the course. Chi Square\(^8\)
was applied to the answers given by these students in an effort to
determine whether the grades students received in the course and
the answers which they gave to the questions on the Summarizing
Questionnaire were related. Following are the results of the ap­
plication of this statistical technique to the questionnaires.

Only those questions yielding statistically significant
values of Chi Square are discussed. These questions follow:

**Question Number 2:** What is your opinion of the pace of the
television teacher?

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\(^8\) The Chi Square computation sheets for Questions 1 to 21
and Questions 24 and 25 may be found in Dr. Nathan Lazar's Office,
Department of Education, The Ohio State University, Columbus, Ohio.
Possible Answers: (1) Too Fast (2) About Right (3) Too Slow

The value of Chi Square found was 17.974. According to a Chi Square table with this value and four degrees of freedom, the null hypothesis is rejected at better than a one percent level of confidence, suggesting a high positive correlation between the grades students received in Mathematics 400 and their answers to Question Number 2, for $X^2 = 17.974$, $C = .36$.

**Question Number 3:** How would you rate the explanatory material in the text?

Possible Answers: (1) Excellent (2) Average (3) Inadequate

The value of Chi Square found was 5.695. According to a Chi Square table with this value and two degrees of freedom, $0.05 < P < 0.10$. The value of $P$ found does not quite pass our criterion of significance (0.05) but the indications are certainly strong that there is a positive correlation between grades students received in the course and the answers they gave to Question Number 3, for $X^2 = 5.695$, $C = .21$.

**Question Number 4:** How well does your assignment sheet serve you?

Possible Answers: (1) Very Well (2) Satisfactorily (3) Inadequately

The value of Chi Square found was 12.766. According to Chi Square table with four degrees of freedom, the null hypothesis is rejected at better than a two-percent level of confidence, suggesting a high positive correlation between the grades students
received in the course and the answers they gave to Question Number 4.

**Question Number 5:** How much of the assigned homework do you do?

**Possible Answers:**
1. Over 2/3
2. From 1/3 to 2/3
3. 1/3 or less

The value of Chi Square found was 15.257. According to a Chi Square table with three degrees of freedom, the null hypothesis is rejected at better than a one percent level of confidence, suggesting a high positive correlation between the grades students received in the course and their answers to Question Number 5, for $X^2 = 15.257, C = .34$.

**Question Number 9:** How well does your TV teacher anticipate and answer your questions?

**Possible Answers:**
1. Almost Always
2. Sometimes
3. Seldom

The value of Chi Square found was 8.005. According to a Chi Square table with four degrees of freedom, $0.05 < P < 0.10$. The value of $P$ found does not quite pass our criterion of significance ($0.05$) but the indications are certainly strong that there is a positive correlation between grades students received in the course and the answers they gave to Question Number 9, for $X^2 = 8.005, C = .25$.

**Question Number 11:** Do you learn as effectively by TV as you have in other classrooms?

**Possible Answers:**
1. Yes
2. No
3. Not Sure

The value of Chi Square found was 12.051. According to Chi Square table with six degrees of freedom, $0.05 < P < 0.10$. The value
of P found does not quite pass our criterion of significance (.05) but the indications are certainly strong that there is a positive correlation between grades students received in the course and the answers they gave to Question Number 11, for $X^2 = 12.051$, $C = .30$.

**Question Number 12:** In your opinion, how much do you miss being able to participate in class discussion and ask questions during the telecasts?

**Possible Answers:** (1) A Great Deal (2) A Little (3) Not At All

The value of Chi Square found was 10.564. According to a Chi Square table with four degrees of freedom, the null hypothesis is rejected at better than a five percent level of confidence, suggesting a positive correlation between the grades students received in Mathematics 400 and the answers they gave to Question Number 12, for $X^2 = 10.564$, $C = .29$.

**Question Number 13:** If this course were offered both in the regular manner and also by television during the same quarter and at the same time, would you recommend that a friend take the course by television?

**Possible Answers:** (1) Yes (2) No (3) Undecided

The value of Chi Square found was 10.933. According to a Chi Square table with six degrees of freedom, $.05 \leq P \leq .10$. The value of P found does not quite pass our criterion of significance (.05), but the indications are certainly strong that there is a positive correlation between grades students received in the course and the answers they gave to Question Number 13, for $X^2 = 10.933$, $C = .29$. 
**Question Number 16:** Would it help you to be able to see a film of the telecast on the day following the initial telecast after you had attempted doing your homework?

**Possible Answers:** (1) Very Much  (2) Somewhat  (3) A Little

The value of Chi Square found was 17.602. According to a Chi Square table with four degrees of freedom, the null hypothesis is rejected at better than a one percent level of confidence, suggesting a high positive correlation between the grades students received in Mathematics 400 and the answers they gave to Question Number 16, for $X^2 = 17.602, C = .36$. 

**Question Number 21:** How do you think your final course grade will be?

**Possible Answers:** (1) Better than in a non-TV class?  
(2) No expected difference?  
(3) Not as high as in a non-TV class?

The value of Chi Square found was 19.799. According to a Chi Square table with four degrees of freedom, the null hypothesis is rejected at better than a one-tenth percent level of confidence, suggesting a positive correlation between the grades students received in Mathematics 400 and the answers they gave to Question Number 21, for $X^2 = 19.799, C = .39$. 

**Question Number 25:** Have the tests been fair?

**Possible Answers:** (1) Yes  (2) No  (3) No Opinion

The value of Chi Square found was 6.560. According to a Chi Square table with two degrees of freedom, the null hypothesis is rejected at better than a five percent level of confidence, suggesting a positive correlation between the grades students received.
in Mathematics 400 and the answers they gave to Question Number 25, for $X^2 = 6.560$, $C = .23$.

**Statistical Analysis of the Answers**

**Given to the Questions on the Teacher-Course Evaluation Questionnaire of The Ohio State University Mathematics Department**

Perhaps the most revealing questionnaire given to the television-taught students was The Ohio State University Department of Mathematics Teacher-Course Evaluation Questionnaire. Each quarter, the Mathematics Department encourages interested instructors to give this questionnaire to their students. The purpose is to determine their reactions to the teacher and to the course he teaches.

Fortunately for the study, during the Winter Quarter, 1958, these questionnaires were given to the Mathematics 400 classes of those instructors who served as quiz section teachers during the Spring Quarter, when Mathematics 400 was taught by television. These five teachers also gave the questionnaire to their quiz sections during the following Spring Quarter.

The Chi Square statistical technique was used on the two sets of questionnaires in an effort to determine whether or not students taking Mathematics 400 in different quarters and under different teaching conditions answered the questions differently.

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9 The Chi Square computation sheets for Questions 1 to 20 may be found in Dr. Nathan Lazar's Office, Department of Education, The Ohio State University, Columbus, Ohio.
Since they are the same for each of the following questions taken from the questionnaire, the possible answers will be listed for the first question considered only.

**Question Number 3:** Physical adequacy of the classroom.

**Possible Answers:** (1) Excellent (2) Good (3) Average (4) Poor (5) Unsatisfactory

The value of Chi Square found was 44.278. According to Chi Square table with four degrees of freedom, the null hypothesis is rejected at better than a one-tenth percent level of confidence, suggesting a high positive correlation between the quarter in which the student took the course (instructional conditions) and the answers he gave to Question Number 3, for $X^2 = 44.278$, $C = .39$.

**Question Number 4:** The organization of this course.

The value of Chi Square found was 8.541. According to a Chi Square table with three degrees of freedom, the null hypothesis is rejected at better than a five percent level of confidence, suggesting a positive correlation between the quarter in which students took Mathematics 400 (instructional conditions) and their answers to Question Number 4, for $X^2 = 8.541$, $C = .19$.

**Question Number 7:** The interest which my instructor showed in me.

The value of Chi Square found was 7.340. According to a Chi Square table with three degrees of freedom, $.05 < P < .10$. The value of $P$ found does not quite pass our criterion of significance ($.05$), although there is a strong indication of a positive correlation.
between the quarter students took Mathematics 400 (instructional conditions) and the answers they gave to Question Number 7, for \( X^2 = 7.340, C = .17. \)

**Question Number 8:** The interest which my instructor displayed for the course. (Television Quiz Section Instructor or Conventional Instructor)

The value of Chi Square found was 10.658. According to a Chi Square table with two degrees of freedom, the null hypothesis is rejected at better than a one percent level of confidence, suggesting a high positive correlation between the quarter students took Mathematics 400 (instructional conditions) and the answers they gave to Question Number 8, for \( X^2 = 10.658, C = .21. \)

**Question Number 9:** The classroom personality of my instructor. (Television Quiz Section Instructor or Conventional Instructor)

The value of Chi Square found was 6.785. According to a Chi Square table with two degrees of freedom, the null hypothesis is rejected at better than a five percent level of confidence, suggesting a positive correlation between the quarter students took Mathematics 400 (instructional conditions) and the answers they gave to Question Number 9, for \( X^2 = 6.785, C = .17. \)

**Question Number 11:** The lectures of my instructor. (Television Instructor or Conventional Instructor)

The value of Chi Square found was 26.546. According to a Chi Square table with three degrees of freedom, the null hypothesis is rejected at better than a one-tenth percent level of
confidence, suggesting a high positive correlation between the quarter the students took Mathematics 400 (instructional conditions) and the answers they gave to Question Number 11, for $X^2 = 26.546$, $C = .40$.

**Question Number 12:** The opportunities for my participation in the class.

The value of Chi Square found was 6.547. According to a Chi Square table with three degrees of freedom, $.05 < P < .10$. The value of $P$ found does not quite pass our criterion of significance, although there are strong indications of a positive correlation between the quarter students took Mathematics 400 (instructional conditions) and the answers they gave to Question Number 12, for $X^2 = 6.547$, $C = .17$.

**Question Number 13:** The answers my instructor gave to my questions. (Television Quiz Section Instructor or Conventional Instructor)

The value of Chi Square found was 12.551. According to a Chi Square table with three degrees of freedom, the null hypothesis is rejected at better than a one percent level of confidence, suggesting a high positive correlation between the quarter students took Mathematics 400 (instructional conditions) and the answers they gave to Question Number 13, for $X^2 = 12.551$, $C = .23$.

**Interviews with Television-Taught Students**

In addition to completing five questionnaires during the first six weeks of the quarter, a summarizing questionnaire at the
end of the quarter, and the Mathematics Department's Teacher-Course Evaluation Questionnaire, fifteen television-taught students enrolled in the five quiz sections of Mathematics 400 were interviewed by this writer. This was done in an effort to elicit students' opinions of the course which were not obtained from questionnaires. Three students from each of the five quiz sections were interviewed, one from each of three groups, labeled according to their mathematical proficiency as "poor," "average," and "good." Accordingly, either teachers gave the name of one student in each category at the time of the interviews, or this writer was allowed to ask for three students, according to their relative positions in the class.

These fifteen students were asked the following questions:

1. Would you rather have taken the course in the regular manner?
2. What do you feel the shortcomings of the course as presented over television are?
3. What are the strong points of this method of teaching Mathematics 400?
4. Would you take another course in mathematics by the television-teacher-quiz section procedure if you had a choice between this procedure and the conventional method?
5. Would you take a required course in another field (such as literature or history) by the procedure used in this course if you had a choice between this method of taking the course and the conventional method?
6. Have the quiz sections been helpful to you?

---

In addition to being asked these specific questions, each student was encouraged to talk freely about aspects of the program not covered in these questions.
The results of the interviews with the fifteen students follow. Each of the students will be assigned a letter (L to Z); the letter appearing in parentheses is the grade the student received in the course.

Student L ("A") stated that he would have preferred taking the course in the conventional manner so that he could have asked questions during the lecture-demonstrations and could have participated in discussion. He also felt that he would have had more personal attention if he had taken the course in the regular manner.

He thought that much irrelevant material was presented in the television lectures and that the television teacher-quiz section procedure for presenting the course was inferior to the conventional method.

If he had a choice, he would take any other required course in the conventional manner, regardless of the subject.

He thought that the quiz sections were helpful. In fact, he would recommend that more quiz section meetings be made a part of the course.

Student M ("C") stated that she would rather have taken the course in the conventional manner. She thought that the course was presented a bit too rapidly. She also missed the opportunity to ask questions and participate in discussion during the televised lecture-demonstrations.

She thought that the methods used by the television teacher were not always the ones used by her quiz section teacher. She found this variation in method confusing. She would recommend that the method used in presenting a certain body of material be agreed upon by the television and quiz section teachers prior to presenting the material.

This student contended that the use of visual aids and physical devices by the television teacher enhanced the presentation.

She would not take another course by television if she had a choice between this method and the conventional method.

This student found the quiz sections very helpful, but could not always think of questions to ask her teacher. She thought that if the quiz section teachers began lecturing or working problems, questions from the class would be forthcoming.

Student N ("C") stated he liked taking Mathematics 400 by television. Furthermore, he felt that he could not have done any better in the course had he taken it in the conventional manner.

He listed as weak points of the method the impossibility of asking questions during the lecture demonstrations, and objected to the lighting in the television viewing room.
This student thought that the television method of teaching Mathematics 400 had many advantages. For one thing, the approach is different and refreshing. One could hear well because the teacher was in front of the entire class. The use of visual materials was superb. He thought that the use of visual materials would have been limited under conventional methods.

He would probably take another course in mathematics by the television teacher-quiz section procedure if he had a choice between this method and the conventional method.

He thought that television teaching lent itself better to mathematics than most other subjects. Hence, he would be inclined to (take) required courses in other subjects in the conventional manner when a choice was possible.

This student found the quiz sections helpful, but thought that they could have been more helpful.

Student O ("A") stated that he could have done better in Mathematics 400 had he been able to take it in the conventional manner.

Aside from practical reasons (rising enrollments, diminishing competent staff) he could see no advantages of the use of the method.

The impossibility of asking questions during the television lecture-demonstrations was his chief criticism.

He would take any course in any subject in the conventional manner if he had a choice between this method and the television teacher-quiz-section procedure.

This student found the quiz sections helpful, for questions could be asked here.

Student P ("EP") stated that he could have done better in the course if he had been able to take it in the conventional manner.

He stated that the use of visual materials enhanced the program.

The impossibility of asking questions and engaging in discussion during the television lectures is a serious shortcoming of the procedure, according to this student. He thought that mathematics is too difficult a subject to be taught over television.

He would not take another course in mathematics by television if he had a choice of the two methods. He would rather not take a course in another subject by television.

He did not find the quiz sections very helpful. Questions were not answered well by his instructor.

Student Q ("C") stated that she would have learned just as much if she had been taught conventionally.

She thought that one of the advantages of taking the course by television teacher-quiz section procedure was that the television lecture-demonstrations can be viewed at home or in the
dormitory, where the atmosphere is relaxed. She thought that this could well become a weakness of the technique also. The fact that people besides those officially registered for the course would also watch it appealed to this student.

The impossibility of asking questions during the television lecture-demonstrations seemed a limitation of the method to this student.

She would enroll in another televised course in mathematics rather than in a conventional one. However, she believed that a course in another subject might be better taken in the conventional manner than by the television teacher-quiz section procedure.

This student found her quiz section meetings very helpful. Questions were well answered by her teacher.

Student R ("A") stated that he would have done about the same quality of work had he taken the course in the conventional manner.

He stated that he was more relaxed in the televised course than he thinks he would have been in the class taught conventionally. Note taking seemed to have been encouraged more by the television teacher-quiz section approach than the conventional one.

He thought that a weakness of this particular series of programs was that more difficult material was covered too rapidly.

He would prefer to take another course in mathematics (for example, Mathematics 401) by television rather than conventionally. He would also prefer to take any other required courses by television if he had a choice of method.

This student found his quiz section meetings very helpful. He thought that his quiz section instructor was particularly good.

Student S ("C") stated that she liked the television teacher-quiz-section procedure for teaching Mathematics 400. She thought that one's attention is held better by this procedure than by the conventional manner.

The use of visual materials placed the course notches above a conventional presentation. She thought that the fact that questions could not be asked made the course easier to follow. She thought that many students used this "question business" as an excuse. She stated that the very students who state that they would have done better in the course had they been able to ask questions would not have asked them if it had been possible to do so. This student thought that the television lecture-demonstrations, and the quiz sections were well coordinated. A transfer student, she stated that never had she seen students helped so readily.

As far as this student is concerned, there are no weak points in the television method of teaching Mathematics 400.

She would take any course by television in preference to the conventional method.
Student T ("DM") stated that he would have done better had the course been offered in the conventional manner.

He felt that the impossibility of asking questions is a limitation of the method. The course moved too rapidly, and there was no way in which the television teacher could be "slowed down."

On the other hand, he considered the pace made possible by the use of television a strong point of the presentation. If he had to take another course in mathematics or in any other subject and it were offered by television and conventionally, he would choose the conventional manner.

He found the quiz sections helpful, although he forgot many of the questions which he wanted to ask between the last television lecture-demonstration and the quiz section meeting.

