

THE EFFECTS OF VIEWING LOOPFILM ON
TENNIS SKILL AND FORM

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TENNIS SKILL AND FORM

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CHAPTER I

INTRODUCTION

The present educational system is rapidly becoming one of the most important media which influence today's youth. The great technical advances which are constantly being made are putting tremendous pressures on those teachers responsible for the education of these young people. In order for teachers to be aware of these new advances, they must assume the responsibility of adequately preparing themselves in their own subject fields, in educational teaching methods, and in utilizing special educational devices.

A great concern of many educators deals with which method is the most effective means of presenting their subject material to their students. The answer is, there is no best method of teaching. A good teacher uses the method which best fits the subject matter, the goals and objectives of the class, and her own personality. The teacher who is sincere in her work--a true professional--is experimenting with various methods of teaching.

One method which has been the subject of a great deal of research is the use of audio-visual materials. Audio-

visual materials have become valuable tools of learning in today's progressive world. For the past several decades, such fields as industry, business, government, medicine, and religion have found these aids useful. They assist in informing the public, in instructing the employees, and in improving the quality and quantity of work. In education, audio-visual materials have received a great deal of attention and emphasis. Research studies in education show that these materials bring about greater efficiency in the teaching and acquisition of knowledge.¹

The audio-visual device of special interest in this study is the medium of motion picture film. This device has enriched and enhanced many areas of the educational curriculum. The field of physical education, dealing with physical movement of the body, has put this medium to good use, since a significant value of the motion picture is its ability to capture on film many forms of bodily movement. For some time now, motion pictures have been widely used in athletic programs. Coaches of team sports, such as football, are able to analyze films of their own teams and those of other teams in terms of techniques and team play, and benefit greatly from them. Also coaches of individual sports, such

¹Cline M. Koon, Motion Pictures in Education in the United States (Chicago, 1934), p. 17.

as track and swimming, benefit from motion pictures because of the visual depiction of form and style.

In teaching a motor skill, the demonstration-explanation method has become one of the most widely used employed by physical educators. Research indicates that the more senses involved in learning, the better and more permanent the learning will be.² With this method the students see the skill being performed while they hear the explanation and analysis.

Physical education is composed of a great number of motor skills, with each skill requiring its own special talents and physical attributes. It would be an exceptional physical education teacher who could demonstrate effectively all motor skills included in the physical education curriculum. The question then arises concerning the possibility, and perhaps feasibility, of using motion picture film as a supplementary demonstrator in the physical education class. With this type of aid the teacher has a standard and identical model every time. This frees her to teach, analyze, and discuss with the class the necessary movements being viewed.

Studies in educational research reveal that the most effective films are those which deal exclusively with a

²Edgar Dale, Audio-Visual Methods in Teaching (New York, 1954), p. 20.

single concept of learning.³ This idea was instrumental in the development of the loopfilm. A loopfilm is a band of motion picture film, approximately eight feet in length, in which the two ends have been spliced together.⁴ Each loop is a separate skill that has been filmed preferably in slow motion. It runs continuously through the film projector, providing that necessary element of repetition for more thorough learning.

Physical educators generally agree that in a majority of the motor skills included in physical education programs, there is a preferred method of performance.⁵ The motor skills involved in the highly complex individual sport of tennis require such components as coordination, strength, speed, agility, endurance, flexibility, and timing for skillful performance. In analyzing many of the top tennis players in the world, it has been noted that, although each player has a unique style of his own, there is great similarity in their basic form. They execute the fundamental strokes in essentially the same way.

If the preceding assumption concerning the use of the loopfilm and learning is true, then a beginning tennis

³Ibid., p. 204.

⁴Clifford Stevenson, "Let's Use Loopfilms," Journal of Health, Physical Education, and Recreation, XXVIII (September, 1957), 65.

⁵Donna M. Miller and Katherine L. Ley, Individual and Team Sports for Women (New Jersey, 1955), p. 13.

student should benefit significantly from viewing loopfilms of the basic tennis strokes performed by a tennis expert. This study was an attempt to determine the effectiveness of loopfilms as a supplement to the demonstration-explanation method of teaching sports skills. This was accomplished by experimenting with two groups of students. Both groups were taught by the traditional teacher demonstration-verbal explanation method with only one of the groups receiving the additional aid of the loopfilms. It is hoped that findings from this study will provide additional information of value for those persons interested in tennis instruction.

Statement of Problem

The problem of this study was to determine the effects of viewing loopfilms on the individual student's tennis skill and form.

Purposes of the Study

The purposes of the study were as follows:

1. To determine the effects of viewing loopfilms on tennis skill.
2. To determine the effects of viewing loopfilms on tennis form while hitting a forehand drive and a backhand drive.

3. To discover the effects of the addition of viewing loopfilms to the traditional teacher demonstration-verbal explanation method as a method of teaching sports skills.

4. To discover whether or not the addition of viewing loopfilms is administratively feasible in terms of expense, equipment, and ease of use.

5. To discover whether or not the addition of viewing loopfilms is of value for those persons interested in tennis instruction.

Hypotheses

The following hypotheses were proposed for this study:

1. There will be no significant difference between the means of the experimental and control groups' initial scores on the two skill tests and the form test.

2. There will be no significant difference between the means of the experimental and control groups' intervening scores on the two skill tests and the form test.

3. There will be no significant difference between the means of the experimental and control groups' final scores on the two skill tests and the form test.

Definition of Terms

The following definitions are pertinent to this study:

1. Skill

A. Theoretically

"Skill implies that some learning has occurred and that a smoothing or an integration of behavior has resulted."⁶

B. Operatively

Skill, as utilized in this study, was represented by the scores obtained on the Hewitt Revision of the Dyer Backboard Tennis Test and the Broer-Miller Tennis Achievement Test.

1) Initial Skill

Initial skill, as used in this study, was the pre-study skill test scores.

2) Intervening Skill

Intervening skill, as used in this study, was the skill test scores obtained after the two week training period by the demonstration-explanation teaching method.

3) Final Skill

Final skill, as used in this study, was the final skill test scores obtained after a five week experimental training period.

⁶Bryant J. Cratty, Movement Behavior and Learning (Philadelphia, 1964), p. 156.

2. Form

A. Theoretically

"Form is the correct execution of fundamental movements in athletics which guarantees the most efficient and effective results."⁷

B. Operatively

Form as utilized in this study referred to the following three elements in hitting a forehand and backhand drive:

- 1) Side to the net.
- 2) Step into the ball toward the net.
- 3) Relaxed arm swing (arm slightly bent, firm wrist, follow through).

3. Loopfilm

A. Theoretically

"A loopfilm is a length of motion picture film with the two ends fastened or spliced together to form an endless loop or band."⁸

B. Operatively

The loopfilms that were utilized in this study were 16 mm. homemade colored loopfilms approximately eight feet in length. The skills filmed

⁷John W. Bunn, Scientific Principles of Coaching (Englewood Cliffs, N. J., 1965), p. 103.

⁸Stevenson, op. cit., p. 65.

were the forehand drive and the backhand drive. The subject in the films was a former girls Texas State AAAA Singles Champion and member of the Texas and National Junior Wightman Cup Tennis Teams.

Limitations of the Study

This study was limited to sixty-nine female high school students enrolled in beginning tennis classes at Irving High School, Irving, Texas, the fall semester of 1968.

The study was limited to ten weeks of work. During three of these weeks, the students were engaged in testing so actual tennis instruction and practice was limited to seven weeks. Subjects were limited to those who had no previous experience in tennis.

Delimitations of the Study

The study included only high school girls who ranged from fourteen to eighteen years of age. Educationally they were classified as freshmen, sophomores, juniors, and seniors.

It was also bounded in scope to include only an investigation of the use of the loopfilm in the teaching of tennis strokes.

Sources of Data

The data necessary for this study were collected, studied, and assimilated from the following sources:

1. Documentary

Books, periodicals, theses, dissertations, research studies, and other available materials pertinent to all aspects of the study were used.

2. Human

The human sources of data were the sixty-nine high school girls enrolled in beginning tennis classes at Irving High School, Irving, Texas, the fall semester of 1968.

CHAPTER II

REVIEW OF RELATED LITERATURE

The literature reviewed in this chapter was chosen primarily because of its relationship to the investigation. Experimental studies, surveys, and articles dealing with audio-visual materials were reviewed. Of specific interest were those studies related to the use of motion picture film and the loopfilm, and their value and effectiveness in the learning of various sports skills.

Research studies and other published literature concerning the use of audio-visual materials are plentiful in the fields of physical education and athletics. The visual aid considered one of the most conducive to the learning of sports skills is the motion picture. Freeman,¹ in analyzing the usefulness of the motion picture, stated that their particular province was the exhibition of moving objects and the facilitation of the analysis of motion. A skilled act, which is a complex movement, is probably more clearly understood by the perceiving of the motion.

¹Frank N. Freeman, Visual Education (Chicago, 1924), p. 71.