Student U ("MC") stated that she would not have done any better in the course had she taken it in the conventional manner.

She thought that the course was very clearly presented, with no pauses to answer questions or engage in discussion. She thought that this made the course easier to follow and more interesting. She also thought that the student's attention is held better in the television course than in the conventional one.

This student thought that too many visual aids were used during the television lecture-demonstrations.

She would rather take any required course in mathematics by television or any other course relying on visual aids. Others might be better if taken conventionally.

She found the quiz sections helpful.

Student V ("EB") stated that she enjoyed the course. She did not believe that she would have done better had she taken the course in the conventional manner.

She rated the use of visual materials in the course highly; she thought that the use of television in teaching made it possible for more students to be reached by a good teacher. She believed that the students who criticized the course were the students who did not attend television lecture-demonstrations or neglected their work in other ways. She stated that if the class had been taught conventionally and questions had been possible, most of the students would not have asked any.

This student could think of no weak points of the presentation.

As to whether or not she would take other courses in mathematics or other fields by television, it would depend on the nature of the course stated this student.

Student W ("EM") stated that he would have done better had he taken the course in the conventional manner.
He thought that the pace of the television teacher was too fast. He missed not being able to ask questions and stated that television failed to motivate him.

He could think of no advantages of the method.

If he had a choice, he would take any other required courses in mathematics in the conventional manner. Whether or not he would take a television course in another subject would depend upon the particular course.

He found the quiz sections helpful.

Student I ("D") stated that she did not think she would have done better had the course been offered in the conventional manner. She thought that homework should have been discussed in class more often. She also thought that the quiz section period was too short. More algebra and less arithmetic should have been covered by the television lecture-demonstrations, according to this student.

Television teaching holds the attention of the student better than the conventional method of teaching, according to this student. The fact that the teacher cannot be stopped for questioning is good, for the material is presented more smoothly, and the presentation is easier to follow.

This student would take another required course in mathematics by the television-teacher-quiz section procedure rather than in the conventional manner if she had a choice. She does not believe that the method of presentation of the course determines whether a student succeeds or fails in it. She would also take a course in another subject by television were it offered both conventionally and by television.

This student found the quiz sections very helpful. She felt that students should be placed in quiz sections on the basis of ability. She liked the informality of the quiz section meetings. She thought that there could have been closer coordination between the work in the quiz sections and the television lecture-demonstrations.

Student Y ("B") stated that he would have done no better had he taken the course in the conventional manner.

He thought the fact that questions could not be asked during the lecture-demonstrations was the most serious limitations of the program.

The fact that no interruptions were possible is an advantage. This student thought that the material of the course was presented in a more simplified form than it would have been had it been offered in the conventional manner.

This student stated that he would take any other course by television in preference to the conventional method.

He found the quiz sections helpful.
Student Z ("E") said he thought he could have done better in the course had he been able to take it in the conventional manner. He also thought the fact that questions could not be asked during the lecture-demonstrations was a serious limitation of the method. He thought the television course tended to be less stimulating than a course taught in the conventional manner was likely to be.

He could think of no advantages of the method. He would take any other required course in the conventional manner if he could choose.

He did not find the quiz sections too helpful. He never had time to have all his questions answered. He thought the period of time which elapsed between television lecture-demonstrations and quiz section meetings was too great.

The Reactions of Participating Instructors to the Televised Mathematics 400 Program

In an effort to determine the opinions of the participating instructors of the quiz sections of the televised Mathematics 400 program, a questionnaire was given to all five of them. The questionnaire was an unstructured one of the following questions:

1. What are your personal opinions about teaching Mathematics 400 by television?
2. How does this method of presentation differ from the regular method?
3. Do your quiz section students seem to be as enthusiastic about the course as former students who were taught the course by conventional methods?
4. Did you feel "rushed" during the quarter?
5. Did you come to know your students as well this quarter as during other quarters?
6. Please write any additional comments which you might have on the course.

The complete answers the five quiz section teachers gave to these questions are given below.

Question 1: Teacher "A" stated the following concerning the televised Mathematics 400 program:
I must admit that I miss getting to teach five days a week myself, but results from my class seem to indicate that students did about as well by the television method as by the conventional. I don't know whether or not I am qualified to say that the television method is as effective as or more effective than the conventional method after only one quarter's work with the television teacher-quiz section procedure. I do feel that the results of the present experiment have not been at all bad.

Concerning her opinions of teaching Mathematics 400 by television, Teacher "B" said the following:

I feel that the students heard much better lectures over television than they would have heard if I had taught the course five days a week in the conventional manner. I think this course is somewhat difficult to teach and that the more experience a teacher has had the easier it is for him to teach it. I also felt that the time which I had to answer questions and elaborate on some points of the lectures was too limited.

Teacher "C" who was also the television instructor, remarked that he found the teaching of Mathematics 400 by television satisfactory.

Teacher "D" expresses her opinions of teaching Mathematics 400 by television as follows:

Like any other teaching set-up, TV could be good, bad or mediocre, depending upon many factors, such as money available, location of television receivers, time of day of the course, personnel available at the television station, personnel available for the program, number of students in the course, the policy of the University toward what goes out over open circuit, etc. For these reasons, I feel that my opinions concerning teaching Mathematics 400 by television could vary from quarter to quarter or from year to year.

Teacher "E" had the following to say:  

I feel that teaching Mathematics 400 by the television teacher-quiz section procedure has been effective this quarter. Students seemed to enjoy the new approach to the teaching of a college course. I personally believe that students received better instruction in
Mathematics 400 during the Spring Quarter than in former quarters. In addition to being presented with very good and well organized television lecture-demonstrations by the television instructor, the quiz section teachers were more than eager to make points of difficulty clear to the students. The students were exposed to more experienced teachers in this presentation than in most other quarters. I believe that with some improvements here and there, this method of presenting mathematics could prove as good as or superior to the conventional method.

Question 2: In discussing some of the differences between the conventional and television method of teaching, Teacher "A" mentioned the following:

An advantage which television teaching offers is the use of more and better visual aids — materials which I consider very important for a class at this level. As for the problem of not being able to ask questions during the telecasts, I feel that most of the students who complain do not ask questions in the regular classes either.

Teaching by television necessitates a well-organized and planned lecture every day that lectures are presented. Teachers are not always organized or prepared in conventional classes.

One other advantage which television teaching enjoys over the conventional method is that more students are reached by an experienced and capable teacher like Dr. Miller, our present television teacher.

The homework problem is one of serious concern to me. My students have complained, and I think justly so, that at times they had to hand in homework before it was ever explained to them. Then, too, too much time elapses between the administration of examinations and the return of same. I feel that much of the educational value of examinations is lost in this way.

Teacher "B" commented on the ways in which television teaching differs from conventional teaching:

I feel that this method adds interest to the course which cannot be obtained by the typical teacher in the typical classroom.

This teacher thought, as did many of the others, that television lectures are prepared with more care than lectures for conventional classes.
About the ways in which teaching by television differs from
the conventional method, Teacher "D" commented:

Teaching by television requires more careful planning by the
instructor, eliminates irrelevant comments and questions, puts
more responsibility on the student in some ways, such as paying
attention, practically eliminates visual and hearing problems that
occur in the conventional classroom.

Concerning the differences between the two methods of teach­
ing Mathematics 400, Teacher "E" remarked:

In the first place the two methods are similar in that they
strive to accomplish the same goal — to teach the Mathematics 400
student all that they can about arithmetic and elementary algebra.
The teacher (quiz section) certainly had to crowd more into a
shorter period of time than the conventional teacher. The tele­
vision teacher had to spend many more hours in preparation than
he would have had to do had he taught the course in the conven­
tional manner. On the other hand, the quiz section teacher had
fewer preparations to make, for instead of meeting his or her
class five times a week, he or she only met it two times, and even
then much of the class period was given over to the administration
of questionnaires, examinations, and questions and discussion.
With the exception of the television instructor and his assistant,
who was also a quiz section teacher, the instructors fared better
under this method than under the conventional method.

Question 3: Concerning the enthusiasm displayed by her quiz
section students for the course as compared with her conventional
students in previous quarters, Teacher "A" had this to say:

I would say that there seems to be little difference in en­
thusiasm from previous classes. Most of the students in my quiz
section seem fairly well interested in their work. All of the
students will not become interested or enthused no matter what the
instructional conditions or the efforts of the teacher are.

As for the enthusiasm of her quiz section students for the
course as compared with former conventionally taught students,
Teacher "B" summarized:
On the whole, my quiz section was more enthusiastic about the work of the course than my former conventional classes. However, those who disliked television were less enthusiastic than former conventional students.

When questioned about the enthusiasm shown by his quiz section students as compared with former conventional students, Teacher "C" responded:

No, my quiz section students did not show as much enthusiasm as former conventionally taught students. However, I have found that few mathematics students show enthusiasm.

Teacher "D" thought that her students seemed about as enthusiastic during the Spring Quarter as in preceding quarters.

About the enthusiasm displayed by his quiz section students, Teacher "E" said:

My quiz section students seemed about equally as enthusiastic as former students who were taught by conventional methods. They did seem a little more grade conscious than did students in conventional classes. I did notice a little more "resistance" toward the course than in conventional classes.

**Question 4:** Teacher "B" added that she felt "rushed" only when she was covering the algebraic portion of the course.

Teacher "C" stated that he felt "rushed" during the quarter, but that he feels this way every quarter.

Teacher "D" felt "rushed" during the Spring Quarter.

Teacher "E" stated that he felt "rushed" during the quarter and often felt guilty because he thought that too much of the students' and quiz section teachers' time was being taken up in the filling out of questionnaires and the taking of examinations. He thinks, however, that students on a whole learned as much during the Spring Quarter as in other quarters.
Question 5: Teacher "A" went on to say that she did not believe that she came to know her students quite as well in the Spring Quarter as in other quarters when students were taught by conventional methods.

Teacher "B" answered the question concerning her acquaintance with her students as follows:

I know the names of all of my students but it took me longer to learn them. I feel now that I know my quiz section students as well as those which I taught five days a week in previous quarters.

Teacher "C" did not come to know his students as well during the Spring Quarter as he did in previous quarters.

Teacher "D" thought that she came to know her quiz section students about as well as she had come to know conventional students in previous quarters.

Teacher "E" thought that he did not come to know his students quite as well as he would have had he met them five times a week in class.

Question 6: Teacher "A" made the following general comments:

I feel that the questionnaires will be of value in planning future programs, but as far as this quarter's classes are concerned, I believe almost more time was spent in this way than in teaching in the quiz sections. The students seemed to have begun to feel like guinea pigs. Possibly this entered in on the general outlook of the program and also on their test results. I think they were necessary, but I hope that they will be valid enough to eliminate the necessity of administering so many next year.

If it were possible to group Mathematics 400 students according to ability, I think it would be a good idea. With such heterogeneous classes, as far as ability in mathematics is concerned, it
is difficult to keep all of the different levels of ability interested in the classroom work. I would not object to having one of the less bright sections. I am interested in only one thing in so far as Mathematics 400 is concerned — more effective teaching.

The following comments were made by Teacher "D":

If a student really wants to learn, the media by which the knowledge is offered will not really prevent his learning. This is another way of saying that I believe that we must not expect television or any other set-up to be THE magic wand to make people want to learn. In evaluating this quarter's television presentation, I believe we might do well to keep this in mind.

Teacher "E" made the following comments:

I have never worked with a more cooperative or congenial group of teachers than the quiz section teachers. Whatever success this program may have attained, may, in large measure, be attributed to this group of people.

I feel that many aspects of the presentation can be improved. The time that homework is due should be changed so that the material which a particular homework assignment covers is discussed in the quiz sections before the assignment is turned in. Perhaps some method could be devised by which questions might be more easily solicited from "shy" students in the quiz sections. Perhaps some special question and discussion periods could be provided for this group besides the regular quiz section meetings. I believe that in time, The Ohio State University will almost be forced to use this procedure or a similar one in other courses offered at the University.

Summary

I. Comparative Achievement of Students Taught Conventionally and by Television

A. Students' t-ratio test indicated no statistically significant difference in the achievement of the two groups.

B. A higher percentage of the conventionally taught group (71.35) than the television-taught group (64.67) made final grades "A," "B," "C." The percentage of students in each group making
the grade "D" was approximately the same. The percentage of television-taught students (16.00) who failed the course was approximately twice that of the conventionally taught (8.82).

II. Student Reaction to Television Instruction
   Expressed in the First Four Questionnaires

A. Except in Questionnaire Number II, approximately equal numbers of students commented favorably and unfavorably on televised instruction.

B. The most frequent favorable comments were:
   1. The course is effectively presented.
   2. The use of visual aids enhances the course.
   3. The fact that so many students can profit from excellent instruction is an advantage of the method.

C. The most frequent unfavorable comments were:
   1. The instructor presents the subject matter too rapidly.
   2. The fact that students cannot participate is a limitation of the method.
   3. The instructor works too many simple problems and too few difficult ones.

D. Recommendations Offered by the Students:
   1. Slow down the presentation of the subject matter.
   2. Return to the conventional method of teaching.
   3. Provide more time for notetaking.
   4. Spend more time in working difficult problems on television.

III. Questionnaire Number V

A. The only structured questionnaire given during the first six weeks of the quarter was Questionnaire Number V. A summary of the findings follows:
1. Most of the students (66%) thought that the television presentations were clear.
2. Although 57% of the students thought that the lectures were paced "about right," more students (39%) felt that they were "too fast" rather than "too slow" (4%).
3. A majority of students (76%) rated the use of charts and other visual aids "about right."
4. More students (52%) than not (22%) missed being able to participate.
5. While 58% of the students found their interest varied more (37%) found the course "interesting" rather than "boring" (16%).
6. More students (53%) than not (25%) would recommend the television course to a friend, were a conventional course offered the same quarter.

IV. The Summarizing Questionnaire, Number VI

A. Students receiving "A" and "B" at the end of the Quarter indicated stronger approval for televised instruction than those receiving "D" and "E." Students receiving "C" seemed almost neutral to it.

V. The Ohio State University Mathematics Department Teacher-Course Evaluation Questionnaire

A. The responses of the two groups of students can be compared as follows:

1. Television-taught students liked their quiz-section teachers better than conventionally taught students liked their classroom teachers.
2. Conventionally taught students rated the organization of Mathematics 400 "excellent," while the television-taught students rated them "poor" to "unsatisfactory."
3. Conventionally taught students rated their opportunities for participation in class "excellent," while the television-taught students rated them "poor" to "unsatisfactory."
4. Conventionally taught students rated the physical adequacy of the classroom "average," to "unsatisfactory," while the television-taught students rated it "good" to "excellent."
5. The conventionally taught group rated instructors' interest "average" to "unsatisfactory." The television-taught group rated the quiz-section instructors' "excellent" to "good."

6. The conventionally taught group rated the instructors' enthusiasm for the course from "average" to "unsatisfactory." The television-taught group rated the instructors' enthusiasm for the course "excellent!"

7. The conventionally taught group rated the instructors' classroom personality "average" to "unsatisfactory." The television-taught students rated the quiz-section teachers' personality "excellent."

8. The conventionally taught group rated the lecture-demonstrations of its instructors both higher and lower than the television-taught group did. The conventionally taught group rated the lecture-demonstrations "excellent," and "poor" to "unsatisfactory," while the television-taught group rated the television lecture-demonstrations "good."

9. The conventionally taught group rated their instructors' answers to questions "average," while the television-taught group rated their quiz-section teachers' "good."

VI. Interviews with Students

A. Eight of the fifteen students preferred the television-teacher-quiz section technique to conventional teaching methods.

B. The three failing students thought they would have done better in a conventional class.

C. Of the three top students two would have preferred taking the conventional course. 12

D. Students making "A," "B," and "C" considered "strong points" certain aspects of the course which the slower students thought to be "shortcomings." Some are:

12 Note that this differs from the findings when Chi Square was applied to the Summarizing Questionnaire. The students making "A" and "B" indicated a preference for the television method. One must consider the relatively small number of students interviewed in making this comparison.
1. The rapid pace at which the television instructor presented the subject matter
2. The impossibility of questions during the lecture-demonstrations
3. The use of visual aids
4. The possibility of viewing the presentations anywhere
5. The number of quiz-section meetings

VII. Evaluation of Televised Instruction by Participating Quiz Section Instructors

A. The quiz-section instructors generally agreed that the use of the television teacher-quiz section technique in teaching Mathematics 400 was "satisfactory" to "effective."

B. Quiz section instructors, on the whole, believed that the lecture-demonstrations of the television course were superior to those previously presented by conventional teachers in their respective classes. These instructors agreed that visual aids could be more effective in televised instruction. Some felt, furthermore, that televised instruction forced more responsibility upon the student.

C. Three teachers stated that their students displayed about as much enthusiasm as did those in former, conventionally taught classes. One teacher thought that her quiz-section students were more enthusiastic than former conventionally taught students, while one thought they were less so. The teachers indicated little agreement.

D. Four of the quiz-section teachers felt rushed during
the quarter, although some added that they had felt rushed while teaching conventionally.

E. Four of the five quiz-section teachers stated that they did not come to know their students as well during the televised course as they had in previous quarters. One teacher stated that although it took her longer to learn her students' names, she thought that she had come to know them as well as she had her former conventionally taught students.

F. The five quiz-section instructors commented:

1. Too many questionnaires were given during the quiz-section meetings.\(^{13}\)
2. Television is probably as effective a method of teaching Mathematics 400 as the conventional method.
3. The method of handling homework could be improved.
4. Some method for eliciting questions from students should be devised.
5. Additional question and discussion periods would probably be good.

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\(^{13}\) This adverse criticism would not be made ordinarily since it is unlikely that a study would always be in progress during a presentation.
Conclusions

On the basis of this study, the writer concludes:

1. That students enrolled in the televised course in Mathematics 400 during the Spring Quarter, 1956, learned as effectively as those students enrolled in a conventional course in Mathematics 400 during the Winter Quarter, 1958.

2. That, according to the Summarizing Questionnaire and an application of the Chi Square Statistical Technique to it, students making "A" and "B" final grades were much more enthusiastic about the televised course than students making a final "D" or "E" and that students making "C" indicated an almost neutral response.

3. That television-taught students rated their quiz-section instructors higher than conventionally taught students did their classroom instructors.

4. That while conventionally taught students rated the organization of Mathematics 400 "excellent," television-taught students rated its organization only "good."

5. That while conventionally taught students rated their opportunities for classroom participation "excellent," television-taught students rated their opportunities to participate in quiz sections "poor" to "unsatisfactory."
6. That while conventionally taught students rated their instructors' interest "average" to "unsatisfactory," television-taught students rated their quiz-section instructors' interest "excellent" to "good".

7. That while conventionally taught students rated their instructors' enthusiasm for the course "average" to "unsatisfactory," television-taught students rated their instructors' enthusiasm "excellent".

8. That while conventionally taught students rated their instructors' classroom personalities "average" to "unsatisfactory," the television-taught students rated their quiz-section instructors' personality "excellent".

9. Conventionally taught students rated their instructors' lecture-demonstrations both higher and lower than the television-taught students did. While the conventionally taught students rated the lectures "excellent" and "poor" to "unsatisfactory," the television-taught group rated the televised lecture-demonstrations "good".

10. That while conventionally taught students rated their instructors' answers to questions "average," television-taught students rated their quiz-section instructors' answers "good".
RECOMMENDATIONS

On the basis of this study, the writer recommends:

1. That televised instruction in Mathematics 400 be continued for the following reasons:
   a. Televised lecture-demonstrations by a superior teacher reach more students.
   b. Televised lecture demonstrations will in time be more economical than multiple sections taught conventionally.

2. That students be required to fulfill homework assignments only after the subject matter covered in the assignment has been discussed in the quiz-section meeting.

3. That homework be evaluated and the final grade be computed by uniform standards.

4. That a committee comprising both students and faculty evaluate kinescopically recorded and live lectures of the television instructor.

5. That students in quiz sections, since their contact with the quiz-section instructors is limited be especially encouraged to ask questions and seek explanations.

6. That during one or more of the televised lecture-demonstrations, a few students represent the class in asking questions and engaging in discussions.
RECOMMENDATIONS FOR FURTHER STUDIES

On the basis of this study, the writer recommends the following further studies:

1. A study of the conventionally taught and television-taught groups to compare the degree to which the students retained the subject matter.

2. A comparison of conventionally taught and television-taught groups taking Mathematics 400 simultaneously. The study might be organized as follows:

   a. One group of approximately 150 students might view televised lecture-demonstrations three times a week. This group might then be divided into five sections headed by five staff members and meeting twice weekly to ask questions and participate in discussion about the lectures.

   b. Another group of 150 students might view a televised lecture one-half hour daily, followed by a twenty-minute question and discussion period. A comparison might then be made of the mathematical achievement of this group with that of group "a" and of the two groups of conventionally taught students discussed under "c" and "d."

   c. A third group of 150 students might be divided into five conventionally taught classes, headed by the instructors who are in charge of the five quiz sections of the televised lecture-demonstrations.

   d. A fourth group of 150 students might attend conventional lectures together by the instructor of the televised lecture-demonstrations. This group might then be divided into five sections headed by the instructors in charge of the television quiz sections and meeting at least bi-weekly to ask questions and to participate in discussion about the lectures.
Inadequacies of the Study in Retrospect

Plans for the study necessarily developed after plans had already been made to offer Mathematics 400 by television. If the study could have been organized concomitantly with the televised course, it might have yielded more meaningful results for the following reasons:

a. More adequate instruments for assuring the homogeneity of the two groups might have been used. The ones used in this study were, however, the only ones available.

b. The comparison should have been limited to the television-taught group, on the one hand, and those conventionally taught students, on the other hand, whose instructors had, during the Spring Quarter, 1958, taught televised classes.

c. If the two groups had been given the same examinations during the quarter and the same final examinations (second part) a further basis might have been provided for comparing the groups' achievement, in part dependent upon the class members' final grades.

d. The homework, which varied throughout the five quiz sections and sometimes used in computing the final grade and sometimes not, might have been made more uniform.
e. Inasmuch as The Ohio State University Mathematics Placement Test, Form G-2, was given to both groups of students before they took the course, a different device might have been used to determine the comparative effectiveness of televised and conventional instruction.
APPENDIX A

Educational Television: A Brief Definition and Survey

And

History of Teaching Mathematics by Television
Appendix A

**Educational Television: A Brief Definition and Survey**

The foregoing study is primarily concerned with instructional television, and specifically with the use of television in teaching courses in mathematics. On the other hand, though, a television program may be considered educational in the broadest possible sense, depending essentially upon its purpose. The difference between the educational television program and the strictly instructional one is a difference of emphasis. If it provides the opportunity of a perhaps otherwise unobtainable view of the world, almost any program may be educational. The Ohio Legislative Service Commission, however, has made a broad classification of educational television programs as follows:

1. *Classroom instruction at all levels.*
2. *Direct adult education for scholastic credit.*
4. *General adult education.*
5. *General cultural and educational programming.*

Instructional television, according to Dr. I. Keith Tyler, Director of Radio Education, The Ohio State University, Columbus, Ohio, is television used for an aid to teaching, for a supplement to regular

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classroom teaching, or for the teaching of an entire formal, sequentially-organized body of material. Dr. Tyler states:

Instructional television is television used in formal, organized, sequential, education. It does not include television involved in casual, informal education. It involves a sequential presentation, one step following another, in series. It is usually employed by a recognized educational organization -- a school, an adult education group, a branch of the armed services. Instructional television can take place on either open or closed circuit, and it can involve any level of learning, primary, intermediate, junior high, senior high, the college level, or adult education.2

In the sense of Tyler's definition of the term, instructional television began before the mechanical perfection of that medium, at the State University of Iowa, where more than 400 programs, including lecture courses in art, shorthand, engineering, and botany, as well as drama, and other entertainment were transmitted between 1932 and 1939. These programs were televised over the school's experimental station W9XX by way of a mechanical scanning system. The university's radio outlet, WSUT, transmitted the sound accompanying the pictures.3

After the mechanical perfection of television, the first educational programs were presented over commercial television stations,

2 I. Keith Tyler, "Instructional Television: Types and Objectives", Paper read at the Workshop Conference on Educational Television, San Jose State College, San Jose, California, (July 15, 1957), 1.

for educational channels did not come into being until April 14, 1952, when the Federal Communications Commission allocated 242 channels to non-commercial use -- eighty VHF and 162 UHF.  

Schools have used both open and closed-circuit television for instructional, as well as educational purposes. Some of the schools which experimented early with closed-circuit television for instructional purposes were the following: (1) Pennsylvania State University, (2) New York University, (3) The University of Houston, and (4) The United States Army Signal School. Today, more than one hundred closed-circuit television installations in colleges, universities, and public schools operate in nearly every state and in the District of Columbia.

Philadelphia has led the nation in in-school programming of educational television programs. Other cities which have made use of this means of aiding the teachers, enriching their offerings, and extending the classroom to the community have included St. Louis, Cincinnati, Lincoln, Nebraska, Oklahoma City, Oklahoma, Chicago, and others. In the next few pages, the history of the teaching of mathematics by television will be traced.


6Ibid.
HISTORY OF TEACHING MATHEMATICS BY TELEVISION

Even before television had fully established itself in the American home, some dreamed of exploring its potentialities as a medium of education. Not, however, until Millersville State Teachers College, Millersville, Pennsylvania, offered to the public over Station WGAL, Lancaster, Pennsylvania, six fifteen-minute lessons on the slide rule, did mathematics educators realize their dream. Yet from that modest beginning in 1949, television has asserted itself as a significant vehicle for instruction in mathematics.

After much research on the place of television and films in mathematics instruction with particular emphasis on college, Phillip S. Jones, Professor of Mathematics at the University of Michigan, offers the following classification of television presentations:

A survey of these projects (mathematical television presentations) will show that they can be roughly classified as (1) "cultural", where the chief objective is to interest a

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1 Phillip S. Jones is Chairman of the Committee on Instructional Films of the Mathematical Association of America, Incorporated. He is also a member of the Committee on Mathematical Films and Television in the Mathematics Division of the National Academy of Science — National Research Council.
general audience, give it some idea of a small segment of mathematics, and perhaps by this device give it a better appreciation of what mathematics is, or at least of wherein some of its fascination lies; (2) "public relations" and/or "guidance", where various groups, but largely public schools, have tried to show taxpayers and parents how their children are taught and to interest students (and their parents) in electing more mathematics; (3) "course", where the object is to teach a definite body of mathematical knowledge, often, but not always, for high school or college credit.  

The earliest mathematical television presentations were aimed, as they were in many other academic spheres, at the enlightenment of the public that is to say, specialized information for the student of mathematics was often relegated to the background for the sake of guiding the layman toward a general appreciation of the subject as a whole. By the academic year 1957-58, however, most programming had shifted its emphasis, attempting, rather to convey a body of specific subject matter, sometimes offered for credit and sometimes not.

In spite of the usefulness of Dr. Jones' system of classification, television presentations do not lend themselves to easy distinction; the line of demarcation, that is, is by no means well

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3 Ibid.
defined. In the ensuing discussion, therefore, mathematics presentations will be assigned categorically on the basis of their emphasis only, on the basis of their principal purpose.

I. Cultural Mathematical Television Programs

A. (1949)

Dr. George R. Anderson, Professor of Mathematics, Millersville, (Pennsylvania) State Teachers College, is credited with giving the first mathematical television presentation in 1949. Although his six fifteen-minute lectures on the origin and use of the slide rule were "cultural", they were included as preparation for a short "course" on the use of the slide rule in computation, given three years later during the first semester of the academic year 1952-53.4

B. (1950-51)

The available records indicate that from 1950 to 1951, no mathematical television programs of this type were telecast.

C. (1952)

A fifteen-minute program entitled, "Counting-Then and Now", was presented by Creighton University, Omaha, Nebraska, over the Omaha Station WOW-TV. A dialogue between a member of the Creighton

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4 George R. Anderson, "Teaching the Slide Rule Via Television", The Mathematics Teacher, XLIII, Number 6 (October, 1950), 272.
University Mathematics Department and a student, the program centered upon a discussion of counting instruments -- from the Abaci to the Hindu-Arabic Numerals.  

Dr. Phillip S. Jones, Department of Mathematics, University of Michigan, gave a series of seven eighteen-minute lectures over WWJ-TV, Detroit, Michigan. It was entitled, "Understanding Numbers: Their History and Use", and intended primarily for adults with at least a high school education. The major objective of the program was cultural -- "to increase the viewer's appreciation of the nature, use, historical development, and the varieties of numbers."  

D. (1953)  

Four thirty-minute popular interest programs were presented over WATV, Newark, New Jersey; they were entitled "Spotlight on Mathematics."  

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6 Phillip S. Jones, op. cit., p. 413.  


Station WGAL-TV, Lancaster, Pennsylvania presented another "cultural" mathematical program in 1953, entitled "Let's Look at Mathematics," consisting of sixteen programs. Dr. George R. Anderson was the lecturer for this series.9

E. (1954)

A fifteen-minute program, "Magic Squares," was presented over WREX-TV, Rockford, Illinois, in cooperation with Northern Illinois University, DeKalb, Illinois; Mr. Herbert Miller was the lecturer.10

Four thirty-minute programs entitled, "Contributions of Pythagoras, Fermat, Pascal, and Descartes" and "An Introduction to Nomographs" were presented by Elizabethtown College over WGAL-TV, Lancaster, Pennsylvania.11

In the same year, WFIL, Philadelphia, Pennsylvania, in cooperation with "University of the Air," of which Bryn Mawr College is a member, presented a series of programs entitled, "Invitation to Mathematics." This series, for which Dr. Marguerite Lehr was the lecturer, consisted of fifteen twenty-seven minute programs, some of them entitled "Regular Patterns and Symmetry," "Regular

9 Ibid.
10 Ibid., p. 412.
11 Ibid., p. 413.
Shapes," "Products and Primes," and "Questions on Least and Most."  

The same year, Rutgers University in cooperation with Station WTA, Newark, New Jersey, presented a series of thirteen programs entitled "This is Mathematics." Mr. Fred G. Fender lectured on such topics as number systems, number theory, and the greatest and least transfinites.  

F. (1955)  

Michigan State University, East Lansing, Michigan, in cooperation with WKAR-TV, East Lansing, Michigan, presented twelve thirty-minute programs entitled "Nomography and Graphical Methods."  

G. (1956-57)  

As in 1953, Station WATV-TV, Newark, New Jersey, presented another series of six thirty-minute public interest programs entitled "Spotlight on Mathematics."  

"Mathematical Potpourri," a series of sixteen popular lectures, was presented for a half-hour each week over the Alabama State Educational Television Network, with Stations WBIQ,
Birmingham, WTIQ, Mumford, and WAIQ, Andalusia. Fifteen members of the Mathematics Department, The University of Alabama, University Alabama, participated in discussing such topics as "Fallacies and Paradoxes," "Concepts of Infinity," "Electronic Computers" and the Binary Number System," "Orbital Missiles," and "Number Congruences." These programs were intended for gifted high-school students, their teachers, college students, and the general public.\(^{16}\)

The University of Michigan prepared half-hour kinescopes on "The Meaning of Geometry," "Modern Geometry," and "The Element of Chance," which were later distributed to several television stations.\(^{17}\)

During the Summer of 1958, Pennsylvania State University, in cooperation with WFBG-TV, presented thirteen one-hour programs in mathematics.\(^{18}\)

The number of "cultural" mathematical presentations, it is interesting to note, decreased in 1955 and 1956; by 1957-58, however, they were once more on the increase.

\(^{16}\) Ayrlene McGahey Jones, "Television Activity, Department of Mathematics, University of Alabama," \textit{The American Mathematical Monthly}, LXV (June-July, 1958), 422.

\(^{17}\) Phillip S. Jones, \textit{op. cit.}, p. 409.

\(^{18}\) \textit{Ibid.}
II. Public Relations and Guidance Mathematical Television Programs

A. (1951)

Cleveland, Ohio, was the site of the first "public relations" television program when, in 1951, the City Board of Education began to present a series of fifteen-minute "Demonstration Lessons" over Station WEWS. Concentrating upon grades eight through ten, Mr. Herschel Grime, Directing Supervisor of Mathematics, Cleveland City Board of Education, acted as commentator, using some of the local teachers of these grades and currently enrolled students as personnel. Since then, these demonstrations have appeared semi-yearly, illustrating such sample lessons as grade 8 (Informal Geometry), grade 10 (Plane Geometry), grade 10 (Shop Mathematics Class, Slide Rule in a Trigonometry Class).19

B. (1952)

WBEN-TV in Buffalo, New York, cooperating with the Buffalo City Board of Education, presented "Demonstration Lessons," employing Mr. Louis F. Scholl, Director of Mathematics, Buffalo City Board of Education, as commentator and Buffalo city teachers and students in grades ten to fourteen as participants. Centering mainly upon grades one to eight, these thirty-minute telecasts continued through 1955-56.20

19 Ibíd., p. 414.
20 Ibíd., p. 413.
C. (1953)

Available records indicate that no "public relations" or "guidance" mathematical television programs were made during this year.