Early Studies Dealing with Motion Pictures in Physical Education

As early as 1936, Palmer conducted a survey to determine the interest and demand for films by physical education teachers for women at the college level. From the questionnaire that was used, she concluded

1. The motion picture has an important function in the field of physical education because it facilitates the analysis of motion.
2. Colleges and universities have the facilities for showing motion pictures.
3. The most desirable motion picture is one which combines the analyses of correct and incorrect sports techniques, a well-played game, and champions in action.
4. Instructional motion pictures are of most value in the teaching of tennis, basketball, football, archery, swimming, diving, golf, and volleyball.
5. There is substantial demand for the rental and purchase of films as teaching aids for women's sports.²

Palmer further postulated that the motion picture had an important and distinctive function in the area of physical education, in that it makes possible the slow-motion analysis of a rapid movement which can be shown in no other way. Additional advantages for its use by the physical education teacher are the following:

1. The film affords an opportunity to view the separate skills used in a game not only under playing conditions but when practiced in isolation from the game.

²Gladys E. Palmer, "A Motion Picture Survey in the Field of Sports for College Women," Research Quarterly, VII (March, 1936), 159.

2. The timing element which is so important in sport performance can be clearly shown.

3. The contrast between good and bad form can be shown to an advantage.

4. Students with poor coordination could gain much through the use of the "endless loop" type of film which would repeat specific techniques.

5. The "close-up" is an advantage in teaching large groups.³

One of the first major experimental studies dealing with the motion picture in physical education was undertaken by Ruffa⁴ in 1936. He attempted to determine the effectiveness of motion pictures in the teaching of such athletic skills as the high jump, broad jump, shot put, football throw, and 100-yard dash. He concluded that the students in the visual group learned more rapidly than the group who did not watch the film by displaying a greater gain in their scores. The slow-motion film was 3.9 per cent more effective than the traditional lecture-demonstration method.

In 1939 Priebe and Burton⁵ initiated a study on the use of films as a device for teaching the "western roll" high jump. The control group received regular instruction which

³Ibid., p. 163.

⁴Edward J. Ruffa, "An Experimental Study of Motion Pictures as Used in the Teaching of Certain Athletic Skills," unpublished master's thesis, School of Education, Leland Stanford University, 1936.

⁵Roy E. Priebe and William H. Burton, "The Slow-Motion Picture as a Coaching Device," School Review, XLVII (March, 1939), 192.

included the lecture and demonstration methods; the experimental group's instruction included these methods along with motion picture film of champion jumpers for a period of six weeks. The results showed a mean gain of 4.58 inches higher for the experimental group. Priebe and Burton concluded that

1. The use of slow motion pictures in coaching the western roll style in the high jump made for faster progress and better achievement.

2. The use of slow motion pictures eliminated to a large extent the initial period of trial and error.

3. Illustrations of good form in slow motion pictures seemed definitely superior to oral direction and physical demonstration of good form, particularly during the initial period of learning.

4. The use of slow-motion pictures was a definite assistance in aiding performers to change from a familiar form of skill to a new, superior, but unfamiliar form.

5. With the use of the slow motion pictures a larger number of boys could be handled per unit of class time.

6. The use of the slow motion picture contributed definitely to the marked interest in analyzing individual errors and in improving picture defects.⁶

Adams⁷ undertook a study dealing with the teaching of the tennis serve through the use of films. He selected eight beginning students and filmed their attempts to serve before instruction was given. Motion picture film of experts was shown to the class along with that of beginners so comparisons could be made. The eight beginners were rephotographed

⁶Ibid.

⁷Thurston Adams, Motion Pictures in Physical Education (New York, 1939), p. 55.

after class instruction of demonstrations, discussions, and films. He listed some of the following conclusions as a result of his study:

1. Demonstration and verbal description aid instruction, but the best method of teaching combines motion pictures, demonstrations, and verbal descriptions.

2. Instruction time could be cut approximately fifty percent by using good motion pictures and still not sacrifice the learning results.

3. Actual practice in the gymnasium or elsewhere should follow the showing of a film as quickly as possible.

4. Since some students learn more slowly than others, they would need more showings of the films than their classmates.

5. Motion pictures were used effectively in reviewing skills taken up in class over a period of weeks.⁸

The Use of Motion Pictures in Teaching Sports Skills

Hupprich⁹ conducted an investigation of the use of visual aids in teaching tennis. She sought to discover during which phase of learning a particular teaching method would be most effective. Her results revealed that demonstration was especially valuable during the initial practice periods. As skill increased, the value of the demonstration decreased. Oral instructions had little value in the early stages of learning but as the amount of learning and skill

⁸Ibid.

⁹Florence L. Hupprich, "The Use of Visual Aids in Teaching Tennis," Journal of Health, Physical Education, and Recreation, XII (February, 1941), 93.

progressed, more profit was gained from this method. Hupprich concluded that the ideal medium for presenting a motor activity was through the use of the slow-motion picture. She further postulated that the slow-motion picture demonstrates a skill better, more accurately, and more consistently than a teacher demonstration.

Lockhart studied the value of motion pictures as an instructional device in teaching bowling to college freshman women. The experimental group viewed the film each day in which attention was directed to particular points. At the completion of the study, Lockhart concluded

1. The rate of improvement in learning of the film group is more consistent than that of the control.

2. During the first two weeks of instruction the performance in the two groups is practically identical. As shown by the data and slope of the curve during the third week, the experimental group continues the initial rapid rate of improvement, whereas, the control group remains at practically a standstill during this period. A similar plateau of learning was shown by the control group in the fifth week, whereas, again the experimental group maintains a steady improvement, its curve showing a slight tapering off in the fifth week.

3. There is strong evidence, as shown in the critical ratios of the fifth week, that the experimental group at this time is definitely superior to the control.

4. Although the film and control classes started with practically the same mean score at the end of the third week of instruction the film classes surpassed the non-film and continued to be superior throughout the remaining periods of instruction.¹⁰

¹⁰Aileen Lockhart, "The Value of the Motion Picture as an Instructional Device in Learning a Motor Skill," Research Quarterly, XV (May, 1944), 181.

Brown and Messersmith¹¹ used motion picture film of trained tumblers and of the subjects in the experimental group to determine the value of the use of film in teaching tumbling. The findings of the study indicated that while the mean score of the experimental group was higher than that of the control group, it was not high enough to indicate a significant difference. There seemed to be a tendency for the students in the experimental group to be more highly motivated. They further concluded that the expenditure for the film was too great to warrant its use.

Fowler¹² investigated the value of the slow-motion picture as an instructional aid in the teaching of tennis skills. She found that the experimental group, who viewed the slow-motion pictures, displayed a higher mean gain than the control group, who received regular instruction, which only approached significance. This indicated that the use of the pictures was beneficial to the student learning tennis skills when coupled with regular instruction.

The sound film-filmstrip method, the silent loopfilm method, and the verbal instruction method were the three

¹¹Howard Brown and Lloyd Messersmith, "An Experiment in Teaching Tumbling With and Without Motion Pictures," Research Quarterly, XIX (December, 1948), 304.

¹²Joyce Fowler, "The Value of the Slow-motion Picture as an Instructional Aid in the Teaching of Tennis Skills," unpublished master's thesis, School of Education, University of North Carolina, Chapel Hill, 1955.

methods used in Irwin's¹³ study dealing with the teaching of beginning tennis skills and knowledge. The Dyer Backboard Test of Tennis Ability was used to assess tennis skill, while the Scott Knowledge Test on Beginning Tennis judged tennis knowledge. The results of her study revealed that all three methods of teaching were equally effective in improving tennis playing ability and knowledge. This study was unable to confirm the concept that the use of audio-visual material was more effective in improving learning than a more traditional method which deletes these aids.

Spencer¹⁴ used three types of visual aids--movies, still slides, and demonstrations--for teaching movement patterns to classes in beginning modern dance. The same explanations for the movement patterns were given to the three classes; the teaching method differed only in the type of visual aid used. Judges rated each student on the performance of each pattern on a five point scale. After an average score for each student was computed, the single variance was calculated to test for differences between the

¹³June Irwin, "The Effect of Selected Audio-Visual Aids on Teaching Beginning Tennis Skill and Knowledge to College Women," unpublished doctoral dissertation, School of Health, Physical Education, and Recreation, Indiana University, 1958.

¹⁴Patricia May Spencer, "Movies, Slides, and Demonstration as Visual Aids for Teaching Movement Patterns," unpublished master's thesis, Department of Physical Education, University of Colorado, 1961.

means of the groups. The analysis indicated that no one of the visual aids appeared to be better than the other for teaching movement patterns in modern dance.

In the study conducted by Winslade,¹⁵ the 8 mm. slow-motion color film was used. He investigated the effects this type of film would have on basketball skills. Three groups of ninth grade boys were in the study: a film group, a teacher demonstration group, and a control group who received no basketball training at all. At the conclusion of the study, both the film group and the demonstration group had improved significantly, but neither group improved significantly more than the other.

Hawthorne¹⁶ studied the effects of the 8 mm. slow-motion picture as a device for improving golf form. Pictures were taken of all the subjects, but only the members of the experimental group were allowed to see their performance. Errors in form were depicted and suggestions for improvement were made by the instructor. The control group participated in a regular golf class. After three class periods of

¹⁵Donald K. Winslade, "The Effect of the 8 mm. Slow Motion Color Film on the Learning of Specific Motor Skills," unpublished master's thesis, School of Physical Education and Recreation, The University of British Columbia, Vancouver, Canada, 1963.