D. (1954)

In cooperation with some of the city teachers and students, WKRC-TV, Cincinnati, Ohio, presented three thirty-minute "Demonstration Lessons," centered upon the second, fifth, eighth, and twelfth grades. Representing the Cincinnati City Board of Education was Mrs. Mildred Keiffer, Supervisor, Mathematics 7-12. 21

For the Educational Television and Radio Center, Ann Arbor, Michigan, the University of Michigan made seven thirty-minute kinescopes, which were then widely distributed; 22 the subjects of these seven lessons were "The Earliest Numbers," "Bases and Places," "Big (and Small) Numbers," "Fundamental Operations," "Short Cuts and Computing Devices" and "Fractions and New Numbers." 23

Arranged by Dr. Margaret Willerding, Station KETC, Saint Louis, Missouri, presented a twenty-five minute kinescope entitled "Should I Study Mathematics?" The program consisted of a panel discussion

21 Ibid., p. 412.
22 Ibid.
23 Ibid.
led by Dr. Harold P. Fawcett, Professor of Education, The Ohio State University, Columbus, Ohio, and Mr. Eugene Smith, Director of Mathematics, Wilmington, Delaware, with high-school students from Missouri and Ohio as participants.24

E. (1955)

Three twenty-five minute programs entitled "Measurement in Industry" were presented over WCET, Cincinnati, Ohio, in cooperation with the Cincinnati Milling Machine Company and public school students. Designed to illustrate the importance of mathematics in industry to junior and senior high school classes, these programs were arranged by Mrs. Mildred Keiffer, Supervisor, Mathematics 7-12, Cincinnati City Board of Education, Cincinnati, Ohio.25

"Demonstration Lessons" in arithmetic were presented by KTTS-TV, Springfield, Missouri, in cooperation with the Springfield Public Schools.26

In Washington, D.C., Station WRC, three high school teachers, and a group of high school students cooperated in giving two fifteen-minute programs for the purpose of illustrating modern teaching techniques.27

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25 Ibid., p. 412.
26 Ibid.
27 Ibid.
F. (1956-57)

During the Spring Quarter 1956, Prof. Nathan Lazar, The Ohio State University, gave a series of eight programs on WOSU-TV entitled "Parents, Teachers, and Arithmetic.

G. (1957-58)

In the school year 1957-58, the Westinghouse Broadcasting Company prepared nine half-hour programs intended to interest junior high school students. These programs were planned by Dr. Howard F. Fehr, and the scripts for the programs were written by Bill and Cora Baird, whose puppets were used in the presentations.

III. Course Mathematical Television Programs

"Course" mathematical television programs will be discussed under the following headings:

A. Courses Which Were Not Controlled Studies

1. Elementary
2. High School and College Preparatory
3. College
4. Graduate

B. Courses Which Were Controlled Studies

1. Elementary
2. High School and College Preparatory
3. College
4. Graduate

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Ibid., p. 409.
A. Television Courses Which Were Not Controlled Studies

1. Elementary School Courses

   a. (1949-54)

   Available records indicate that from 1949 to 1954, no "course" mathematical television programs were telecast on this level.

   b. (1955-56)

   Television was first used to teach an elementary-school course by the Pittsburgh, Pennsylvania Public Schools in cooperation with Station WQED, Pittsburgh, Pennsylvania in 1955-56. For twenty-five minutes of a forty-minute class period, twenty fifth-grade classes from ten schools were taught arithmetic five days a week for 178 days. Mrs. Anita Seewald was the television teacher in this project; it was financed by the Fund for the Advancement of Education.29

   c. (1956-57)

   The preceding course was continued in the 1956-57 school term.30

   d. (1957-58)

   Available records indicate that during the school term 1957-58, no "course" mathematical television programs were telecast on this level.

29 Ibid., p. 412.

30 Ibid., p. 411.
2. High School — College Preparatory Courses

a. (1949-53)

Available records indicate that from 1949 to 1953, no "course" mathematical television programs were telecast on this level.

b. (1954)

Station WQED, Pittsburgh, Pennsylvania, presented eighteen thirty-minute lessons on material taken from high school algebra, in order to prepare interested persons for state high school credit examinations.31

c. (1955)

The Mathematics Department of North Carolina State College at Raleigh, began over Station WUNC-TV, Raleigh, North Carolina, a series which is finding increasing favor in higher education — a college preparatory course in solid geometry. This course, offered thirty minutes a week for sixteen weeks,32 is described in greater detail in Appendix B.

d. (1956)

During this year, many high-school courses were offered on television — some were offered by colleges and universities, some by public school systems, some by individual public schools. Some

31 Ibid., p. 412.

32 Ibid.
were offered over closed circuit, some over educational television stations, and some over commercial television stations.

Station KETA-TV, for example, in Oklahoma City, Oklahoma, began to offer high-school mathematics courses to students of the state who otherwise would not have been able to take them. The State Board of Education co-sponsored courses which included solid geometry, plane geometry, trigonometry, and elementary algebra. Local teachers were employed as television teachers. 33 For greater detail on these courses, see Appendix B.

During the school term, Station WTTV, in cooperation with Indiana University, Bloomington, Indiana, presented a series of eighteen thirty-minute programs in high-school trigonometry, for which enrolled students received one-half unit credit. 34

The Mathematics Department of the University of Nebraska presented over the University's own television station KUON-TV, in Lincoln, a course in beginning high-school algebra. Mr. David Wells, the television instructor, presented each program for twenty minutes daily during the school term. 35 For greater detail on this course, see Appendix B.

The Chicago City Schools presented over WTTW, the Chicago Educational Television Station, ten experimental lessons on

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quadratic equations for high-school students; Mr. Jerome Sachs of the Chicago City Junior Colleges faculty was the instructor. 36

During the summer of 1956, The University of Alabama, University, Alabama, offered a course in college preparatory algebra to high-school graduates intending to enter college in the Fall of that year. This course was repeated during the following summer; during the summer of 1958, a review course in plane geometry, in addition to the course in college preparatory algebra, was offered by the University over its Educational Television Network. 37

In the fall of 1956, the Board of Education of Washington County, Maryland, of which Hagerstown is the county seat, began a study in teaching many public-school courses by closed circuit television; plane geometry was one of them. This study was still in progress in 1958-59. 38

e. (1957-58)

The University of Alabama presented enrichment mathematical materials for the high schools of the state during the school term. Members of the Mathematics Department of the University lectured

36 Ibid., p. 411.

37 Ibid.

38 Ibid.
on topics chosen by the high-school mathematics teachers of the state, for example, "Fundamentals of Geometry," "Transition from Arithmetic to Algebra," and "Functions and Graphs."

During the summer of 1957, a course in basic algebra was offered by the Altoona Extension Center of the Pennsylvania State University, Altoona, Pennsylvania, and taught by Dr. Steven A. Adler. The course was intended to prepare students planning to enter college in the fall of that year in basic principles of algebra. For greater detail on this course, see Appendix B.

During the school term, Station WQED, Pittsburgh, Pennsylvania, in cooperation with the City and State Boards of Education, presented courses in general mathematics, algebra, and business arithmetic through its "Adult School of the Air." Intended to prepare persons for both Army and for State of Pennsylvania examinations, these courses were to lead to high-school diplomas.

Station KUON-TV, Lincoln, Nebraska, in cooperation with the University of Nebraska, supplemented its offerings with courses in general mathematics, first year high-school algebra, and high-school geometry. For a summary of these courses see Appendix B.

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40 Phillip S. Jones, op. cit., p. 409.
41 Ibid.
42 Ibid., p. 410.
3. **College Courses**

   a. (1949-54)

   Available records indicate that from 1949 to 1954, no "course" mathematical television programs were telecast on this level.

   b. (1955)

   Although the first mathematics course was offered on television in 1952, not until 1955 was television used to instruct college students in mathematics. Breaking ground with a course entitled "The Teaching of Arithmetic," was Iowa State Teachers College, Cedar Falls, Iowa. The programs were given over WOI-TV\(^{43}\) — the first commercial television station to be owned and operated by a college.\(^{44}\) For greater detail on this course, see Appendix B.

   In this same year, the University of Houston, which had used television extensively in course presentations, offered over its Educational Television Station KUHT, Houston, Texas, another one, entitled "Mathematics of Finance." Although highly mathematical, it was classified as a business course at the University, and consequently, was presented by the Department of Business. Enrollees who completed the course successfully earned three semester hours of credit.\(^{45}\)

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\(^{44}\) *William Kenneth Cummings*, *This is Educational Television* (Ann Arbor, Michigan: Edwards Brothers, 1954), 37.

\(^{45}\) *Phillip S. Jones*, *op. cit.*, p. 412.
Televised mathematics instruction reached an unprecedented peak during the school term 1956-57. In nearly every section of the country, colleges and universities initiated or continued formal television instruction.

In the Northwest, the University of Washington, Seattle, Washington, began to present a course in intermediate algebra;\(^{46}\) for greater detail, see Appendix B.

In the Spring Semester of 1956-57, the University of Washington offered its freshman course in plane trigonometry;\(^ {47}\) this course, too, is summarized in more detail in Appendix B.

In the Midwest, the University of Oklahoma, Oklahoma City, offered three hours of credit for a televised course in intermediate algebra. The lectures presented over the educational television station in Oklahoma City and extended over eighteen weeks, met three times weekly for half-hour periods.\(^ {48}\)

Washington University, Saint Louis, Missouri, offered to the Midwestern television audience a course entitled "College Algebra and Plane Trigonometry." This course is discussed in greater detail

\(^{46}\) Ibid., p. 410

\(^{47}\) Ibid.

\(^{48}\) Ibid., p. 411.
in Appendix B. Since this initial venture, Washington University has offered several other courses by television.49

The University of Alabama offered college credit for courses by television in intermediate algebra and in plane trigonometry during the same school term. These are also described in detail in Appendix B. In addition, The University of Alabama offered on campus a course in plane trigonometry by closed-circuit television.50 This course, too, is summarized in Appendix B.

From September, 1956, to June, 1958, five more colleges and universities offered mathematics courses to high school, college, and graduate students than did during the preceding school year.51

The Chicago City Junior Colleges added a course for one credit hour in the Slide Rule to its mathematics television programs.52

During the spring of 1958, after much experimentation in instructional television, Pennsylvania State University, University Park, Pennsylvania, presented its first mathematics course on campus over closed-circuit; "Algebra for Non-Technical Students."53 This course is discussed in detail in Appendix B.

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49 Ibid.
50 Ibid.
51 Ibid., pp. 408-414.
52 Ibid., p. 409
53 Ibid.
The University of Houston, Houston, Texas, offered during the school term 1957–58 a course in plane trigonometry, its first experience in teaching mathematics by television; the course is summarized in Appendix B.

During the same school term, The Massachusetts Institute of Technology presented six one-hour television lectures as an elective course for freshmen; the course was open only to students not majoring in mathematics.

That year, Stephens College, Columbia, Missouri, experimented in a mathematics course with television lectures followed by small group discussions.

Fairleigh Dickinson University, Rutherford, New Jersey, had its first experience in teaching mathematics by television during the Summer of 1958. The course, "Introduction to College Mathematics," will be described in detail in Appendix B.

4. Graduate School Level
   a. (1949–56)

The available records indicate that from 1949 to 1956 no graduate mathematics courses were offered on television.

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54 Ibid.
55 Ibid., p. 408.
56 Ibid.
b. (1957-58)

The University of Maryland, College Park, Maryland, in cooperation with the Walter Reed Medical Center, Washington, D.C., offered one of the first two televised graduate courses; "The Foundations of Analysis," presented through color television, is discussed in detail in Appendix B. 58

Washington University, Saint Louis, Missouri, offered a graduate course in "The Theory of Games" during the same school term; this course will also be summarized in Appendix B. 59

B. Controlled-Study Television Courses

1. Elementary School Level

   a. (1949-58)

   Literature on the use of television in mathematics instruction indicates that no controlled studies have yet appeared in teaching arithmetic by television.

2. High School-College Preparatory Level

   a. (1949-51)

   Available records indicate that from 1949 to 1951, no controlled studies in the use of television for mathematical instruction on this level were conducted.

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58 Phillip S. Jones, op. cit., p. 408.

59 Ibid., p. 410.
b. (1952)

Dr. George R. Anderson, Millersville (Pennsylvania) State Teachers College, presented six thirty-minute lessons on the use of the slide rule to three classes of high school sophomores. This study is summarized in detail in Appendix C.

c. (1953–58)

Available records indicate that from 1953 to 1958 no controlled "course" mathematical programs on the high school–college preparatory level were telecast.

3. College Level

a. (1949–55)

The available records indicate that from 1949 to 1955 no controlled "course" mathematical program on the college level were presented by television.

b. (1956–57)

Literature on the use of television in teaching college mathematics courses discloses two controlled studies during this school term.

The first of these studies occurred during the Fall Semester of 1956–57 at Purdue University, Lafayette, Indiana. The course

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providing the basis for the study was "Mathematics 241," an introductory calculus course. This study is summarized in detail in Appendix C.61

The second televised mathematics course organized as a controlled study was offered by the Chicago City Junior Colleges during the Spring Semester of the same school term. "Mathematics 101," Introduction to Mathematics, is described in detail in Appendix C.62

a. (1949-1958)

Literature indicates that no controlled studies in teaching graduate mathematics courses on television have yet appeared.

Summary

The first televised mathematics programs were by no means courses in mathematics. On the contrary, until the school term 1956-57, or, rather, not until the public had been supplied a basis of acceptance, did the mathematics course become sufficiently popular to outdistance its predecessor, the program aimed at the layman — the "cultural" program.

The first televised mathematics course was offered in 1949 at Millersville State Teachers College, Millersville, Pennsylvania.


62 Ibid., p. 409.
It was intended primarily for a select group of high-school students.

Not until 1955 did Iowa State Teachers College, Cedar Falls, Iowa, offer the first televised college mathematics course. Since this initial venture, many other courses have been presented through television by many other institutions.

The school term 1956–57 appears to have been significant for experimentation in mathematics instruction by television. That is to say, during that year many schools, colleges, and universities gave their first programs; others continued programs begun earlier.

The school term 1957–58 ushered in the first two televised graduate courses in mathematics, one of them presented in color.

This school term also saw at The Pennsylvania State University the first "Talk Back" system and, at Fairleigh Dickinson University, Rutherford, New Jersey, the first representative studio class used in a televised mathematics course.
APPENDIX B

A Summary of Twenty-Four Mathematics Courses

Taught by Means of Television
Appendix B

A Summary of Twenty-Four Mathematics Courses
Taught by Means of Television

The purpose of this summary is to give the reader an idea of mathematics courses which have been offered on television and which are too numerous to discuss in detail here. Regardless of the number of courses offered by an institution, each one listed will be designated by a separate letter of the alphabet in order to facilitate the recording of data.

A. Millersville (Pennsylvania) State Teachers College
   The Slide Rule — 1952-53

B. Iowa State Teachers College — Cedar Falls, Iowa
   The Teaching of Arithmetic — 1955

C. Washington University — Saint Louis, Missouri
   Mathematics 115 (College Algebra and Trigonometry) — 1956-57

D. Washington University — Saint Louis, Missouri
   Mathematics 116 (Analytic Geometry and Calculus) — 1956-57

E. Washington University — Saint Louis, Missouri
   Theory of Games — 1957-58

F. Chicago City Junior Colleges — Chicago, Illinois
   Introduction to Mathematics — 1956-57

G. Purdue University — Lafayette, Indiana
   Introductory Course in Calculus — 1956-57
H. Purdue University — Lafayette, Indiana
Fundamentals of College Mathematics -- 1957-58

I. University of Washington -- Seattle, Washington
Intermediate Algebra -- 1956-57

J. University of Washington -- Seattle, Washington
Plane Trigonometry -- 1956-57

K. The Pennsylvania State University -- University Park, Pa.
Basic Algebra -- Summers 1957, 1958

L. The Pennsylvania State University -- University Park, Pa.
Mathematics 2 (Intermediate Algebra) -- 1957-58

M. The University of Alabama -- University, Alabama
Intermediate Algebra -- 1956-57

N. The University of Alabama -- University, Alabama
Plane Trigonometry -- 1956-57

O. The University of Alabama -- University, Alabama
Plane Trigonometry -- 1957-58

P. The University of Alabama -- University, Alabama

Q. University of Houston -- Houston, Texas
Plane Trigonometry -- 1957-58

R. Fairleigh Dickinson University -- Rutherford, New Jersey
Introduction to College Mathematics -- Summer 1958

S. University of Maryland -- Washington, D. C.
Foundations of Analysis -- 1957-58

T. The University of Oklahoma -- Norman, Oklahoma
Courses for High School Students -- 1956-58

U. The University of Nebraska -- Lincoln, Nebraska
Courses for High School Students -- 1956-58

V. Northeastern University
Basic High School Mathematics -- 1957-58
To facilitate making references to the twenty-four preceding courses, available information will be classified under the following six main headings:

I. Mechanics of the Courses
II. Enrollment and Syllabi of the Courses
III. Organization of Controlled Studies
IV. Teaching Conditions in the Courses
V. Reactions to the Course and Comparative Student Achievement

I. Mechanics of the Courses

A. Institutions Having Open-Circuit Television Lectures

1. Kinescopes Exclusively
   None
2. "Live" Exclusively
   A B I J K P R T U V W X
3. Kinescopes and "Live" Combined in One Period
   C D F M N
4. Regular Film
   Q
5. Number of Open-Circuit Lectures on Any One Lesson
   A B D E I J K L M N P R T U V W X — (1), CFQ — (2)