¹⁶Martha Ellen Hawthorne, "A Study of the Effectiveness of the Slow-Motion Picture in Teaching Golf," unpublished master's thesis, Department of Health, Physical Education, and Recreation, Louisiana State University, Baton Rouge, 1964.

practice, the final pictures were taken of all the subjects. The results concluded that the 8 mm. slow-motion pictures were an effective aid in improving golf form.

The study conducted by Wyness¹⁷ on the effects of motion pictures as an aid in teaching a gross motor skill utilized the shot put. There were four unequated groups in which all were taught by the lecture-demonstration method. Three of the groups also received a visual aid variable. One film group viewed moving pictures of themselves which were taken each week for twelve weeks. One group viewed film of national shot put champions. Another group received the aid of films of themselves and the champions. All of the groups improved in the skill of putting the shot, but neither group improved significantly more than the other.

The Use of Loopfilms in Teaching Sports Skills

Educational research on motion picture film has revealed that the most effective films are those which deal exclusively with a single concept of learning.¹⁸ It was this idea that was instrumental in the development of the loopfilm. A loopfilm is a band of motion picture film, approximately eight feet in length, in which the two ends have been

¹⁷Gerald B. Wyness, "A Study of the Effectiveness of Motion Pictures as an Aid in Teaching a Gross Motor Skill," unpublished doctoral dissertation, School of Health, Physical Education, and Recreation, University of Oregon, Eugene, 1963.

¹⁸Dale, op. cit., p. 20.

spliced together, forming an endless loop or band.¹⁹

Stevenson has conducted considerable research on this particular type of visual aid and has listed the following advantages of the loopfilm:

1. Loopfilm allows one sequence of movement to be retained on the screen as long as desired.

2. Loopfilm helps in the learning of one fundamental skill in its entirety rather than in parts.

3. Loopfilm allows continuous repetition without having to reverse the projector, leaving the teacher free to teach.

4. Students can effectively teach each other.

5. The commentary can be varied and not rushed because the same picture will repeat itself every few seconds.

6. Loopfilms are inexpensive and can be produced fairly easily by an amateur.

7. Because of repetition, loopfilms seem to be the best medium for making a strong impression on the minds of students. There are definite possibilities for learning sports skills through kinesthetic imagery.

8. Loopfilm can be an excellent substitute as the skilled demonstrator.

9. Loopfilm can be used in conjunction with a daylight screen set up right in the gym, field house, swimming pool, or athletic field. This gives the students a constant demonstration.

10. Loopfilm can take valuable advantage of slow motion and the stop-action projector.

11. We know that many times some faults are not detected by the eye at normal speed. Loopfilms have the advantage of giving enough repetition for faults to be recognized.²⁰

In 1952 Murnin, Hayes, and Harby²¹ experimented with daylight projection of loopfilms as the teaching medium in

¹⁹Stevenson, op. cit., p. 65.

²⁰Ibid.

²¹J. A. Murnin, W. Hayes, and S. F. Harby, "Daylight Projection of Film Loops as the Teaching Medium in Perceptual Motor Skill Training," Human Engineering Report SDC 269-7-26, Pennsylvania State College, May 1952, pp. 1-6.

perceptual motor skill training. They attempted to determine whether or not loopfilms were as effective as live demonstration in teaching a skill, and whether or not naive students could effectively learn to perform complicated tumbling skills from loopfilm demonstration alone. The two teaching methods used were an inexperienced instructor using the loopfilm and an experienced instructor using conventional teaching methods. It was found that the experimental group achieved a fair level of proficiency in the complicated athletic skills and that with the loopfilms an inexperienced instructor could teach perceptual motor skills almost as effectively as an expert instructor using live demonstration.

Nelson's²² study involved the use of slow-motion loopfilms on the learning of golf. Four different classes were used in which three of the classes contained both experimental and control students, while the fourth was entirely experimental. The explanation-demonstration method of teaching was used for all groups, with the addition of the loopfilm afforded the experimental groups. The findings of the study showed the experimental and control groups improving in golf skill but neither significantly more than the other.

²²Dale O. Nelson, "Effect of Slow-Motion Loopfilms on the Learning of Golf," Research Quarterly, XXIX (March, 1958), 37.

Dressen²³ used two groups of twenty-two junior high school students in her study to determine the value of loop-film as a supplementary aid in teaching the crawl stroke in swimming. The teacher-demonstration method was used to teach both groups with the experimental group also receiving the aid of the loopfilm as a source of reference, self-help, and correction of errors. It was concluded that the supplementary loopfilm aid did not influence the learning of the crawl stroke to a significant degree.

Douglas²⁴ conducted a study to ascertain the effectiveness of loop movies as a method of teaching wrestling. The students were tested on the Rogers PFI, the Johnson-Metheny Motor Educability Test, a verbal intelligence test, and their performance on wrestling maneuvers. The experimental group was taught through the use of loop movies and explanation; the control group was taught using the explanation-demonstration technique. The results of the study showed that there was no significant difference between the two groups. The jury of experts who rated the wrestling

²³Clyda June Dressen, "The Value of a Loop Film in Teaching the Crawl Stroke," unpublished master's thesis, Department of Physical Education, University of Colorado, Boulder, 1961.

²⁴John G. Douglas, Jr., "The Value and Limitations of Loop Movies in the Teaching of Wrestling Maneuvers at the University of Massachusetts," unpublished master's thesis, Department of Physical Education, Springfield College, Springfield, Massachusetts, 1963.

performances commented that the control group appeared to perform better than the experimental group.

Gray and Brumbach²⁵ investigated the effects of the daylight projection of film loops on the badminton-playing ability of male college students using the Technicolor Instant Motion Picture Projector and the Magi-Cartridges. The viewing of the loops by the experimental group during the second through the fifth weeks of the ten week study was the only difference in the instruction of the two groups. The traditional manner of demonstration, explanation, further demonstration, followed by practice was the method used. The three skill tests were administered during the first, sixth, and tenth weeks of the study. The conclusions of the study indicated a significant difference between the two groups from the initial to the midterm testing period, with the experimental group making greater improvement. The analysis made of the groups from the initial to the final testing period revealed a difference in improvement between the groups, but it was insignificant. This appeared to indicate that the basic skills are learned more quickly with the use of the loopfilm.

²⁵Charles A. Gray and Wayne B. Brumbach, "Effect of Daylight Projection of Film Loops on Learning Badminton," Research Quarterly, XXXVIII (December, 1967), 562.

Differences in the Literature

It is interesting to note the lack of agreement among the various studies concerning the value of the motion picture and loopfilm. In a majority of the experimental research studies involving the use of motion pictures and/or loopfilms as an aid in teaching sports, the results obtained indicated that the films helped in the improvement of skill, but no more so than the traditional lecture-demonstration method. While the statistical data showed no significant difference, the investigators seem to feel that the use of films was of great value in motivating students, in grasping the skill quicker, in correcting errors, in demonstrating when the instructor is inexperienced, in eliminating trial and error, and in illustrating good and poor form.

CHAPTER III

PROCEDURES IN THE DEVELOPMENT OF THE STUDY

This study sought to investigate the effect of the addition of viewing loopfilms to the traditional teacher demonstration-verbal explanation method of teaching in the development of student tennis skill and/or form.

Preliminary Procedures

The initial procedure in this study was an examination of the literature in the area of audio-visual materials. Related studies were reviewed and pertinent information was ascertained concerning the use of motion picture film, slow motion film, and loopfilm in the fields of physical education and athletics.

Selection of the Subjects

The subjects selected for this study were seventy-four girls enrolled in beginning tennis classes the second and fifth periods at Irving High School, Irving, Texas, during the fall semester, 1968. These girls chose tennis from the six activities offered during the fall semester. Five of the girls who began the study withdrew from school before

the final tests were administered. Their withdrawal from school was due to transferring to other schools, getting married, going to work, or dropping out of school, and was not attributed to the physical education class or this study. From the sixty-nine girls who completed the study, thirty were enrolled in second period and thirty-nine were enrolled in fifth period.

Class Procedures and Equipment

The tennis classes met five days per week for a total of fifty class periods. The time schedule for the classes at Irving High School was so arranged that the second period class was 9:45 to 10:50 A.M. and the fifth period class was 1:45 to 2:40 P.M. This allowed thirty-five minutes for actual class teaching. When students were absent, the investigator spent additional class time with those students. Make-up tests were given to those students who were absent during the testing periods.

The classification of the students ranged from freshman to senior and their ages from fourteen to eighteen. The girls were required to wear the official blue, one-piece uniform of Irving High School, tennis shoes, and during inclement weather warm-ups were worn over their uniforms.

The tests used in this study were administered to all of the subjects three different times. Five days were

allowed for each testing period. A table of random numbers¹ was used to assign the subjects into the experimental and control groups upon completion of the intervening tests. Thirty-six girls participated in the experimental group, while thirty-three girls participated in the control groups. This table was also used in assigning each girl to one of six testing groups. They remained in these same groups throughout the entire study. The order in which they were assigned to the groups was the order in which they took each test.

Selection of the Tests

The selection of tests for this study was governed by the objectives of the study, review of literature, and availability of facilities and equipment. The criteria used for selection were validity, reliability, objectivity, and ease of administration.

The Broer-Miller Tennis Achievement Test² was selected because it measured both the ability to execute a forehand drive and a backhand drive. The reliability of the test was computed by correlating the first seven forehands plus the first seven backhands with the second seven forehands plus

¹A. C. Rosander, Elementary Principles of Statistics (New York, 1951), p. 680.

²Marion Broer and Donna Mae Miller, "Achievement Tests for Beginning and Intermediate Tennis," Research Quarterly, XXI (October, 1950), 311.

the second seven backhands. The reliability coefficient was .80. The validity of the test was computed by correlating the subjective judges' rating of student performance with the student performance on the test. The validity coefficient was .85 for the intermediate group and .61 for the beginning group.

The Hewitt Revision of the Dyer Backboard Tennis Test³ was chosen for this study because of its ability to better classify the beginning tennis student. The reliability of the test was computed by the test-retest method. For the advanced group the reliability was .93; for the beginning group, .82. The validity of the test was determined by comparing the rank order of playing ability (the results of a round robin tournament) with the scores on the skill test. For the beginning classes the validity was .68 through .73; for the advanced classes the validity was .84 and .89.

The Camp Tennis Form Test⁴ was devised in the spring of 1968 in order to establish a more objective type of tennis form grading which would be simple to judge and easy to administer. The split-half method of correlation was used

³Jack E. Hewitt, "Revision of the Dyer Backboard Tennis Test," Research Quarterly, XXXVI (May, 1965), 155.

⁴Barbara A. Camp, "Tennis Form Test," unpublished term project for the course Physical Education 515, Department of Physical Education, North Texas State University, Denton, Texas, 1968, pp. 13-18.

to establish reliability. The first five balls thrown were compared with the last five. A coefficient of .83 was obtained. Reliability was also obtained by correlating form and accuracy. A .83 coefficient was also obtained. The rank-difference method of establishing validity was used for validation. The players were ranked according to their playing ability before the administration of the test. After the test their scores were correlated with the rank they had received. The coefficient obtained was .78.

General Procedures in Test Administration

Facilities and equipment were prepared for the testing program in compliance with the specifications as established by the Broer-Miller Tennis Achievement Test,⁵ the Hewitt Revision of the Dyer Backboard Tennis Test,⁶ and the Camp Tennis Form Test.⁷ The equipment necessary for the administration of the tests was made available prior to the testing period and is listed as follows: three dozen new tennis balls; brown tape for marking court lines; two boards eight feet long and two inches wide; forty foot rope; white adhesive tape for marking lines in the gymnasium; basket

⁵Broer and Miller, op. cit., p. 309.

⁶Hewitt, op. cit., p. 154.

⁷Camp, op. cit., pp. 8-12.

container; Ball Boy machine with special framework; score sheets; clipboards; pencils; and stopwatch.

A group of officials composed of physical education instructors and student assistants aided the investigator in the administration of the tests. Test administration procedures were carefully explained to the officials and the tests were administered to them several times prior to the actual testing periods so that they might have full command of the procedures they were to direct. The student assistants were carefully trained in the correct operation of the Ball Boy machine and in the proper scoring of each test. The officials and student assistants were assigned to a specific test and testing station where they remained during each of the testing periods.

Description of the Tests

The Broer-Miller Tennis Achievement Test.⁸--The subject was instructed to hit fourteen forehands and fourteen backhands so that they passed between the top of the net and a restraining rope four feet above the net. The player stood behind the baseline, bounced the balls to herself, and attempted to place them in the backcourt of the opposite court. Each ball hit was scored 2, 4, 6, 8, 6, 4, 2, depending upon where it landed in the court. Balls going over the

⁸Broer and Miller, op. cit., p. 309.

restraining rope received one half the value of that area. A missed ball counted as a trial and let balls were taken over. The total number of the fourteen balls on the forehand and the fourteen balls on the backhand was recorded. (A description of the test may be found in Appendix A.)

The Hewitt Revision of the Dyer Backboard Tennis Test.⁹--A wall twenty feet long by twenty feet wide was used with a restraining line twenty feet from the wall. The net line was marked three feet from the floor. The student taking the test was instructed to stand behind the restraining line with two balls. The test was started with any type of serve. When the served ball hit the wall above the net line, the stopwatch was started. The student continued to rally using any type of stroke for thirty seconds. If the student lost a ball on a rally, additional balls were available in a basket. Each new ball was started with a serve. One point was scored each time the ball hit the wall above the net line from behind the restraining line. The test was taken three times in group rotation. The average of the three trials was recorded as the final score. (A description of the test may be found in Appendix B.)

The Camp Tennis Form Test.¹⁰--A Ball Boy machine was used to project the balls to the student. The test

⁹Hewitt, op. cit., p. 154.

¹⁰Camp, op. cit., pp. 8-12.

administrator stood on the opposite side of the net from the subject so she could see her clearly. The test was started with fourteen balls in the machine. (Four practice trials were allowed.) The subject stood in the center of the court behind the baseline in the ready position. The machine was started, throwing the first ball to the forehand. The subject ran over and attempted to hit it and then went back to the center. The machine was then moved and threw a ball to the backhand. The subject ran over and attempted to hit it and then went back to the center. This continued until all ten balls were thrown. The scoring method used was a number system which gave a specific number of points for form and for accuracy.

1. Good Form -- 5 points
 - a. Side to net
 - b. Step into ball toward net
 - c. Relaxed arm swing (arm slightly bent, firm wrist, follow through)
2. Fair Form -- 3 points
 - a. Side to net
 - b. Step into ball toward net
3. Poor Form -- 1 point
 - a. Student is facing net
 - b. Swatting at the ball
4. Accuracy -- 1 point

Balls hit into the singles court received one point.

The possible score was sixty points. The total number of points received for form and for accuracy was recorded. (A description of the test may be found in Appendix C.)

Experimental Design and Class Procedures

Figure 1 is a diagram of the experimental design used in this study. The schedule of events is outlined as follows:

- A. Administration of Initial Tests. A description of the Hewitt Revision of the Dyer Backboard Test, the Broer-Miller Tennis Achievement Test, and the Camp Form Test may be found in the Appendices.
- B. Two Week Training Period. All students participated, with the teaching method being the Traditional Teacher Demonstration-Explanation method.

Content of Two Week Training Period:

1. Lesson 1--Forehand Drive
 - a. Footwork drills--Students were taught to pivot, step, and swing and they were also taught the two step drill: step together step, turn, step, swing.
 - b. Handball Tennis (used the Buddy System)
 - 1) Drill--ball dropped to self, caught, used forehand swing.
 - 2) Drill--ball dropped to self, used forehand swing and hit it to buddy.
2. Lesson 2--Forehand Drive
 - a. Reviewed footwork
 - b. Paddle Tennis--small wooden paddles were used as tennis rackets
 - 1) Forehand grip (Eastern) on paddle.
 - 2) Drill--ball dropped, hit with paddle to buddy six feet away, used forehand swing.
 - 3) Drill--ball dropped, hit over the net to buddy on service line.
3. Lesson 3--Forehand Drive
 - a. Paddle Tennis

	One Week	Two Weeks	One Week	Five Weeks	One Week
	Initial		Intervening		Final
Control Group	Hewitt Test Broer-Miller Test Camp Form Test	Training Traditional Method	Hewitt Test Broer-Miller Test Camp Form Test	Training Traditional Method	Hewitt Test Broer-Miller Test Camp Form Test
	Initial		Intervening		Final
Experimental Group	Hewitt Test Broer-Miller Test Camp Form Test	Training Traditional Method	Hewitt Test Broer-Miller Test Camp Form Test	Training Loopfilm Plus Traditional Method	Hewitt Test Broer-Miller Test Camp Form Test

Fig. 1--Diagram of the experimental design showing the schedule of events during the study.

- 1) Buddy, six feet away, tossed ball to partner and she returned it, used forehand swing.
- 2) Buddy, across the net, tossed ball to partner and she hit it back across net, used forehand swing.

4. Lesson 4--Forehand Drive

a. Tennis Rackets

- 1) Forehand Grip (Eastern)
- 2) Ball dropped, hit against the fence with the tennis racket, used the forehand swing.
- 3) Teacher worked individually with each student, instructing each to hit the ball in her hand to show the correct distance between the body and the ball; teacher then dropped the ball and instructed the student to swing and hit it into fence; the student then dropped the ball herself, swung, and hit it into fence.

5. Lesson 5--Forehand Drive

a. Tennis Rackets

- 1) Teacher finished working individually with students in hitting the ball against the fence.
- 2) Remainder of students dropped the balls to themselves and hit them over the net to their buddy on the base line.

6. Lessons 6 through 10--Backhand Drive

The same procedures were followed for the backhand as for the forehand: handball tennis, paddle tennis, and the tennis racket.

C. Administration of Intervening Tests

- D. Five Week Experimental Training Period--Experimental and Control Groups. The experimental group viewed the loop-film of the forehand and the backhand strokes for the first five minutes of class, three times a week.

Content of Five Week Experimental Training Period:

1. First Week--Forehand Drive

- a. Teacher threw balls individually to the students, worked in test groups, two groups per period.