B. Institutions Having Closed-Circuit Television Lectures

1. Kinescopes Exclusively
   C D M N
2. "Live" Exclusively
   G H L O S
3. Kinescopes and "Live" Combined in One Period
   None
4. Regular Film
   None

5. Number of Closed-Circuit Lectures on Any One Lesson
   C (1), D (2), E (3)

C. Time at Which Kinescopes Were Made

1. Prior to the First Presentation
   C, D, M, N, Q

2. Simultaneous with The First Presentation
   F

D. Institutions Offering Courses in Color Television
   S

E. Institutions Whose Lectures Were Used by Other Colleges or Public Schools
   C, T, U, X, M, N

F. Institutions Offering More Than One Mathematics Television Course
   D, E, H, L, N, O, P, T, U

G. Total Number of Mathematics Television Courses Offered by Each Institution

H. Methods Used in Financing Courses

1. Institutions in which courses were financed partially or entirely by The Fund for The Advancement of Education
   S, F, T, U

2. Institutions in which courses were financed by the Educational Television Station
   X

3. Institutions in which courses were financed by some combination of the Educational Television Station, the department concerned, and the Fund for The Advancement of Education
   F, T, U

4. Institutions in which courses were financed by the Carnegie Fund
   0

5. Institutions for which no information about financing is available
II. Enrollment and Syllabi of the Course

A. Rank of Students for Whom Courses were Designed

1. Pre-College
   A I K M P T U V W
2. Freshman
   I L M X
3. Sophomore
   B G
4. Junior or Senior
   None
5. Graduate
   E S

B. Availability of Academic Credit

1. Institutions in which courses were available for credit only
   B C D E H I J L O Q R S T U W
2. Institutions in which courses were available for no credit only
   K P V
3. Institutions in which courses were available with or without credit
   F I M N X

C. Range of Courses Offered by Institutions

1. Arithmetic
   B
2. Plane Geometry
   P T U W
3. Solid Geometry
   T U W
4. High School Trigonometry
   T U
5. Elementary Algebra
   K P T U
6. Elementary Algebra and Arithmetic
   X
7. Introductory College Mathematics
   F H R
8. Intermediate Algebra
   I L M
9. College Algebra
   None
10. College Plane Trigonometry
   J N O Q
11. College Algebra and Plane Trigonometry
   C
12. The Slide Rule
   A F I
13. Analytic Geometry
   None
14. Analytic Geometry and The Calculus
   D
15. The Calculus (First Course)
   G
16. Methods of Teaching Mathematics (Arithmetic)
   B
17. Graduate Courses
   E S

D. Preparation of Syllabus and Textbook

1. Institutions in which the television teacher prepared the course syllabus
   A B C D E F G H I J K L M N O Q R S T U W X
2. Institutions in which the television teacher was the author of the textbook used
   C X
3. Institutions for which no information is available
   P V

E. Audiences for Whom Courses Were Primarily Designed

1. Courses were primarily designed to remove mathematical deficiencies in order to prepare students for college work
   I K M P T U W X
2. Courses were primarily designed to make available to high-school students courses which otherwise might have been unavailable
   K T U M
3. Courses were primarily designed to prepare employed persons for up-grading in their jobs
   B V

III. Organization of Controlled Studies

A. Institutions Conducting Experiments which Used Matched Groups in Comparing Achievement Data
   A F G

B. Institutions Conducting Experiments Which Used Unmatched Groups in Comparing Achievement Data
   C X
C. Institutions Using "Large Class" or Classes for Control Section or Sections

D. Institutions Which Provided a Special Period for Control Groups to Ask Questions and to Discuss Lectures

E. Bases for Comparing the Mathematical Achievement of the Control and Experimental Groups

1. Institutions conducting experiments using the score made on the final examination and the scores made on examinations given during the semester, quarter, or some shorter period of instruction

2. Institutions conducting experiments using scores made on the final examination or a part of the final examination only

IV. Teaching Conditions in the Courses

A. Provisions for Television Lectures

1. Television lectures given by one regular mathematics department staff member

2. Television lecturing responsibility shared by more than one regular member of the mathematics staff

3. The use of discussion and question period personnel on television in an instructional capacity
   a. Appearing weekly or more frequently
   b. Appearing occasionally

4. Repetition of television lectures by kinescopes
   a. Institutions in which a closed-circuit was used as a means of repeating television lectures for students
   b. Institutions in which an open-circuit was used as a means of repeating television lectures for students
B. Provisions for Questions and Discussions

1. Location of question and discussion periods

   a. Institutions making provisions for questions during the televised lecture
      L R
      (1) From viewer participants L
      (2) From studio class R

   b. Institutions making provisions for question and discussion periods immediately following the televised lecture
      D O T U
      (1) Conducted by the television teacher None
      (2) Conducted by graduate assistant in the department of mathematics D O
      (3) Conducted informally among students with proctor T U
      (4) Conducted by itinerant teacher T U

   c. Institutions making provisions for question and discussion periods not immediately following the television lecture but within a twenty-four hour period or more
      B C E F G H I J L M N Q R S X

   d. Institutions making provisions for question and discussion periods immediately following examinations
      F R S

   e. Institutions making provisions for non-televised question and discussion periods
      B C D F G H I J L M N O Q R S T U X

   f. Institutions making no provisions for question and discussion periods
      A V

2. Number and duration of question and discussion periods

   a. Institutions offering daily informal "help", "quiz", or "tutorial" sections
      C D
b. Institutions offering a limited number of informal "help", "quiz", or "tutorial" sections
Q X

3. Provisions for answering questions sent in by television students

a. Institutions answering questions by mail
B E I J K P F
b. Institutions answering questions on the air
F I J W

4. Guides for the question and discussion periods

a. Institutions employing regular staff personnel only
B E Q R S
b. Institutions employing both regular staff personnel and undergraduate college students with outstanding records in mathematics
C
c. Institutions employing both regular staff personnel and graduate students in the department
C D G M N O X
d. Institutions employing only graduate students in the department
H I J
e. Institutions employing only the television teacher
S

5. Attendance at question and discussion periods

a. Institutions requiring attendance at question and discussion periods
G H O Q R S T U X
b. Institutions not requiring attendance at question and discussion periods
B C D F I J L Q

C. Provisions for Examinations

1. Institutions giving midterm and final examinations as follows:

a. One midterm and one final examination
B I J
b. Two midterms and one final examination
   None

   c. Three or more midterms and one final examination
      A C D F G H L Q X

2. Institutions providing some type of review before a midterm or final examination (e.g., practice tests, television reviews, "quiz" section reviews)
   C D F I J Q X

3. Institutions providing review of examinations after they were graded and returned to the students (e.g., on television, in the "quiz" sections)
   C D X I J

4. Institutions for which no information about examinations is available
   E K M N O P R S T U V W

D. Provisions for Homework

   1. Provisions for requiring homework

      a. Institutions requiring homework of students
         B C D F G H I J L M N O Q R S T U W X K
            (1) Institutions grading and returning homework
               B C D I J K L M N O Q R S T U W X
            (2) Institutions checking (not grading) and returning homework
               F G H P

      b. Institutions not requiring homework
         A

   2. Provisions for collecting and returning homework

      a. Institutions collecting and returning homework by mail
         B I J W

      b. Institutions collecting and returning homework during the "quiz", "help", or "tutorial" session meetings
         F L M N O Q R S T U X

      c. Institutions providing for an itinerant teacher's collecting and returning homework
         T U
3. Provisions for making assignments
   a. Institutions making homework assignments on the air
      I J
   b. Institutions making homework assignments in advance by means of study guides, assignment sheets, etc.
      B C D F I J W X
4. Institutions for which no information about homework is available
   E V
E. Provisions for Television Instructors

1. Professional rank of television instructors
   a. Institutions employing a television instructor of professorial rank
      A B C D E F G H I J K L Q R S X
   b. Institutions employing more than one television instructor of professorial rank
      C D G H L M N O
   c. Institutions employing television instructors of several ranks
      X

2. Institutions employing either a part of or the whole mathematics department to edit and appraise kinescopes
   C D M N O Q

V. Reactions to the Course and Comparative Student Achievement

A. Comparative Student Achievement

1. Institutions finding mathematical achievement significantly in favor of conventionally taught group
   None
2. Institutions finding mathematical achievement significantly in favor of the television-taught group
   None
3. Institutions finding the mathematical achievement of the two groups about equivalent
   B I J X
4. Institutions finding the mathematical achievement of the television-taught group, though not statistically significant, slightly higher than that of the conventionally-taught group

5. Institutions finding the mathematical achievement of the conventionally-taught group, though not statistically significant, slightly higher than that of the television-taught group

6. Institutions measuring student retention in the two groups

B. Student Reactions

1. Institutions finding an overall favorable reaction to instruction by television

2. Institutions finding an overall unfavorable reaction to instruction by television

3. Institutions finding a progressive change in student reaction from favorable to unfavorable during the course of instruction

4. Institutions finding a progressive change in student reaction from unfavorable to favorable during the course of instruction

5. Institutions for which no information about students' reactions is available

C. Instructor Reactions

1. Institutions finding television instruction as effective as conventional instruction

2. Institutions finding television instruction effective but believing it cannot replace conventional instruction even with the use of repetition by kinescopes

3. Institutions finding television instruction effective only as a supplement to regular instruction.
4. Institutions finding television instruction effective enough without "quiz", "help", or "tutorial" sections
   None
5. Institutions finding television instruction valueless after an initial experience with it
   None
6. Institutions finding preference for regular film over kinescopes
   A J
7. Institutions for which no information about instructors' reactions is available
   D E F H K P Q R S T U V W
APPENDIX C

Three Controlled Experiments with Teaching Mathematics by Television
Appendix C

Three Controlled Experiments with Teaching Mathematics by Television

As a medium of mathematics instruction, the use of television, in schools, colleges, and universities alike, has been rather widespread. Yet although some institutions have used information drawn from a single study as a basis for planning additional courses, most of them have never systematically tested the effectiveness of such instruction. The number of controlled studies, consequently, remains small.

This section of the present study will emphasize a description and discussion of three controlled experiments on the use of television as an instructional medium in regular high school, college, and university mathematics courses. The three controlled experiments made at Millersville State Teachers College, Millersville, Pennsylvania, Purdue University, Lafayette, Indiana, and the Chicago City Junior Colleges, Chicago, Illinois, will be discussed in the order named.

These three controlled experiments on the use of television as an instructional medium will be discussed under the following major headings:

I. Origin of the Study
II. Purpose of Study
III. Format of Study
   A. Description of Study
   B. Means of Matching Control and Experimental Groups
   C. Course Taught in Study
   D. Instructors Participating in Study
   E. Comparative Teaching Conditions of Control and Experimental Groups
      1. Television Lectures
      2. Provisions for Discussion and Questions
      3. Provisions for Homework
      4. Provisions for Examinations

IV. Results of the Study
   A. Comparative Achievement of Control and Experimental Groups
   B. Analysis of Student Reactions
   C. Evaluation of Participating Instructors

Millersville State Teachers College

Origin of the Study

In October, 1949, Dr. George R. Anderson, Professor of Mathematics, Millersville State Teachers College, Millersville, Pennsylvania, received permission to offer a series of six fifteen-minute weekly programs over Station WGAL-TV, Lancaster, Pennsylvania. Since their emphasis was mainly cultural, these programs were designed to add to the listeners' general information.¹ Specifically centering upon the origin and use of the slide rule, the presentation was well-received by viewers.² Having thus paved the

¹ George R. Anderson, "Teaching the Slide Rule Via Television," The Mathematics Teacher, XLIII, Number 6 (October, 1950), 272.

² Ibid., pp. 272-74.
way, Dr. Anderson and his associate, Dr. Abram W. Vander Meer, Pennsylvania State Teachers College, State College, Pennsylvania, offered during the school term 1952-53 another series, this time six half-hour presentations on the use of the slide rule in computations.  

3


4

Ibid.

The purpose of the study was to determine the relative effectiveness of teaching the slide rule by open-circuit television and of teaching it conventionally to a group of high school sophomores.  

In order to test the relative effectiveness of the two methods, the following criteria were used:

1. Student achievement was measured by six tests, one five-item test given at the end of each television lecture to the television group and the same five-item test given to the conventional group at the end of each period of instruction. The sixth test for each group was the final examination, and it consisted of a combination of all the twenty-five items from the first five tests. The
scores made by the two groups on this test provided a means for comparing the groups' retention.\(^5\)

2. Interviews were held with students in both types of classes in an effort to compare their reactions to televised instruction to their reactions to conventional instruction.\(^6\)

3. The participating teachers gave informal evaluations of the course and provided observations of student reactions.\(^7\)

4. The participating teacher and his assistant evaluated the course.\(^8\)

**Description of the Study**

Five classes of high school sophomores participated in the experiment.\(^9\) Of the 115 students in the control and experimental groups, 41 matched pairs, one student from each group in each pair, were chosen as a means of comparing relative achievement. In the television-taught group, 59 percent of the students were males and 41 percent females; in the conventional group, 56 percent of the students were males and 44 percent females.\(^10\) Although the group

\(^5\)Ibid., p. 324.
\(^6\)Ibid., p. 326.
\(^7\)Ibid.
\(^8\)Ibid., pp. 326-28.
\(^9\)Ibid., p. 324.
\(^10\)Ibid.
taught by television was composed of one more boy than was the conventional group, Dr. Anderson and Dr. Vander Meer felt this could not contribute any significant difference to the results of the experiment.

Three of the five classes were taught by open-circuit television and met in small classrooms to view the presentations on 21-inch receivers from 9:45 to 10:15 A.M. on six consecutive Wednesdays. The other two classes were taught conventionally at a different hour on six consecutive Wednesdays.

Means of Matching the Television and Conventional Groups

Before the course began, the California Test of Mental Maturity, Advanced Series, and the Stanford Achievement Test in Advanced Arithmetic, Form E, were administered. On the basis of these tests, two matched groups of 41 students each were chosen for the purpose of comparing the achievement of the two groups. The two groups were equal in the abilities tested. For example,

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11 Ibid.
12 Ibid.
13 Ibid.
14 Ibid.
the Mean Intelligence Quotient of the television group was 110.70, while the Mean Intelligence Quotient for the conventional group was 112.05; the Mean Arithmetic Computation Score for the television group was 75.17, with a standard deviation of 9.72, while the Mean Arithmetic Computation Score for the conventional group was 75.15, with a standard deviation also of 9.72.¹⁵

The Course Taught in the Study

The course — six half-hour presentations on the use of the slide rule — consisted of the following topics:

1. Background materials, reading the "D" scale, elements of multiplication.

2. Review of reading the "D" scale, finding reciprocals, division, combined multiplication and division.

3. Reading "A" and "B" scales, squares and square roots, areas of circles.

4. Reading "K" scales, cubes, cube roots, elements of proportion.

5. Proportion and applications thereof.

6. Review.¹⁶

Instructors Participating in the Study

Dr. George R. Anderson was the instructor for the television group as well as for the conventional group; Dr. Abram W. Vander

¹⁵Ibid.

Meer assisted Dr. Anderson in evaluating the experiment. Besides these two men, several teachers at the college observed the reactions of students to televised instruction on the slide rule and evaluated the experiment informally themselves.\textsuperscript{17}

The Conditions of Instruction

Except for the means by which each group received its lectures, conditions of instruction were similar; they will be discussed in the following sections of this chapter.

Conditions of Instructing the Conventional Group

\textbf{Lectures}. — The two conventionally taught classes, which received instruction on the use of the slide rule, met in their regular classrooms for lectures at a designated hour for half-hour periods on six consecutive Wednesdays.\textsuperscript{18}

\textbf{Provisions for discussion and questions}. — No mention is made of such provisions for the conventional students. It is assumed, however, that they were allowed to ask questions both during and at the end of a class period.

\textbf{Provisions for homework}. — No homework was formally assigned;

\textsuperscript{17} Ibid., p. 326.

\textsuperscript{18} Ibid., p. 324.
it was expected that students would try to solve problems on the slide rule at home.  

Provisions for examinations. — A five-item test on the lesson was given at the end of each period of instruction; the final examination was a compilation of the five short tests.  

Conditions of Instructing the Television Group  

Lectures. — The three television-taught classes met in small classrooms to view the presentations on 21-inch receivers from 9:45 to 10:15 A. M. on six consecutive Wednesdays.  

Provisions for discussion and questions. — No formal provisions were made either for discussion of the television lectures or for questions about them.  

Provisions for homework. — No homework was formally assigned; it was expected that students would try to solve problems on the slide rule at home.  

Provisions for examinations. — The provisions for examinations for the television group were the same as those for the conventional group. Both groups received these examinations on the

19  
Ibid., p. 326.  

20  
Ibid., p. 324.  

21  
Ibid.
same day in order to prevent as much test information "leakage" as possible, and to insure uniformity in test items. 22

Comparison of Achievement Scores

The five weekly tests and the final examination served as the basis upon which to compare the groups' achievement. 23 Although the achievement of the contentionally-taught group was somewhat higher than that of the television-taught group, this difference in achievement was not found to be statistically significant. When the groups were further divided on the basis of sex and intelligence-test scores, it was found that the difference in achievement of these subgroups was not statistically significant either. The Mean Weekly Test score for the conventional group was 42.41, with a standard deviation of 19.23, while the Mean Weekly Test score of the television group was 43.34, with a standard deviation of 19.61; the Mean Final Test score for the television group was 37.95, with a standard deviation of 17.91, while the Mean Final Test score of the conventional group was 41.44, with standard deviation 17.99.

When the two groups were each divided into sub-groups of low 24 and high 24 Intelligence Quotients, it was found that the scores made on

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22 Ibid., pp. 324-25.

23 Ibid., p. 325.

24 High I. Q. is defined for purposes of this study as 110; low I. Q. as 109 or lower.
the final test by the television-taught group did not differ significantly from those made by the conventionally-taught group. The highest possible score on any one test was 100.25

Although students who were taught the slide rule by television seem to have learned as well as those who were taught the slide rule conventionally, the level of learning of both groups was unsatisfactory. Dr. Anderson makes the following observations:

None of the observed groups or subgroups scores as high as fifty percent, on the average, on the final examination. This indicates an unsatisfactory degree of learning for all groups. As measured by the difference between the sum of the weekly lesson test scores, it appears that the groups taught by television forgot what they had learned more readily than groups taught conventionally. The difference between mean and weekly test score and final test score was highly significant (C. R. = 3.25) for the television-taught group, but not for the conventionally-taught group (C. R. = 0.88). The correlation between these scores was .61 for the television-taught group and .81 for the conventional group.26

Reactions of Students to the Course

Dr. Abram W. Vander Meer, who assisted Dr. Anderson, as well as the other participating teachers, made the following observations with reference to the course:


26 Ibid., pp. 325-26.
1. Attention was good for the classes viewing television as it was for ordinary teacher presentations. Those disinterested in slide rule were equally disinterested in the tenth grade mathematics they were then studying.

2. Co-operating teachers and students alike generally agreed that the poor showing on the final examination was due to lack of practice rather than lack of understanding. A few students took the attitude that this work was somewhat extracurricular in nature and that they did not need to study with the same sincerity as they did their regular classwork.

3. Some students would have preferred to be in a group other than the one in which they found themselves; opinion was about equally divided here.

4. The television groups were unanimous in stating that they would like to have had the opportunity to ask questions. One student said: "When we got lost on one point we missed most of the rest of the presentation."

5. Television viewers said it was difficult to look at their rules and at the same time to look at the screen.27

Comments on the study. — The above experiment seems to have been adequately and scientifically controlled.

The use of scores made on pre-tests, one testing the mental maturity of the students and the other their arithmetic knowledge, administered prior to the beginning of the experiment, in matching the experimental and control groups would seem to validate the results of the study. The use of 41 matched pairs in comparing the achievement of the experimental and control groups seems to be an adequate sample.

The administration of examinations of the same type and on the same day would also seem to give more meaning to the findings.

The lack of practice was believed by both co-operating instructors and students enrolled in the course to be an important factor in the poor showing made by students on the examinations given.

The fact that the subject matter presented was not a part of a regular high school mathematics course may account in part for the low level of achievement of both groups. This failure to achieve more highly on the part of both groups is one aspect of this experiment which could bear closer study.

The use of all of the test items administered on the six five-item tests as the final examination provided a very effective means of gauging the retention of knowledge by the students in both groups.

Perhaps prepared and individually administered questionnaires would have gauged the reactions of students to televised teaching more accurately than did the observations made by the cooperating teachers.

Summary

During the school year 1952-53, Millersville State Teachers College not only taught the first mathematics course ever to be formally offered on television, but also conducted the first controlled experiment with a television mathematics "course" presentation.
The presentation, lasting for six consecutive Wednesdays, consisted of six lessons on the origin and use of the slide rule. Five classes of high school sophomores were used in the experiment, each containing from twenty-one to twenty-six students. Three of these classes received television lectures, while the other two were taught in the conventional manner.

Forty-one pairs of students, one from the television and one from the conventional group in each pair, were matched on the basis of scores made on pretests in mathematics.

Six five-item tests were given during the course of the six week period as well as an hour long final examination, consisting of all twenty-five items which had appeared on the five five-item tests.

As measured by these six tests, the achievement of the conventionally taught group was somewhat higher than that of the television taught group, but the difference in achievement was not statistically significant.

Purdue University

In the Fall Semester of 1956, Purdue University, Lafayette, Indiana, conducted its first study in the teaching of mathematics by television with an introductory calculus course (Mathematics 241) over closed-circuit television.  

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28 Warren F. Seibert, A Brief Report and Evaluation of Closed-Circuit Television Instruction in the First Semester Calculus Course (Mimeographed) (Purdue University, July, 1957), p. 1
Description of the Study

The controlled study was based upon 194 students enrolled in eight discussion sections. Four of these sections were taught by closed-circuit television and consisted of 103 students. The other four sections, in which 91 students were enrolled, were assembled in one large lecture room where they received "live" lectures three days each week. On the fourth day they were divided into four small sections for a question and discussion period. What follows are the principal reasons for the decision to use a large lecture class for the control groups: (1) The lecture class of the control group most nearly approximated that of the experimental group which received television lectures; (2) The lecture class provided a means of minimizing the "instructor variable" which would have been maximized if four small lecture classes had been used.

The 194 students with whom the study was conducted were males with the exception of three students. Approximately 90 percent were first-semester sophomores. Sixty-nine percent were 18 to 20 years old, and 90 percent were engineering students. The experimental group was balanced with the control group in respect to year

in college, major curriculum, and sex. The only characteristic in
which the two groups differed significantly was age, for the con­
trol group averaged nearly one year more than its experimental
counterpart. This age difference, however, did not seem to con­
taminate the findings; that is to say, very low correlations were
found between the age of the student and his scores on the six-
hour-long examinations given to both groups during the semester. 30

The Purpose of the Experiment

The purpose of the experiment here described was to compare
the effectiveness of the use of three closed-circuit lectures and
one discussion and question period a week in teaching an introduc­
tory calculus course with the effectiveness of teaching the same
course to a section of similar size in the conventional (large
class) manner. The control group was instructed throughout the
semester by means of three lectures and one discussion and question
period per week. 31

In order to test the outcome of the study, the following
criteria were used:

1. Scores obtained on six hour-long tests given during
the semester was assumed a measure of student achieve­
ment.

2. A ten-item questionnaire answered by most participating
students before and after the semester's instruction
gauged student reaction to televised instruction.

30 Warren F. Seibert, op. cit., p. 5.
31 John Dyer-Bequet, op. cit., p. 432.
3. Instructors in the study provided informal evaluations of it.\textsuperscript{32}

Dr. Warren F. Seibert, Television Research Consultant, Purdue University, makes the following statement about the reliability of the six hour-long tests given during the semester:

Reliabilities of the six tests are unknown but might be inferred from the correlations found among the six test scores for the two groups. Correlations among the various pairs of individual test scores range from .24 to .64 with a median value of .425. Thus one may suppose that the reliabilities of these tests are moderately but not extremely high.\textsuperscript{33}

Procedures Used in Matching the Experimental and Control Groups

Before the experimental group's achievement could be compared with that of the control group, it was necessary to determine the comparative intelligence, mathematical ability, and age of the participating students at the onset of the study. The students were matched on the basis of the following three criteria: (1) Their grade-point indices, assumed to be a measure of general intelligence; (2) Their scores on the Freshman Orientation Mathematics Test (Purdue University Mathematics Training Test, Form Am), used to measure the mathematical ability of the students for whom they were available; and (3) The ages of the control and experimental students.\textsuperscript{34}

\textsuperscript{32}Warren F. Seibert, \textit{op. cit.}, p. 6.
\textsuperscript{33}Ibid.
\textsuperscript{34}Ibid., p. 8.
In order to belong to one of the matched groups, a student had to have taken all six one-hour tests administered during the semester, and his grade-point index had to be available. The grade-point indices, however, were available for only 91 of the 103 experimental students and 77 of the 91 control students.  

Seibert compares the grade-point indices of the control and experimental groups before matching:

The respective averages of the television-taught group and the control group were 4.37 and 4.54 (4 = "C", 5 = "B", etcetera). These indices are based on college work completed by June, 1956 and for the majority of students, therefore, represent average performance in the work completed as college freshmen.

Because the grade-point indices of students in the control and experimental groups were the principal criteria used in matching the two groups, a summary of the method followed seems appropriate. Seibert states:

Student cumulative grade-point indices carry two places to the right of the decimal point, for example, 3.47. Twenty three perfect matches were obtained (grade-point difference 0.00 between paired students), eleven differences were 0.01, and ten were 0.02. No matched pairs exhibited differences greater than 0.07, and there was only one such difference. The indices of these students range from 5.40 (about midway between an "A" and a "B") down to 3.27 (just above a "D").

The average grade-point index of each group before matching

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35 Ibid., p. 5.
36 Ibid.
37 Ibid., p. 8.
was 4.37 for the experimental group and 4.54 for the control group. After matching, the average grade-point indices for the experimental and control groups were 4.14 and 4.15 respectively. 38

In addition to being matched by grade-point indices, students in the control and experimental groups were also matched on the basis of scores on the Freshman Orientation Mathematics Test. These scores were available for 87 of the 103 experimental students and for 73 of the 91 control students. 39 Before matching, the average Freshman Orientation Mathematics Test score for the control group was 49.2 and for the experimental group 48.7. After matching, the average scores on the test for the control and experimental groups were 42.8 and 44.9 respectively. 40

The age of the students provided the third criterion. Before matching, the average ages of the control and experimental groups were 21.5 and 20.5 respectively. After matching, the average age of the control group was 21.3, while that of the experimental group was 20.6. 41 The method outlined above provided 61 matched pairs of students. 42

38 Ibid., p. 5.
39 Ibid., p. 8.
40 The maximum possible score on the Mathematics Test is 60.
42 Ibid.
43 John Dyer-Bennet et. al., op. cit., p. 433.
A comparison of the matched and unmatched grade-point indices, Freshman Orientation Mathematics Test scores, and ages of the control and experimental groups indicates that the inequality which existed between the grade-point indices of the experimental and control groups was corrected by the matching, although the inequality which existed between the ages of the two groups and between their Freshman Orientation Mathematics Test Scores was hardly affected by it.  

Description of the Course

The course taught in the Study, "Mathematics 241," Introductory Calculus, is described as follows in the *Purdue University Bulletin*:

Mathematics 241—Calculus I. Sem. 1 and 2, class 4, cr. 4. Prerequisites: Mathematics 132 or 142 (both courses in college algebra and plane trigonometry as well as the elements of analytic geometry). The course was offered for the last time during the second semester, 1956-57.

The course provided an introduction to differential and integral calculus. It was a four-hour course, meeting four fifty-minute periods a week throughout the sixteen week semester.

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45 Purdue University, *Purdue University Bulletin, 1957-58 Catalog Issue*, LVII, Number 17 (Purdue University, March 1957), 71.

46 Ibid.
The Instructors of the Control and Experimental Groups

Both the control and experimental groups were taught by the same two instructors during the semester. Both of these men held the degree Doctor of Philosophy in mathematics; each had had more than twelve years of experience in teaching college mathematics; each had taught "Mathematics 241" several times before to small classes.47

To minimize the "instructor variable," one teacher taught the four sections which received television instruction for eight weeks of the semester while the other taught the large ("live") lecture control section. At mid-semester, the instructors exchanged classes.48

Teaching Conditions

Except for the use of televised lectures given simultaneously to four sections of the experimental group and the "live" lecture given to the entire control group, the teaching conditions of the two groups— discussed separately in the following sections — were almost identical.

Teaching Conditions in the Control Group

Lectures — The 91 students receiving conventional instruction

47 Letter from Warren F. Seibert, Television Research Consultant, Purdue University, Lafayette, Indiana, June 25, 1958.

48 Warren F. Seibert, A Brief Report and Evaluation of Closed-Circuit Television Instruction in the First Semester Calculus Course (Mimeographed) (Purdue University, July 1957), 4.
met in a large room for three fifty-minute periods each week of the semester for a "live" lecture on the day's lesson.49

Provisions for questions and discussion — The fourth fifty-minute meeting of the control group was devoted to questions about and discussion of the week's lessons. The control group was broken up into four small sections of approximately twenty-three students each for these discussion and question periods.50

Provisions for homework — The week's homework was collected at the question and discussion period, that is, at the fourth class meeting. At the same question and discussion period, homework which had been taken up during the preceding week at the question and discussion period and corrected by the instructor for each group was returned. Although grades were not assigned to these papers, if they were correctly and neatly done, students were given credit for them. The number of homework assignments completed, however, had little bearing on the final course grades. According to correspondence with Seibert:

In a few cases, homework may have been a factor involved in drawing a line between two students who had performed equally on the six tests.51

Provisions for examinations — Six one-hour examinations

49Ibid., pp. 3-4.

50Ibid.

during the course of the semester were given to the control group. These six examinations were administered during the one-hour question and discussion period. The simultaneous administration of the six one-hour tests to both groups was important so that comparisons between the achievement of the two groups would be valid, and so that the hazard of information "leakage" might be eliminated.\textsuperscript{52}

Teaching Conditions in the Experimental Group

\textbf{Lectures} — The four experimental sections, of approximately 25 students each, met three times a week for instruction by closed-circuit television. Each of the participating students was assigned to one of the four monitor-equipped rooms. No proctors were regularly assigned to oversee the television classes during the lectures.\textsuperscript{53}

\textbf{Provisions for questions and discussion} — The provisions for questions and discussion were the same for the experimental group as for the control group.

\textbf{Provision for homework} — The provisions for homework were the same for the experimental group as for the control group.

\textbf{Provisions for examinations} — The provisions for examinations were the same for the experimental group as for the control group.

\textsuperscript{52}Warren F. Seibert, \textit{A Brief Report and Evaluation of Closed-Circuit Television Instruction in the First Semester Calculus Course} (Mimeographed) (Purdue University, July 1957), 4.

\textsuperscript{53}Ibid., pp. 3-4.
Comparison of Achievement Scores Made by the Two Groups

Inasmuch as the two groups were practically equivalent in mathematical ability and point-hour index at the beginning of the study, the scores which each group made on the six tests given during the semester may be statistically compared and analyzed. Seibert states:

Scores on each of the six calculus tests and the summed scores from all six tests have been compared statistically by means of the t-test between correlated means with the following results:

Student achievement in calculus, as measured by six classroom tests, is very nearly the same for conventionally and television-taught students. Achievement differences most often favor the conventional student group; however, tendencies in the opposite direction also exist. Four of the seven differences between average scores favored the conventional group, two of these at a level which achieved statistical significance. There was no significant difference in the total semester's performance of the two groups.54

Mr. Seibert concludes that students of "below," "average," and "above average" ability seemed to do as well through televised teaching as through the conventional situation.55

Analysis of Experimental-Students' Reactions

A comparison of response to questions on the ten-item attitude questionnaire administered to the experimental students prior to instruction with response to the same questionnaire following

54Ibid., p. 2

55Ibid.
instruction indicated a trend toward the rejection of televised instruction. Students seemed unanimously to think that the necessary elimination of questions and discussion during the television lecture is a serious limitation of the method.

Evaluation of the Course by the Participating Instructors

The two instructors who participated in the study were satisfied with its results. They state:

We judge that the effectiveness of the present method of televised calculus instruction is satisfactory. In view of the fact that the personnel (teachers, students, and production personnel) had little or no experience in situations such as were represented here, improvement is expected with additional experience.

Summary

Purdue University, unlike many colleges and universities, began its experimentation with televised instruction in mathematics with an advanced undergraduate mathematics course—an introductory course in calculus. In the study a control group of 91 students and an experimental group of 103 students participated.

The control group received conventional (large section) lectures for three fifty-minute periods a week, while the experimental groups received closed-circuit television lectures for three

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56 Ibid., p. 3.
57 Ibid.
58 Ibid.
fifty-minute periods a week. A fourth fifty-minute period was devoted in each group to questions and discussion, guided by a graduate student in the department of mathematics.

The two instructors, both of whom held the Doctor of Philosophy degree in mathematics, participated in the study, both men teaching each group for half of the semester, in an attempt to eliminate the "instructor variable" in the outcome of the study.

The mathematical achievement of each group was measured by six one-hour tests given during the course of the semester. Sixty-one matched pairs of students were used in the analysis of group achievement. With Students' t-test as a basis for analysis, no statistically significant difference occurred between the overall achievement of the two groups. Applying Students' t-test to individual test scores, a statistically significant difference in achievement occurred on two tests, both of which favored the control group.