- b. Remainder of class in buddy system, threw balls to each other.
2. Second Week--Backhand Drive
 - a. Teacher threw balls individually to the students, worked in test groups, two groups per period.
 - b. Remainder of class in buddy system, threw balls to each other.
3. Third Week--Forehand Drive
 - a. Teacher hit balls from the net individually to the students, worked in test groups.
 - b. Remainder of class was stroking on the courts.
4. Fourth Week--Backhand Drive
 - a. Teacher hit balls from the net individually to the students, worked in test groups.
 - b. Remainder of class was stroking on the courts.
5. Fifth Week--Forehand Drive and Backhand Drive
 - a. Teacher stroked the ball with each student, worked in the test groups.
 - b. Remainder of class was stroking on the courts.

E. Administration of Final Test

Treatment of the Data

The statistical procedures used to analyze the data were the difference method for determining the significance of the difference between correlated means and analysis of covariance. Mean gains on the Broer-Miller Tennis Achievement Test,¹¹ the Hewitt Revision of the Dyer Backboard Tennis Test,¹² and the Camp Tennis Form Test¹³ were determined for

¹¹Broer and Miller, op. cit., p. 309.

¹²Hewitt, op. cit., p. 154.

¹³Camp, op. cit., p. 3.

each group between the initial and intervening test scores; intervening and final test scores; and initial and final test scores. This procedure was followed with the forehand drive scores, the backhand drive scores, and the total scores on the Broer-Miller Test,¹⁴ with the average scores on the Hewitt Test,¹⁵ and with the total scores on the Camp Test.¹⁶ The t ratios were computed to ascertain whether or not the groups had gained significantly from one test to another. Through the use of the t test, a comparison was made between the initial group of scores and the intervening set of scores and the final scores and the initial and final group of scores, in order to determine whether a difference between them occurred at the five per cent level of confidence. In order to determine whether one method of instruction was superior to the other, the combination of trials which yielded significant gains were further treated by analysis of covariance, since the two groups used in the study were unequated.

¹⁴Broer and Miller, op. cit., p. 309.

¹⁵Hewitt, op. cit., p. 154.

¹⁶Camp, op. cit., p. 3.

CHAPTER IV

FINDINGS

This chapter presents an analysis of data and an interpretation of the findings of the study. The findings were derived from statistical treatment of the data by an IBM 1620 computer. Tests were administered to sixty-nine female high school students. These tests were chosen to determine the effects of viewing loopfilms in the development of tennis skill and form. The Fisher's t was computed to determine whether or not the mean changes between the initial and intervening tests, the intervening and final tests, and the initial and final tests were statistically significant. In order to determine whether the method which added the use of the loopfilms was superior to the traditional method alone, the combination of trials which yielded significant gains was further treated by analysis of covariance, since the two groups used in the study were unequated.

Results of the Broer-Miller Tennis Achievement Test

Table I presents the results of the groups' mean scores on the initial and intervening tests. The gains made by the

experimental group and the control group were statistically significant. A t of 1.96 was required to be statistically significant at the .05 level of confidence.

TABLE I
DIFFERENCES BETWEEN INITIAL AND INTERVENING MEAN SCORES FOR EXPERIMENTAL AND CONTROL GROUPS ON THE BROER-MILLER TENNIS ACHIEVEMENT TEST

Broer-Miller Test	Initial		Intervening		Difference	t	P
	Mean	SD	Mean	SD			
Experimental (N=36)	23.81	15.11	52.33	19.96	28.53	10.35	.05
Control (N=33)	26.36	18.56	53.18	19.94	26.82	9.16	.05

The results of the initial and final tests are presented in Table II. Both the experimental group and control group made statistically significant gains.

TABLE II
DIFFERENCES BETWEEN INITIAL AND FINAL MEAN SCORES FOR EXPERIMENTAL AND CONTROL GROUPS ON THE BROER-MILLER TENNIS ACHIEVEMENT TEST

Broer-Miller Test	Initial		Final		Difference	t	P
	Mean	SD	Mean	SD			
Experimental (N=36)	23.81	15.11	54.61	15.74	30.81	10.97	.05
Control (N=33)	26.36	18.56	58.61	14.53	32.24	8.71	.05

Table III presents the mean scores on the intervening and final tests. Neither the experimental group nor the control group made significant gains between these two tests, with the control group displaying a higher mean score than the experimental group.

TABLE III
DIFFERENCES BETWEEN INTERVENING AND FINAL MEAN
SCORES FOR EXPERIMENTAL AND CONTROL GROUPS
ON THE BROER-MILLER TENNIS ACHIEVEMENT
TEST

Broer-Miller Test	Intervening		Final		Differ- ence	t	P
	Mean	SD	Mean	SD			
Experimental (N=36)	52.33	19.96	54.61	15.74	2.28	.87	NS
Control (N=33)	53.18	19.94	58.61	14.53	5.42	1.35	NS

Results of the Hewitt Revision of the
Dyer Backboard Tennis Test

Table IV presents the results of the groups' mean scores on the initial and intervening tests. The gains made by the experimental group and the control group were statistically significant.

TABLE IV

DIFFERENCES BETWEEN INITIAL AND INTERVENING MEAN SCORES
FOR EXPERIMENTAL AND CONTROL GROUPS ON THE HEWITT
REVISION OF THE DYER BACKBOARD TENNIS TEST

Hewitt Test	Initial		Intervening		Differ- ence	t	P
	Mean	SD	Mean	SD			
Experimental (N=36)	7.36	2.06	8.50	1.67	1.14	3.85	.05
Control (N=33)	7.00	1.89	8.18	2.22	1.18	3.90	.05

The results of the initial and final tests are presented in Table V. The gains made by the experimental group and control group were statistically significant.

TABLE V

DIFFERENCES BETWEEN INITIAL AND FINAL MEAN SCORES FOR
EXPERIMENTAL AND CONTROL GROUPS ON THE HEWITT
REVISION OF THE DYER BACKBOARD TENNIS TEST

Hewitt Test	Initial		Final		Differ- ence	t	P
	Mean	SD	Mean	SD			
Experimental (N=36)	7.36	2.06	9.81	2.01	2.44	7.53	.05
Control (N=33)	7.00	1.89	9.73	1.76	2.73	7.70	.05

Table VI presents the mean scores on the intervening and final tests. Both the experimental group and the control group made significant gains between these two tests, with the experimental group making a slightly higher mean score than the control group.

TABLE VI

DIFFERENCES BETWEEN INTERVENING AND FINAL MEAN SCORES
FOR EXPERIMENTAL AND CONTROL GROUPS ON THE HEWITT
REVISION OF THE DYER BACKBOARD TENNIS TEST

Hewitt Test	Intervening		Final		Differ- ence	t	P
	Mean	SD	Mean	SD			
Experimental (N=36)	8.50	1.27	9.81	2.01	1.31	4.95	.05
Control (N=33)	8.18	2.22	9.73	1.76	1.55	4.10	.05

Results of the Camp Tennis Form Test

The third test administered to the sixty-nine high school girls in this study was the Camp Tennis Form Test. In the administration of this test, three judges were trained to rate the subjects. The Pearson-Product Moment Zero Order Method of Correlation was used to calculate the relationship between the judges' scores. Table VII presents the correlation coefficients of the judges' ratings, which indicate

high reliability in the ability of the judges to rate the variables on the form test.

TABLE VII
CORRELATION OF JUDGES' RATINGS ON
THE CAMP TENNIS FORM TEST

	Initial	Intervening	Final
Judge A with B	.88	.87	.95
Judge A with C	.90	.90	.98
Judge B with C	.91	.88	.97

Table VIII presents the results of the groups' mean scores on the initial and intervening tests. The gains made by the experimental group and the control group were statistically significant.

TABLE VIII
DIFFERENCES BETWEEN INITIAL AND INTERVENING MEAN
SCORES FOR EXPERIMENTAL AND CONTROL GROUPS ON
THE CAMP TENNIS FORM TEST

Camp Test	Initial		Intervening		Differ- ence	t	P
	Mean	SD	Mean	SD			
Experimental (N=36)	20.08	6.49	26.56	5.84	6.47	5.82	.05
Control (N=33)	19.88	4.84	26.06	6.10	6.18	5.45	.05

The results of the initial and final tests are presented in Table IX. Both the experimental group and control group made statistically significant gains.

TABLE IX
DIFFERENCES BETWEEN INITIAL AND FINAL MEAN SCORES
FOR EXPERIMENTAL AND CONTROL GROUPS ON
THE CAMP TENNIS FORM TEST

Camp Test	Initial		Final		Differ- ence	t	P
	Mean	SD	Mean	SD			
Experimental (N=36)	20.08	6.49	39.69	8.45	19.61	14.55	.05
Control (N=33)	19.88	4.84	38.00	7.34	18.12	13.13	.05

Table X presents the mean scores on the intervening and final tests. Both the experimental group and the control group improved significantly between these two tests, with the experimental group making a slightly higher mean score than the control group.

TABLE X
DIFFERENCES BETWEEN INTERVENING AND FINAL MEAN
SCORES FOR EXPERIMENTAL AND CONTROL GROUPS
ON THE CAMP TENNIS FORM TEST

Camp Test	Intervening		Final		Differ- ence	t	P
	Mean	SD	Mean	SD			
Experimental (N=36)	26.56	5.84	39.69	8.45	13.14	8.20	.05
Control (N=33)	26.06	6.10	38.00	7.34	11.94	7.79	.05

Group Differences on Broer-Miller
Tennis Achievement Test

The significance of differences between groups was determined by application of the F test at the .05 level of probability. An F ratio of 3.98 was necessary for significance. The source of variation, degrees of freedom, sum of squares, and F ratio for the groups on the initial and intervening tests of the Broer-Miller Tennis Achievement Test are presented in Table XI. There was no significant difference between the experimental group, who viewed the loopfilm, and the control group.

TABLE XI

ANALYSIS OF COVARIANCE BETWEEN THE EXPERIMENTAL
GROUP AND THE CONTROL GROUP ON THE INITIAL
AND INTERVENING ADMINISTRATION OF THE
BROER-MILLER TENNIS ACHIEVEMENT TEST

Source	df	Ss	Ms	F	P
Total	67	13406.56			
Within	66	13167.44	199.51		
Difference	1	239.12	239.12	1.20	NS

Table XII presents the source of variation, degrees of freedom, sum of squares, and F ratio for the groups on the initial and final tests. There was no significant difference between the experimental group and the control group.

TABLE XII

ANALYSIS OF COVARIANCE BETWEEN THE EXPERIMENTAL
GROUP AND THE CONTROL GROUP ON THE INITIAL
AND FINAL ADMINISTRATION OF THE BROER-
MILLER TENNIS ACHIEVEMENT TEST

Source	df	Ss	Ms	F	P
Total	67	14512.39			
Within	66	14329.13	217.11		
Difference	1	183.26	183.26	.84	NS

The source of variation, degrees of freedom, sum of squares, and F ratio for the groups on the intervening and final tests are presented in Table XIII. There was no significant difference between the experimental group and the control group.

TABLE XIII

ANALYSIS OF COVARIANCE BETWEEN THE EXPERIMENTAL GROUP AND THE CONTROL GROUP ON THE INTERVENING AND FINAL ADMINISTRATION OF THE BROER-MILLER TENNIS ACHIEVEMENT TEST

Source	df	Ss	Ms	F	P
Total	65	13290.75			
Within	66	13075.92	201.17	1.07	NS
Difference	1	214.83	214.83		

Group Differences on the Hewitt Revision
of the Dyer Backboard Tennis Test

Table XIV presents the source of variation, degrees of freedom, sum of squares, and F ratio for the groups on the initial and intervening tests. There was no significant difference between the experimental group and the control group.

TABLE XIV

ANALYSIS OF COVARIANCE BETWEEN THE EXPERIMENTAL
GROUP AND THE CONTROL GROUP ON THE INITIAL
AND INTERVENING ADMINISTRATION OF THE
HEWITT REVISION OF THE DYER
BACKBOARD TENNIS TEST

Source	df	Ss	Ms	F	P
Total	67	177.05			
Within	66	176.92	2.68		
Difference	1	.13	.13	.05	NS

The source of variation, degrees of freedom, sum of squares, and F ratio for the groups on the initial and final tests are presented in Table XV. There was no significant difference between the experimental group and the control group.

TABLE XV

ANALYSIS OF COVARIANCE BETWEEN THE EXPERIMENTAL
GROUP AND THE CONTROL GROUP ON THE INITIAL
AND FINAL ADMINISTRATION OF THE HEWITT
REVISION OF THE DYER BACKBOARD
TENNIS TEST

Source	df	Ss	Ms	F	P
Total	67	189.10			
Within	66	188.96	2.86		
Difference	1	.14	.14	.05	NS

Table XVI presents the source of variation, degrees of freedom, sum of squares, and F ratio for the groups on the intervening and final tests. There was no significant difference between the experimental group and the control group.

TABLE XVI
ANALYSIS OF COVARIANCE BETWEEN THE EXPERIMENTAL
GROUP AND THE CONTROL GROUP ON THE INTERVENING
AND FINAL ADMINISTRATION OF THE HEWITT
REVISION OF THE DYER BACKBOARD
TENNIS TEST

Source	df	Ss	Ms	F	P
Total	66	166.98			
Within	65	166.70	2.56		
Difference	1	.28	.28	.11	NS

Group Differences on the Camp
Tennis Form Test

The source of variation, degrees of freedom, sum of squares, and F ratio for the groups on the initial and intervening tests are presented in Table XVII. There was no significant difference between the experimental group and the control group.

TABLE XVII

ANALYSIS OF COVARIANCE BETWEEN THE EXPERIMENTAL
GROUP AND THE CONTROL GROUP ON THE INITIAL
AND INTERVENING ADMINISTRATION OF THE
CAMP TENNIS FORM TEST

Source	df	Ss	Ms	F	P
Total	67	4272.94			
Within	66	4229.80	64.09		
Difference	1	43.14	43.14	.67	NS

Table XVIII presents the source of variation, degrees of freedom, sum of squares, and F ratio for the groups on the initial and final tests. There was no significant difference between the experimental group and the control group.

TABLE XVIII

ANALYSIS OF COVARIANCE BETWEEN THE EXPERIMENTAL
GROUP AND THE CONTROL GROUP ON THE INITIAL
AND FINAL ADMINISTRATION OF THE CAMP
TENNIS FORM TEST

Source	df	Ss	Ms	F	P
Total	67	3798.04			
Within	66	3754.52	56.89		
Difference	1	43.52	43.52	.76	NS

The source of variation, degrees of freedom, sum of squares, and F ratio for the groups on the intervening and final tests are presented in Table XIX. There was no significant difference between the experimental group and the control group.

TABLE XIX

ANALYSIS OF COVARIANCE BETWEEN THE EXPERIMENTAL GROUP AND THE CONTROL GROUP ON THE INTERVENING AND FINAL ADMINISTRATION OF THE CAMP TENNIS FORM TEST

Source	df	Ss	Ms	F	P
Total	66	3794.06			
Within	65	3751.47	57.71		
Difference	1	42.60	42.60	.74	NS

Tests of Hypotheses

The results of this study appeared to justify the following statements.

Hypothesis one stated that there would be no significant difference between the means of the experimental and control groups' initial scores on the two skill tests and the form test. Since there was no significant difference between the groups' initial scores, hypothesis one must not be rejected.

Hypothesis two stated that there would be no significant difference between the means of the experimental and control groups' intervening scores on the two skill tests and on the form test. Since there was no significant difference between the groups' intervening scores, hypothesis two must not be rejected.

Hypothesis three stated that there would be no significant difference between the means of the experimental and control groups' final scores on the two skill tests and the form test. Since there was no significant difference between the groups' final scores, hypothesis three must not be rejected.

Discussion of Findings

The findings derived from this study in regard to the effects of viewing loopfilms on tennis skill and form were in agreement with the results of other studies similar in design. These studies were conducted by Irwin, Nelson, Dressen, Douglas, and Murin, Meyes, and Harby and are referred to in Chapter II.

A comparison of the means of the experimental group and the control group on the initial, intervening, and final administrations of the Broer-Miller Tennis Achievement Test revealed some interesting results. Performance on the final test by both groups showed positive improvement over the

initial scores. The greater part of this improvement, however, was made between the initial and intervening testing periods, during which both groups were submitted to two weeks of training by the traditional teacher demonstration-verbal explanation method of teaching. The improvement made between the intervening and final tests of both groups was so slight that it was statistically insignificant.

The covariance analysis of this test resulted in an F ratio which was not significant. This seems to indicate that the observed improvement of the experimental group could not be attributed to the viewing of the loopfilm.

The climatic conditions during the final testing of the Broer-Miller Tennis Achievement Test were adverse, i.e., those two days were cloudy, windy, and cold. While it was impossible to determine what effect this might have had on the results of the study, it possibly could have been a reason why the subjects did not score better on the test.

On the Hewitt Revision of the Dyer Backboard Tennis Test small but significant gains were made by both the experimental group and the control group between the initial and intervening tests, the initial and final tests, and the intervening and final tests. Although the means for the experimental group were slightly higher on this test than the means for the control group, the F ratio was not high enough to be significant.

Although the ability to rally a tennis ball against a backboard appears to be a complex skill, the experimental group seemed to understand the rhythm of the ball coming off the wall better than the control group. It is possible that the loopfilm could have influenced the experimental group as they viewed the rhythm of the forehand drive and the backhand drive.

Significant gains were also made by both groups between the initial and intervening tests, the initial and final tests, and the intervening and final tests on the Camp Tennis Form Test. The means for the experimental group were slightly higher than the means for the control group, but this difference was not great enough for the F ratio to reveal any significant difference.

Although the F ratio for the form test was insignificant, the experimental group seemed to grasp the principles of executing a forehand drive and a backhand drive faster and with greater understanding than the control group. The experimental group also seemed to be motivated to a greater extent than the control group, in that they seemed to wish to imitate the tennis expert on the loopfilm. It is possible that the loopfilm could have been the reason for this slight difference in the scores. However, this is an assumption.

During the five week experimental period in which the experimental group was viewing the loopfilms, the control

group was instructed to go to the tennis courts, perform their beginning exercises, and practice. This extra five minutes of practice given to the control group, three times a week for five weeks, could have been an important factor in the development of their skill.

The control group, as well as the experimental group, received instruction and demonstration from a tennis expert. The investigator was a former Texas State AAAA Doubles Champion and is presently the coach of the Dallas Junior Wightman Cup Tennis Team. This could have affected the results of the study. However, this is an assumption.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presents a summary of the problem, an analysis of the results, conclusions based on the results, and recommendations for additional studies.