A ten-item questionnaire administered to students before and after instruction revealed a decrease in student acceptance of the televised course after instruction.

Informal evaluations by the instructors of the course indicated that they believed students learned as effectively by televised teaching as by conventional.
Chicago (Illinois) City Junior Colleges

Origin of the Study

In the Fall of the school term 1956–57 the Chicago City Junior Colleges offered their first mathematics course via television. The course offered was Mathematics 101, "Introduction to Mathematics." 59

Description of the Study

The total television enrollment for Mathematics 101 was 1762 students, 233 of whom were registered for credit and 1529 took the course for non-credit. One-hundred and seven or 46 percent of the students who registered for credit remained to receive grades at the end of the quarter. 60

Three "live" lectures were presented per week during the afternoon to the television students. Each lecture was repeated a week after its initial "live" presentation in the evening by kinescope. 61

The students registered for the course given in the conventional manner in the six branches of the Chicago City Junior Colleges, from which group the control group of students was

59 Clifford G. Erickson and H. M. Chausow, The Chicago City Junior College Experiment in Offering College Courses for Credit Via Open-Circuit Television (Chicago City Junior Colleges 1958), ii.

60 Ibid., p. 12.

61 Ibid., p. 10.
selected, received three lectures a week. They could also watch the televised lectures. 62

Purpose of the Study

The purpose of the study in teaching Mathematics 101 by television at the Chicago City Junior Colleges was to investigate the effectiveness of this medium for instructional purposes in the field of mathematics. The effectiveness of television in teaching Mathematics 101 was to be compared with the conventional method of presentation. 63

In order to test the effectiveness of the television medium, the following criterion was used: The performance of the experimental students and the control students on three fifty-minute tests given during the semester and the final examination which was two hours long were compared. 64

In order to gauge the attitudes of the television students toward television instruction, a twenty-two item questionnaire was administered after the students had been exposed to television instruction. 65

Procedures Used in Matching the Experimental and Control Groups

A group of 28 students who were enrolled in Mathematics 101

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62 Ibid., p. 22.
63 Ibid., p. 2.
64 Ibid., p. 24.
during the Spring Semester 1957 at the various branches of Chicago City Junior Colleges, and taught by conventional methods, was matched with a group of 28 students who were taught by television. Since the control classes did not yield enough cases to afford the use of the matched pairs technique, the covariance method was used in equating the two groups of students. 66

Description of the Course

In the Study Guide for the course Mathematics 101, we find the following description of the course:

Mathematics 101 is designed to acquaint you with some of the important concepts of mathematics as well as to provide skills necessary in the application of these ideas. Understanding of mathematics in our highly technical world is as essential to the man of general education as the techniques of mathematics are to the engineer or scientist.

The course is arranged to give you an opportunity to review and unify much of the material from elementary mathematics. The scope of this material is also widely extended and applied in many examples in an effort to show both the theoretical and practical aspects of this subject. The principal objectives of the course are as follows:

1. To show through logical structure of mathematical systems, that mathematics has an intrinsic unity and is far more than a collection of useful skills.
2. To trace some of the historical development of mathematics and to show the role this subject has played in the progress of civilization.
3. To examine the structure of our number system.
4. To examine algebra and geometry as postulatory systems.
5. To discuss some of the important concepts such

66 Ibid., p. 22.
as the function concept and to demonstrate the many useful applications of these concepts.  

The course, which was presented in forty-six (46) lessons, covered the following topics:

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<tr>
<th>Lesson</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>The Nature of Mathematics</td>
</tr>
<tr>
<td>II</td>
<td>Reasoning—Deductive and Inductive</td>
</tr>
<tr>
<td>III</td>
<td>Set and Drawing Conclusions</td>
</tr>
<tr>
<td>IV</td>
<td>Development of Numbers Meaning and Symbols</td>
</tr>
<tr>
<td>V</td>
<td>Extensions of the Fundamental Number Set</td>
</tr>
<tr>
<td>VI</td>
<td>Postulates for the Number Set</td>
</tr>
<tr>
<td>VII</td>
<td>Number Bases</td>
</tr>
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<td>VIII</td>
<td>The Nature of Algebra</td>
</tr>
<tr>
<td>IX</td>
<td>Linear Equations</td>
</tr>
<tr>
<td>X</td>
<td>Quadratic Expression and Equations</td>
</tr>
<tr>
<td>XI</td>
<td>The Quadratic Formula</td>
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<tr>
<td>XII</td>
<td>Problems Involving Quadratics</td>
</tr>
<tr>
<td>XIII</td>
<td>Linear Equations — Two Variables</td>
</tr>
<tr>
<td>XIV</td>
<td>Some Applications of Equations</td>
</tr>
<tr>
<td>XV</td>
<td>Geometric Forms and Measurement</td>
</tr>
<tr>
<td>XVI</td>
<td>Length, Area, Volume, and Angle</td>
</tr>
<tr>
<td>XVII</td>
<td>Measurement and Errors</td>
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<tr>
<td>XVIII</td>
<td>Measurement—Accuracy and Significant Figures</td>
</tr>
<tr>
<td>XIX</td>
<td>Measurement—Direct and Indirect</td>
</tr>
<tr>
<td>XX</td>
<td>Applied Geometry</td>
</tr>
<tr>
<td>XXI</td>
<td>Review of Unit on Geometry</td>
</tr>
<tr>
<td>XXII</td>
<td>Cartesian Coordinates</td>
</tr>
<tr>
<td>XXIII</td>
<td>Distance and Slope</td>
</tr>
<tr>
<td>XXIV</td>
<td>Problems Involving Distance and Slope</td>
</tr>
<tr>
<td>XXV</td>
<td>Straight Line Graphs</td>
</tr>
<tr>
<td>XXVI</td>
<td>Equations of Straight Lines</td>
</tr>
<tr>
<td>XXVII</td>
<td>The Parabola</td>
</tr>
<tr>
<td>XXVIII</td>
<td>Other Conic Sections</td>
</tr>
<tr>
<td>XXIX</td>
<td>Summary and Review</td>
</tr>
<tr>
<td>XXX</td>
<td>Variables, Constants, and Functions</td>
</tr>
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<td>XXXI</td>
<td>Tabular Representation</td>
</tr>
<tr>
<td>XXXII</td>
<td>Graphical Representation</td>
</tr>
<tr>
<td>XXXIII</td>
<td>Analytical Representation</td>
</tr>
</tbody>
</table>

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The course, which carries three semester hours credit, is intended for the person wanting a view of the entire field of elementary mathematics.

The Instructors of the Experimental and Control Groups

Courses taught by television at Chicago City Junior Colleges were planned and taught by teams of instructors. The instructional team for the course Mathematics 101 consisted of two people. They were Dr. Jerome M. Sachs, Assistant Dean in Charge at the Southeast Branch of the City College, and Miss Florence M. Miller, an instructor in the Mathematics Department at the Wright Branch of the Chicago City Junior Colleges.

The instructors of the control students were the same persons who taught Mathematics 101 during the Second Semester of 1956-57.

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68 Ibid.

Teaching Conditions

In this study, the instructional conditions of the control and experimental groups were different. The instructional conditions of the two groups will be discussed in detail in the following sections.

Teaching Conditions of the Control Group

Lectures — The control students received three lectures per week in the various branches of the Chicago City Junior Colleges. They could also watch the television lectures on the course.

Provisions for questions and discussion — It is assumed that the control students had the same opportunities to ask questions and engage in discussion with the teachers and each other that are presented the usual student who receives instruction in the conventional manner.

Provisions for homework — It is assumed that homework was required of the control students as well as the experimental.

Provisions for examinations — It is assumed that the control students were administered the same number of examinations as the experimental students.

---


Teaching Conditions of the Experimental Group

Lectures — The course was telecast three times a week (each lecture being telecast twice) over Station WTTW, Channel 11, Chicago, Illinois. 72

The lectures were presented "live" during the day hours and simultaneously kinescopes were prepared for showing one week later during the evening hours. 73

Provisions for questions and discussion — A discussion period was scheduled after each of the three fifty-minute examinations. A proctor answered questions about the examination and the television lectures. He also took suggestions from the students for possible improvements of the programs which were passed on to the television teacher. Students could also write in to have questions answered on the television program or by mail. 74

Realizing that much learning results from students' discussing what they have read or been taught with other students, the Chicago City Junior Colleges made an attempt to organize informal discussion groups among their television students. This attempt is described in the following words:

At the mid-term examinations in November, 1956, the television students were given an opportunity to

72 Ibid., p. 10.
73 Ibid.
74 Jerome M. Sachs and Florence M. Miller, op. cit., p. 5.
share telephone numbers and addresses for the establishment of voluntary student arranged home discussion groups. Four hundred students submitted their names, addresses, and phone numbers. These were collected, collated by postal zone, mimeographed and distributed.

There seemed to be little evidence of the formation of active discussion groups. An opportunity for a similar inter-change of addresses and phone numbers was afforded in the registration procedure in the February, 1957 registration. So few people submitted names that the plan was abandoned. 75

Provisions for homework — Regarding homework assignments, the following provisions were made. According to the Study Guide the directions to students were as follows:

Keep the assignments you do in a notebook or folder. Identify each assignment by the lesson number. One good scheme for doing this is shown in the assignment heading below.

<table>
<thead>
<tr>
<th>Lesson Number</th>
<th>Name</th>
<th>Pages</th>
<th>Problems</th>
</tr>
</thead>
</table>

Please use the enclosed assignment sheets as the first pages of your assignment notebook. When you finish a lesson circle, on the assignment sheet, the number of problems you have done. This will enable you to return to the problems with which you have had difficulty. Bring the folder with the appropriate assignment sheets and assignments with you to each examination. The proctor will call for your folder and return it to you at the end of the examination period. He will keep the assignment sheets for his records. Do not underestimate the value of doing the assignments. Success in examinations will follow if the assigned work is done promptly and thoroughly. 76

75 Clifford G. Erickson and H. M. Chausow, op. cit., p. 11.

76 Jerome M. Sachs and Florence M. Miller, op. cit., p. 4.
Provisions for examinations — Three fifty-minute examinations were given during the semester. The final examination was two hours long. Students reported to the branch of the Chicago City Junior Colleges nearest them for these examinations. The work of the semester was divided into six units and an examination was given at the completion of every two units. 77

A practice examination on the first two units was included in the Study Guide. A practice examination on units three and four was mailed to students who purchased the Study Guide. Students could work out these examinations and send them in to be corrected and returned to them. 78

Analysis of Achievement Scores Made by the Experimental Group and The Control Groups

Twenty-eight experimental and 28 control students, matched by the use of the covariance technique were used for comparison of the achievement of the experimental and control groups. The mean score of the experimental group was found to be 2.966 and that of the control group 3.174. These scores were computed in terms of the letter grades made by students in the course, where "A" = 5, "B" = 4, "C" = 3, etc. 79

The achievement of students taught by conventional methods

77 Ibid., pp. 4-5.
78 Ibid., p. 4.
was somewhat superior to that of students taught by television. However, according to the Report of the study:

In mathematics where groups were equated by the covariance method, using mental ability and subject pretest as correction factors, there was no significant difference between the achievement of the experimental and control groups.

Analysis of the Reaction Data of the Experimental Students

The Chicago City Junior Colleges Study also included an analysis of the reactions of students to television as a medium of instruction. The group of television students, as a whole, was favorable to course content, materials, teaching, pacing, and other aspects of the teaching-learning situation. They missed the opportunity to ask questions, but reported that many were answered by the television teacher.81

The overwhelming majority indicated a willingness to re-enroll in telecourses and to recommend enrollment in Television College to a friend.82

When the responses of "A" and "B" students were compared with those of "D" and "E" students, no essential difference between reaction and attitude of these groups toward the televised class was discernible.83

80 Ibid.
82 Ibid., p. 15.
83 Ibid.
Comment on the study — In the Report published by the Chicago City Junior Colleges in which the study is discussed and evaluated, no mention is made of the instructional conditions of the control group. It is not known whether or not this group was administered the same examinations as the experimental group. If the control students were not administered the same examinations, then a comparison of their grades with those of the experimental students was not valid.

The use of only 28 experimental students and the same number of control students for purposes of comparing the achievement of the two larger groups of students who were taught the course by television and in the conventional manner would not seem to yield as valid results as the use of larger samples of the two groups for comparative purposes.

Summary

During the second semester of the 1956-57 school year, the Chicago City Junior Colleges offered their first course in mathematics by television. The course, "Mathematics 101," was an introductory college mathematics course.

Two lectures were presented over open-circuit television on each lesson, one of which was presented exactly a week after the initial broadcast.

In the meantime, a control class (taught by conventional methods) was being conducted in each of the six branches of the
Chicago City Junior Colleges. A group of 28 pairs of students, one from the experimental and one from the control group in each pair, matched on the basis of mental ability pretests and subject matter pretests, was used in analyzing the achievement of the two groups.

The achievement of the two groups, as measured by letter grades received in the course, was compared. Differences in achievement, though not statistically significant, favored the control group.
APPENDIX D

Lesson Schedule for Mathematics 400

A Description of the Use of Mathematics 400 Telecasts by Other Schools

Questionnaires Administered to Television and Conventional Students During the Study
Lesson 1 — April 2, 1958


Lesson 2 — April 3, 1958

Hand in Exercise Number 1 pp. 227-228: All exercises.

Lesson 3 — April 4, 1958

Fundamental operations. Definitions of addend, sum, minuend, subtrahend, product, dividend, etc. Five fundamental flaws of arithmetic, e.g. commutative, associative, and distributive laws. Text pages 5-11, Problem Assignment pp. 7, 10, and 11: All exercises.

Lesson 4 — April 7, 1958

Number scale, negative and positive numbers, flaws of operation with signed numbers, absolute values of numbers. Text pages 11-15: Problem Assignment pp. 14, 15: All exercises.

Lesson 5 — April 8, 1958

Hand in Exercises 2 and 3 pp. 229-232: All exercises.

Lesson 6 — April 9, 1958


Lesson 7 — April 10, 1958

Hand in Exercise 5 pp. 235-36: All exercises.

Lesson 8 — April 11, 1958

Unit of measurement, denominate numbers, conversion from one system of measurement to another, operations with denominate numbers, angle, discussions of various kinds of angles, triangles, complementary
and supplementary angles. Text pages 24-30: Problem Assignment pp. 27, 29, 30, 237, and 238: All exercises

Lesson 9 — April 14, 1958

Areas of polygons, definitions of various kinds, parallelism, perimeter of polygons, a brief study of structure of geometry, i.e., undefined terms, definitions, postulates and theorems, summary of section. Text pages 33-37: Problem Assignment pp. 34, 35, 239, and 240: All exercises

Lesson 10 — April 15, 1958

Hand in Exercise 8 pp. 241-242: All exercises. Pick up sample Midterm

Lesson 11 — April 16, 1958


Lesson 12 — April 17, 1958

One hour examination covering Chapters I and II.

Lesson 13 — April 18, 1958

Common fractions, equivalent fractions, basic definitions of parts or types of fractions, multiplication and division of fractions, basic definitions and rules. Reciprocal of a number. Text pages 39-44: Problem Assignment pp. 40, 41, 44, 243 and 244: All exercises.

Lesson 14 — April 21, 1958


Lesson 15 — April 22, 1958

Hand in Exercise 10 pp. 245-46: All exercises.

Lesson 16 — April 23, 1958

Decimal notation, decimal point and positional notation; exponent and base; negative exponents. Addition and multiplication of
decimal fractions, definitions and rules. Text pages 57-64: Problem Assignment pp. 58, 60, 63, 64: All exercises.

Lesson 17 — April 24, 1958

Hand in solutions to all even numbered exercises in exercises 12 and 13 pp. 249-252: All even numbered exercises.

Lesson 18 — April 25, 1958


Lesson 19 — April 28, 1958

Approximations, significant digits, approximate and exact numbers, percentage error, infinite decimals, summary of section. Text pages 73-80: Problem Assignment pp. 76 and 225: All exercises.

Lesson 20 — April 29, 1958


Lesson 21 — April 30, 1958


Lesson 22 — May 1, 1958

Hand in exercise 17 pp. 259-60: All exercises. One hour examination covering Chapters III and IV.

Lesson 23 — May 2, 1958

Introduction to algebra. Definitions of general and specific numbers. Linear equations, solutions of various types. Text pages 81-86. Problem Assignment pp. 82, 83, and 86: All exercises.