This study was designed to determine the effects of viewing loopfilm on tennis skill and form. Sixty-nine high school girls, enrolled in beginning tennis classes at Irving High School, having received no previous instruction in tennis, were subjects for this investigation. Data utilized in this study were composed of scores derived from the administration of the Broer-Miller Tennis Achievement Test, the Hewitt Revision of the Dyer Backboard Tennis Test, and the Camp Tennis Form Test.

The hypotheses under test were the following:

1. There would be no significant difference between the experimental and control groups' initial scores on the two skill tests and the form test.

2. There would be no significant difference between the experimental and control groups' intervening scores on the two skill tests and the form test.

3. There would be no significant difference between the experimental and control groups' final scores on the two skill tests and the form test.

The initial testing of the subjects on the three tennis tests occurred the first week of the study before any instruction in tennis was given. Following this testing period, two weeks of training was given on the forehand drive and the backhand drive, using the traditional teacher demonstration-verbal explanation method of teaching. The intervening tests were then administered. At the conclusion of this testing period, the subjects were randomly placed into the experimental and control groups. Five weeks of training followed, with both groups being taught by the demonstration-explanation method, with the experimental group receiving the additional aid of viewing the loopfilms. The final tests were then administered.

Statistical treatment of the data included the computation of means, standard deviations, the Pearson-Product Moment Zero Order Method of Correlation, the Fisher's t test of significance, and the analysis of covariance technique. The .05 level of confidence was used to decide the acceptance or rejection of the null hypotheses. These statistics were used to examine the differences between the experimental and control groups, to determine the amount of skill gained at

the three testing periods, and to determine the relationship of the judges' ratings on the form test.

The results revealed a high correlation between the judges' ratings on the tennis form test. Both the experimental group and the control group made significant gains in skill and form between the initial and intervening tests and between the initial and final tests. Significant gains were also made between the intervening and final tests on the Hewitt test and the Camp test, but no significant gains were made on the Broer-Miller test. The F ratios on all three tests revealed no significant differences between the experimental group and the control group.

Conclusions

Within the limitations of this study, the results appear to justify the following conclusions:

1. The addition of the loopfilm to the traditional teacher demonstration-verbal explanation method of teaching does not appear to facilitate the learning of tennis skills more than the traditional method by itself.

2. The addition of the loopfilm to the traditional teacher demonstration-verbal explanation method of teaching does not appear to enhance the improving of tennis form more than the traditional method by itself.

3. The addition of the loopfilm to the traditional teacher demonstration-verbal explanation method of teaching is as effective a teaching method as the traditional method by itself, having no deleterious effect upon the learning of tennis.

4. The expense, equipment, and facilities necessary for the projection of the loopfilm appeared nominal considering the multiplicity of use in teaching sports skills.

5. The extra practice time given to the control group, while the experimental group was viewing the loopfilm, plus the expert tennis instruction and demonstration which they received, might have improved their skill and form to some degree.

6. Observation of the two groups revealed that the experimental group appeared to grasp the principles of correct stroke execution with greater understanding than was presented in the statistical analyses.

Recommendations

The following recommendations are presented as a result of this study:

1. A similar study be conducted with mental practice added to the loopfilm variable (the subjects mentally picture the skill being performed while viewing the loopfilm).

2. A similar study be conducted with the loopfilm being initiated at the beginning of the investigation.

3. A similar study be conducted in which motion picture film is taken of the subjects and viewed by the subjects, in addition to the loopfilm of experts.

4. A similar study be conducted with the loopfilm method being used by itself.

5. A similar study be conducted in which the groups would be equated.

6. The loopfilm be used as a rainy day activity to motivate the students to imitate the tennis expert.

7. An inexperienced, unskilled instructor utilize the loopfilm as a form of demonstration for her classes.

8. Loopfilm projection be made accessible as a teaching aid in the gym, on the court, or on the field during class time for use by all students involved in learning sports skills.

APPENDIX A

BROER-MILLER TENNIS ACHIEVEMENT TEST

Description of Test

The test was designed to measure students' ability to place forehand and backhand drives into the backcourt area. It consisted of hitting a given number of balls so that they would pass between the top of the net and a restraining rope placed above the net, and of attempting to place these balls into the back 9 feet of the court. The ball was put into play by the student bouncing the ball to herself.

Equipment

1. One regulation court
2. One regulation net with a rope stretched 4 feet above the top of the net.
3. One racket and 15-20 balls in good condition.
4. Score sheets for each player and pencils.
5. Special court markings:
 - a. Two chalk lines drawn across the court 10 feet inside the service line and 9 feet outside the service line and parallel to it.
 - b. Two chalk lines drawn across the court 5 feet and 10 feet respectively outside the baseline and parallel to it.
 - c. Chalked numbers in the center of each area to indicate its scoring value.

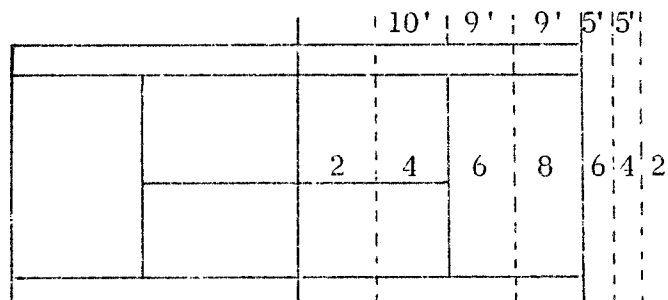
Test

1. The player taking the test stands behind the baseline, bounces the balls to herself, hits the balls and attempts to place them in the back 9 feet of the opposite court.

2. Each player is allowed fourteen trials on the forehand and fourteen trials on the backhand.
3. In order to score the values as shown, balls must be between the top of the net and the rope and land in the designated area or on lines bounding the area (balls landing on a line receive the highest score for that area).
4. Balls which go over the rope score one-half the value of that area in which they land.
5. If the player misses the ball in attempting to strike it, it is considered a trial.
6. Let balls are taken over.

Scoring

1. The number of each trial is marked on the score card diagram in the same relative position as the ball landed on the court.
2. Each ball hit is scored 2, 4, 6, 8, 6, 4, 2, depending upon the area in which it lands. Each ball going over the rope is scored one-half the value of the area in which it lands and is indicated on score card by circling the number.
3. The total score equals the sum of fourteen balls on the forehand and fourteen balls on the backhand.



BROER-MILLER TENNIS ACHIEVEMENT TEST

INITIAL
SCORE SHEET FOR INTERVENING TEST
FINAL

FOREHAND

BACKHAND

NAME _____

FOREHAND SCORE _____

BACKHAND SCORE _____

TOTAL SCORE _____

APPENDIX B

HEWITT REVISION OF DYER BACKBOARD TENNIS TEST

Description of Test

1. A wall 20 feet high and 20 feet wide is used.
2. The restraining line is 20 feet from the wall.
3. A line is marked on wall 3 feet high to indicate the net.

Equipment

1. One dozen new tennis balls placed in basket to left of testee.
2. One tennis racket.
3. Stop watch.
4. Score sheet and pencil.

Practice Warm-up Period

1. A 2-minute warm-up is allowed on the wall.

Test

1. The person taking the test starts with two new tennis balls behind the 20 foot restraining line.
2. The test is started with a serve behind the restraining line. Any type of serve is allowed. When the served ball hits above the net line on the wall, the stop watch is started.
3. The student continues to rally by himself using any type of stroke.

4. If the student loses a ball on a rally, other balls are available in the basket. Each time a new ball is obtained it must be served again behind the restraining line.
5. Hitting continues for a total of 30 seconds.
6. The test is taken three times in class rotation.

Scoring

1. One point is counted each time the ball is hit above the 3 foot net line on the wall. All balls hitting the line are good.
2. No score counted when stepping over the restraining line or hitting the ball below the net line.
3. No deduction taken when additional tennis balls are used.
4. Scores taken on the three tests. Divide by three to obtain the average score.

HEWITT REVISION OF DYER BACKBOARD TENNIS TEST

INITIAL
SCORE SHEET FOR INTERVENING TEST
FINAL

<u>NAME</u>	<u>TRIAL 1</u>	<u>TRIAL 2</u>	<u>TRIAL 3</u>	<u>AVERAGE FINAL SCORE</u>
1. _____	_____	_____	_____	_____
2. _____	_____	_____	_____	_____
3. _____	_____	_____	_____	_____
4. _____	_____	_____	_____	_____
5. _____	_____	_____	_____	_____
6. _____	_____	_____	_____	_____
7. _____	_____	_____	_____	_____

APPENDIX C

CAMP TENNIS FORM TEST

Description of Test

The class is divided into groups of six students each. Each one in the group has a special assignment to perform. One takes the test; one moves the machine; one puts the balls into the machine; one picks up balls on side of the testee; one picks up balls on the side of the machine; and one tells the test administrator whether or not the balls are hit into the singles court. The test administrator stands on the opposite side of the net from the testee so he can see him clearly. The test is started with 14 balls in the Ball Boy machine (the first 4 are practice). The testee stands in the center of the court at the baseline in the ready position. The machine is started, throwing the first ball to the forehand. The testee runs over and hits it and then goes back to the center. The machine is then moved and throws a ball to the backhand. The testee runs over and hits it and then goes back to the center. This continues until all ten balls are hit. The students then rotate positions until all six have taken the test and then the groups change.