Lesson 24 — May 5, 1958

Simple algebraic expressions, terms, similar terms. Laws of exponents. Text pages 87-91, problem assignment pp. 89 and 91: All exercises.
Lesson 25 — May 6, 1958
Hand in exercise 19 pp. 263–264: 1–20, 28–31

Lesson 26 — May 7, 1958
Operations with algebraic expressions, numerical coefficient, definitions of binomial, trinomial, polynomial. Text pages 92–96: Problem Assignment pp. 93, 94, 96, and 261: All exercises

Lesson 27 — May 9, 1958

Lesson 28 — May 12, 1958

Lesson 29 — May 13, 1958

Lesson 30 — May 15, 1958

Lesson 31 — May 15, 1958
One hour examination covering Chapter 5

Lesson 32 — May 16, 1958

Lesson 33 — May 19, 1958
Lesson 34 — May 20, 1958
Hand in exercise 24 pp. 273: All exercises; 274: Exercises 10, 12, 14, and 15

Lesson 35 — May 21, 1958

Lesson 36 — May 22, 1958
Hand in exercise 31 pp. 287-288: Exercises 1, 2, 3, 4, 5.

Lesson 37 — May 23, 1958
Graphs of equations, the rectangular coordinate system. Text pages 162-165: Problem Assignment pp. 164 and 165: All exercises.

Lesson 38 — May 26, 1958

Lesson 39 — May 27, 1958
Hand in exercises 32, 33, 34, pp. 289; 1, 2, p. 290; 6, 4, p. 291; 2, 4 p. 292; 11. p. 293; 7, 9 p. 294; 18

Lesson 40 — May 28, 1958

Lesson 41 — May 29, 1958
Hand in exercise 25 pp. 275-76: All exercises. One hour examination

Lesson 42 — June 2, 1958
Beginning of week of review of course for final examination

Lesson 43 — June 3, 1958
Review in quiz sections. Distributed two sheets of review problems.
Use of Mathematics 400 Telecasts by Other Schools

Prior to the initiation of the Mathematics 400 telecasts by the mathematics department at The Ohio State University and WOSU-TV the high schools in Columbus and in the Columbus Area were notified concerning the telecasts. It was felt that some of these schools might want to make use of these telecasts, in a formal or informal manner.

During the Spring Quarter, Dr. Robert Holsinger, Assistant Dean, College of Arts and Sciences, Part-time, and Administrative Assistant to Director of Broadcasting, WOSU-WOSU-TV, Part-time, conducted a survey of Columbus and Columbus Area High Schools in an effort to ascertain which, if any, of these schools were utilizing the Mathematics 400 telecasts formally or informally in their schools. The following information was gathered by Dean Holsinger:

In addition to the use of the university campus, a number of area high schools have shown great interest in the course as a special remedial aid for students expecting to enroll in college
next year. The lack of use on the part of some schools is due in large part to scheduling problems. Some administrators also expressed the need of closer coordination in the use of television remedial courses between the university and the affected school systems. The following is a general summary of utilization during the Spring Quarter:

**Columbus**

South High School

UHF facilities offered during the final class period. Members of mathematics instructional force present.

West High School

Twenty-five (25) to thirty (30) students selected because of demonstrated deficiency in the subject matter, meet during final period to view.

North High School

Course not used at present.

East High School

Course not being used largely because of scheduling difficulties mentioned above.

Marion-Franklin

Course not being used.

Linden-McKinley

Course not used.

Central High School

UHF viewing facilities are offered for interested students.

Eastmoor High School

Course not being used.

**Columbus Area Schools**

Worthington High School

Offered during regular class period — 2:40 to 3:40 p.m. 17 students regularly view the course. Additional instruction is offered by mathematics staff.

Upper Arlington High School

Course is not being used currently. PTA is in process of obtaining UHF set for viewing.
Whitehall High School  Course offered during the ninth period, 3:00 to 3:40 p.m. Approximately thirty (30) students are enrolled. Ninth grade classes view occasional sessions.

Bexley High School  Not using televised course. Mathematics 400 is taught in the regular curriculum, using Dr. Miller's text.

Grandview High School  School does not have UHF set. Course as offered conflicts with 3:00 p.m. dismissal.

Westerville High School  Not using course at present. Plan for use next year.

Questionnaire — April 15, 1958

Please indicate where you watched the mathematics 400 telecast on the dates shown below (e.g. your sorority or fraternity house, at home, in room 100, Botany and Zoology Building, other). If you did not watch the telecast on any of the dates below, please so indicate.

1. Wednesday, April 2__________.
2. Friday, April 4__________.
3. Monday, April 7__________.
4. Wednesday, April 9__________.
5. Friday, April 11__________.
6. Monday, April 14__________.

Comments (favorable or unfavorable
Questionnaire — April 22, 1956

Please indicate where you watched the mathematics 400 telecast on the dates shown (e.g., your sorority or fraternity house, at home, in room 100, Botany and Zoology Building, other). If you did not watch the telecast on any of the dates below, please so indicate.

1. Wednesday, April 16 ________________________
2. Friday, April 18 ___________________________
3. Monday, April 21 __________________________

In the spaces below please list what you consider to be good or/and bad about the telecasts. Also, make suggestions for possible improvement.

**Good Points**

________________________________________________________________________

**Bad Points**

________________________________________________________________________

**Suggestions for Improvement**
Questionnaire — April 29, 1958

Please indicate where you watched the mathematics 400 telecast on the dates shown (e.g., your sorority or fraternity house, at home, in room 100, Botany and Zoology Building, other). If you did not watch the telecast on any of the dates below, please so indicate.

1. Wednesday, April 23

2. Friday, April 25

3. Monday, April 28

In the spaces below please list what you consider to be good or/and bad about the telecasts. Also, make suggestions for possible improvement.

**Good Points**

________________________________________________________________________

**Bad Points**

________________________________________________________________________

**Suggestions for Improvement**
Questionnaire — May 6, 1958

Please indicate where you watched the mathematics 400 telecast on the dates shown (e.g., your sorority or fraternity house, at home, in room 100, Botany and Zoology Building, other). If you did not watch the telecast on any of the dates below, please so indicate.

1. Wednesday April 30____________________.

2. Friday, May 2____________________.

3. Monday, May 5____________________.

In the spaces below please list what you consider to be good or/and bad about the telecasts. Also, make suggestions for possible improvement.

Good Points

____________________________________

Bad Points

____________________________________

Suggestions for Improvement
1. How do you rate the clearness of presentation?

<table>
<thead>
<tr>
<th>Very Confusing</th>
<th>Rather Confusing</th>
<th>Not Sure</th>
<th>Fairly Clear</th>
<th>Very Clearly Presented</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

2. How would you rate the speed of presentation?

<table>
<thead>
<tr>
<th>Much too Slow</th>
<th>Too Slow</th>
<th>About Right</th>
<th>Too Fast</th>
<th>Much too Fast</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<td></td>
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</tbody>
</table>

3. How would you rate the use of charts and other visual aids?

<table>
<thead>
<tr>
<th>Much too Few</th>
<th>A little too few</th>
<th>About Right</th>
<th>A Little too many</th>
<th>Much too Many</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

4. How much do you miss being able to participate in discussion and ask questions during the televised lectures?

<table>
<thead>
<tr>
<th>Very Much</th>
<th>Quite a Bit</th>
<th>Somewhat</th>
<th>Very Little</th>
<th>Not at All</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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</tbody>
</table>

5. How interesting do you find the course?

<table>
<thead>
<tr>
<th>Very Boring</th>
<th>Boring</th>
<th>Variable</th>
<th>Interesting</th>
<th>Very Interesting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

6. Would you recommend the course to a friend were it offered again via television and by the regular classroom method at the same time?

<table>
<thead>
<tr>
<th>Never</th>
<th>Probably Not</th>
<th>Doubtful</th>
<th>Probably Yes</th>
<th>Certainly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Please indicate below where you watched the telecasts on the dates indicated.

Wednesday, May 7__________________.
Friday, May 9______________________.
Monday, May 12______________________.

Name__________________________________.

______________________________

May 20, 1958

Please supply the following information:

Name______________________________
Date of Birth______________________
College Enrolled in__________________
Hours Earned Toward College Degree to Date__________________

Please indicate where you watched the mathematics 400 tele­
cast on the dates shown below.

Wednesday, May 14__________________
Friday, May 16______________________
Monday, May 19______________________

Please list all of the mathematics courses which you took in high school below.
The Ohio State University Mathematics Department Teacher-Course Evaluation Questionnaire

The department of mathematics is constantly attempting to improve its mathematical instruction. You can help by completing this questionnaire. You need not sign your name. When you have finished hand your questionnaire to the student designated by your instructor. This student will place your replies in an envelope, seal it, and take it to the department office. There it will remain until your final grades for this course are reported and the quarter ends.

Your college _______ Course number ______ Course time ______

Your year _______ OSU math pt. hr_______ Course room ______

Are you required to take this course______________

Average number of hours you spent each day studying this course____

Number of visits you made to the mathematics conference room this quarter______________

After each item circle the appropriate letter to express your opinion according to the following scale: A(excellent), B(good), C(average), D(poor), E(unsatisfactory).

There is space for comment after each item and experience has shown that comments may be more valuable than ratings.

1. My mathematical background for this course A B C D E
   Comment (high school, college, etc.)

2. My effort in this course A B C D E
   Comment

3. Adequacy of the classroom A B C D E
   Comment (blackboards, lights, seats, ventilation, etc.)

4. The organization of this course A B C D E
   Comment (coherence, emphasis, topics, etc.)

5. The assignments for this course A B C D E
   Comment (difficulty, length, number, etc.)

6. The text for this course A B C D E
   Comment (examples, discussion, problems, etc.)
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>The interest which my instructor showed in me</td>
<td>A B C D E</td>
</tr>
<tr>
<td></td>
<td>Comment</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>The enthusiasm which my instructor displayed for the course</td>
<td>A B C D E</td>
</tr>
<tr>
<td></td>
<td>Comment</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>The classroom personality of my instructor</td>
<td>A B C D E</td>
</tr>
<tr>
<td></td>
<td>Comment</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>The blackboard presentations of my instructor</td>
<td>A B C D E</td>
</tr>
<tr>
<td></td>
<td>Comment (completeness, drawings, neatness, visibility, etc.)</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>The lectures of my instructor</td>
<td>A B C D E</td>
</tr>
<tr>
<td></td>
<td>Comment (clarity, difficulty, helpfulness, etc.)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>The opportunities for my participation in the class</td>
<td>A B C D E</td>
</tr>
<tr>
<td></td>
<td>Comment</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>The answers my instructor gave my questions</td>
<td>A B C D E</td>
</tr>
<tr>
<td></td>
<td>Comment</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>The examinations my instructor gave</td>
<td>A B C D E</td>
</tr>
<tr>
<td></td>
<td>Comment (difficulty, frequency, length, value, etc.)</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>The marks my instructor assigned</td>
<td>A B C D E</td>
</tr>
<tr>
<td></td>
<td>Comment</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>My evaluation of this course</td>
<td>A B C D E</td>
</tr>
<tr>
<td></td>
<td>Comment</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>The interest in mathematics which this course instilled in me</td>
<td>A B C D E</td>
</tr>
<tr>
<td></td>
<td>Comment</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>The contribution which this course is making to my education</td>
<td>A B C D E</td>
</tr>
<tr>
<td></td>
<td>Comment</td>
<td></td>
</tr>
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<td>19</td>
<td>The extent to which this course has increased my reasoning ability</td>
<td>A B C D E</td>
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Summarizing Questionnaire — May 29

Please read each question carefully and put a check before the word, phrase, or statement which most adequately expresses your answers to the question.

1. How would you rate the TV course in mathematics 4007?
   - Too difficult
   - About right
   - Too easy

2. What is your opinion of the pace of the TV teacher?
   - Too fast
   - About right
   - Too slow

3. How would you rate the explanatory materials in the text?
   - Excellent
   - Average
   - Inadequate

4. How well does your assignment sheet serve you?
   - Very well
   - Satisfactorily
   - Inadequately

5. How much of the assigned homework do you do?
   - over 2/3
   - From 1/3 to 2/3
   - 1/3 or less

6. How do you feel about the TV teacher's use of charts and other visual aids?
   - Use more
   - About right
   - Use fewer

7. As the quarter progressed, how well did the TV lessons maintain your interest?
   - Very well
   - Moderately
   - Very little

8. How do you feel about your TV teacher's use of guest teachers?
   - Use more
   - About right
   - Use fewer
9. How well does your TV teacher anticipate and answer your questions?
   Almost always   Sometimes   Seldom

10. Do you take notes during the TV lesson?
    Almost always   Sometimes   Seldom

11. Do you learn as effectively by TV as you have in other classrooms?
    Yes   No   Not sure

12. In your opinion, how much do you miss not being able to participate in class discussion and ask questions during the telecasts?
    A great deal   A little   Not at all

13. Were this course offered both in the regular manner and also by television during the same quarter and at the same time (hour in the day), would you recommend that a friend take the course by television?
    Yes   No   Undecided

14. Which combination of televised lectures and quiz sections do you feel would yield best results in mathematics 400?
   a) Two television lectures and three quiz sections weekly?
   b) Three television lectures and two quiz sections weekly?
   c) One half-hour television lecture and one half-hour quiz section daily?

15. If each telecast were repeated on the same day before you attempted doing your homework, do you feel that you would get a better grasp of the material?
    Yes   Probably   No   Uncertain

16. Would it help you to be able to see a film of the telecast on the day following the initial telecast after you had attempted doing your homework?
    Very much   Somewhat   A little

17. Which would you have preferred?
   a) Quiz sections which meet formally and regularly.
   b) Conference periods staffed by teachers of mathematics, arranged especially for math 400 students, and extending over the entire school day, which you would attend only if you felt you needed to
18. How much did you study the text in preparation for listening to the TV lecture?
   A great deal Moderate Not at all

19. How often should tests be given?
   a) More often than this term?
   b) About the same as now?
   c) Less often than this term?

20. From the point of view of the help you received in learning the material of the course, rank each of the following parts (number them 1, 2, 3, 4, in order of the amount of help received, the most helpful part being numbered "1").
   TV lectures Tests Quiz sections Textbook

21. How do you think your final course grade will be?
   a) Better than in a non-TV class?
   b) No expected difference?
   c) Not as high as in a non-TV class?

22. How was the ventilation in the TV lecture room?
   Too much About right Too little

23. How conveniently could you have followed the mathematics 400 telecasts if they had been offered in the evening hours between
   a) 4 and 5? Conveniently With difficulty Impossible
   b) 7 and 8? Conveniently With difficulty Impossible

24. If required courses in other subjects are offered both by television and in the regular manner next term, will you enroll in the television section?
   Yes No Undecided

25. Have the tests been fair?
   Yes No No opinion

26. What topics in the course should be eliminated?

27. What other changes not mentioned in this questionnaire would you recommend?
BIBLIOGRAPHY

Books


**Articles**


III Correspondence

1. Letter from Dr. S. A. Adler, Registrar, Pennsylvania State University, Altoona Extension, April 14, 1958.


3. Letter from Mr. Hymen Chausow, Member of the Research Staff, Television College, Chicago City Junior Colleges, Chicago, Illinois, June 17, 1958.


9. Letter from Mr. Eugene I. Johnson, Director, Civic Educational and Television Activities, Washington University, St. Louis, Missouri, March 20, 1958.

10. Letter from Mrs. Arlene McGahey Jones, Coordinator of Television Activities, Department of Mathematics, University of Alabama, University, Alabama, April 15, 1958.

11. Letter from Dr. H. Kumata, Communications Research Center, Michigan State University, East Lansing, Michigan, February 13, 1958.
12. Letter from Dr. Ross R. Middlemiss, Professor of Mathematics, Washington University, St. Louis, Missouri, May 6, 1958.

13. Letter from Dr. Philip Peak, Assistant Dean, School of Education, Indiana University, Bloomington, Indiana, April 18, 1958.


15. Letter from Mr. Walt Whitaker, Acting Director, Broadcasting Services, University of Alabama Television WUOA (FM), University, Alabama.


17. Letter from C. P. Zimmerman, Jr., Program Coordinator, KURT, Channel 8, The University of Houston, Houston, Texas, May 9, 1958.

Dissertation

Although I, Calvin Elijah King, was born on June 5, 1928, in Chicago, Illinois, my parents moved to Valdosta, Georgia, when I was very young, and so I attended public schools there from 1933 to 1945, graduating from Dasher High School in June, 1945.

In June, 1949, I received the Bachelor of Arts degree from Morehouse College in Atlanta, Georgia, whereupon, I was awarded a scholarship to Atlanta University, Atlanta, Georgia; from there I received the degree Master of Arts in mathematics in June, 1950.

During the school term 1950-51, I returned to Dasher High School to teach mathematics and English. My career was interrupted, however, in July, 1951, when I was drafted into the United States Army, where I served with the Counter Intelligence Corps in Washington, D. C.

After being released from duty in July, 1953, I accepted a position as Instructor of Mathematics at Jackson College, Jackson Mississippi; in June, 1955, I resigned this position to resume graduated studies at The Ohio State University. Since then, I have served as Assistant Instructor of Mathematics, part-time, in the Department of Mathematics. During the Spring Quarter of 1958, I was one of the quiz-section teachers in the first television course taught at the university.