Scoring

The scoring method used is a number system which gives a specified number of points for form and for accuracy.

1. Good Form -- one receives 5 points. This includes performing the following items:
 - a. Side to net.
 - b. Step into ball toward net.
 - c. Relaxed arm swing (arm slightly bent, firm wrist, following through).
2. Fair Form -- one receives 3 points. This includes performing the following items:

- a. Side to net.
 - b. Step into ball toward net.
3. Poor Form -- one receives 1 point. This would show the student facing the net, just swatting at the ball.
 4. Accuracy -- If the student hits the ball into the singles court, then one point is given, no matter what form is used.

The total score is the sum of all the points the student receives. A perfect score would be 60.

APPENDIX D

RAW SCORES ON BROER-MILLER TENNIS ACHIEVEMENT TEST

<u>Subject</u>	<u>Initial</u>			<u>Intervening</u>			<u>Final</u>		
	<u>FH</u>	<u>BH</u>	<u>TS</u>	<u>FH</u>	<u>BH</u>	<u>TS</u>	<u>FH</u>	<u>BH</u>	<u>TS</u>
E1	21	10	31	40	43	83	40	35	75
E2	16	0	16	30	13	43	39	14	53
E3	18	4	22	24	19	43	28	20	48
E4	5	2	7	20	16	36	27	12	39
E5	17	18	35	30	49	79	33	31	64
E6	26	2	28	42	33	75	43	26	69
E7	48	10	58	30	26	56	34	19	53
E8	8	0	8	25	13	38	24	6	30
E9	10	0	10	33	21	54	31	22	53
E10	18	0	18	33	38	71	26	14	40
E11	16	2	18	18	24	42	18	22	40
E12	14	0	14	38	22	60	37	28	65
E13	18	0	18	31	5	36	22	7	29
E14	22	6	28	29	26	55	48	30	78
E15	12	3	15	30	12	42	41	40	81
E16	12	0	12	27	21	48	44	17	61
E17	36	7	42	60	31	91	41	28	69
E18	5	14	19	42	13	55	35	32	67
E19	10	2	12	10	9	19	18	8	26
E20	2	2	4	19	0	19	31	7	38
E21	15	0	15	38	39	77	34	21	55
E22	26	0	26	34	1	35	19	14	33
E23	7	6	13	6	10	16	30	3	33
E24	22	24	46	41	23	64	42	30	72
E25	42	22	64	52	31	83	36	28	64
E26	35	6	41	32	34	66	46	23	69
E27	26	20	46	38	33	71	34	26	60
E28	29	3	32	25	9	34	27	10	37
E29	8	0	8	31	22	53	24	22	46
E30	42	8	50	38	27	65	36	35	71
E31	21	10	31	34	18	52	47	18	65
E32	21	0	21	40	30	70	39	6	45
E33	15	4	19	30	40	70	42	38	80
E34	9	0	9	16	19	35	31	36	67
E35	6	5	11	11	11	22	26	18	44
E36	10	0	10	22	4	26	38	9	47

<u>Subject</u>	<u>Initial</u>			<u>Intervening</u>			<u>Final</u>		
	<u>FH</u>	<u>BH</u>	<u>TS</u>	<u>FH</u>	<u>BH</u>	<u>TS</u>	<u>FH</u>	<u>BH</u>	<u>TS</u>
C37	22	14	36	34	34	68	32	19	51
C38	20	27	47	40	6	46	30	20	50
C39	23	5	28	25	14	39	32	4	36
C40	0	0	0	47	10	57	31	10	41
C41	40	21	61	42	46	88	44	28	72
C42	27	20	47	36	29	65	36	35	71
C43	14	7	21	34	22	56	41	21	62
C44	0	0	0	20	13	33	35	20	55
C45	2	0	2	14	11	25	29	2	31
C46	38	4	42	29	20	49	38	38	76
C47	33	16	49	56	35	91	41	32	73
C48	10	2	12	7	4	11	41	35	76
C49	2	9	11	31	12	43	35	38	73
C50	4	2	6	8	32	40	38	25	63
C51	14	10	24	52	11	63	23	25	48
C52	22	13	35	5	10	15	45	26	71
C53	17	17	34	25	19	44	32	23	55
C54	27	15	42	40	18	58	38	9	47
C55	11	17	28	30	29	59	22	23	45
C56	14	16	30	46	30	76	48	42	90
C57	11	0	11	25	8	33	38	14	52
C58	6	2	8	23	25	48	42	39	81
C59	18	4	22	36	24	60	36	30	66
C60	4	5	9	14	21	35	20	12	32
C61	11	0	11	32	4	36	32	23	55
C62	12	0	12	22	24	46	40	13	53
C63	5	6	11	30	17	47	40	27	67
C64	0	0	0	31	35	66	49	9	48
C65	28	7	35	35	13	48	51	18	69
C66	41	20	61	63	22	85	42	26	68
C67	55	7	62	61	32	93	18	36	54
C68	40	6	46	35	35	70	31	6	37
C69	27	0	27	45	17	62	35	31	66

APPENDIX E

RAW SCORES ON HEWITT REVISION OF DYER BACKBOARD TENNIS TEST

<u>Subject</u>	<u>Initial</u>	<u>Intervening</u>	<u>Final</u>
E1	10	8	11
E2	7	9	10
E3	8	9	9
E4	6	9	8
E5	11	10	15
E6	12	11	14
E7	7	9	10
E8	8	7	7
E9	8	9	13
E10	10	10	12
E11	8	11	11
E12	8	10	11
E13	10	9	9
E14	9	8	7
E15	6	8	9
E16	7	10	11
E17	8	10	11
E18	7	8	9
E19	4	5	10
E20	4	8	8
E21	6	10	12
E22	7	9	11
E23	3	6	8
E24	8	9	11
E25	9	8	11
E26	6	8	10
E27	9	10	10
E28	6	8	10
E29	7	7	7
E30	9	8	8
E31	10	11	11
E32	7	9	10
E33	4	7	8
E34	5	9	8
E35	6	3	7
E36	5	6	6

<u>Subject</u>	<u>Initial</u>	<u>Intervening</u>	<u>Final</u>
C37	8	7	8
C38	8	12	12
C39	7	9	10
C40	7	6	8
C41	11	11	14
C42	8	8	11
C43	7	12	10
C44	4	7	10
C45	5	7	9
C46	9	10	11
C47	10	11	11
C48	6	7	10
C49	5	7	13
C50	7	10	11
C51	7	9	10
C52	6	7	10
C53	7	6	10
C54	3	3	9
C55	8	7	8
C56	7	11	10
C57	6	8	8
C58	5	7	6
C59	9	8	10
C60	8	6	8
C61	7	6	9
C62	3	4	9
C63	5	7	9
C64	5	8	8
C65	7	8	6
C66	9	12	10
C67	9	11	9
C68	9	10	13
C69	9	8	11

APPENDIX F

RAW SCORES ON CAMP TENNIS FORM TEST

Subject	<u>Initial</u>				<u>Intervening</u>				<u>Final</u>			
	<u>A</u>	<u>B</u>	<u>C</u>	<u>AV</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>AV</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>AV</u>
E1	29	31	35	32	41	45	43	43	34	39	35	36
E2	26	23	28	26	25	26	30	27	42	47	48	46
E3	10	10	12	11	19	19	21	20	27	27	31	28
E4	17	19	23	20	27	26	30	28	35	39	40	38
E5	35	29	34	33	25	33	29	29	53	50	53	52
E6	29	29	35	31	26	28	28	27	52	50	54	52
E7	16	15	18	16	37	37	39	38	47	48	52	49
E8	12	14	14	13	22	26	24	24	46	48	50	48
E9	21	18	22	20	22	28	26	25	50	52	54	52
E10	18	15	16	16	28	34	30	31	32	33	36	34
E11	24	20	22	22	27	25	23	25	44	46	49	45
E12	19	18	21	19	28	30	34	31	31	30	35	32
E13	17	15	19	17	27	30	28	28	32	37	37	35
E14	16	16	22	18	24	22	18	21	46	49	50	48
E15	17	15	23	18	30	26	30	29	43	42	47	44
E16	26	24	29	26	20	24	22	22	45	44	49	46
E17	33	31	35	33	32	30	34	32	45	49	50	48
E18	29	27	27	28	24	20	22	22	48	49	52	50
E19	21	21	19	20	28	33	29	30	28	26	30	28
E20	19	15	13	16	19	19	17	18	34	36	38	36
E21	13	15	15	14	21	25	23	23	38	39	40	39
E22	13	15	17	15	20	23	23	22	24	28	30	27
E23	13	13	11	12	16	16	14	15	32	33	35	33
E24	32	24	28	28	22	24	26	24	43	45	49	48
E25	13	19	15	16	18	20	22	20	24	24	28	25
E26	24	24	26	25	30	31	33	31	22	25	24	24
E27	15	13	17	15	29	31	29	30	50	52	56	53
E28	26	26	28	27	34	36	37	36	45	47	50	47
E29	12	12	12	12	29	30	32	30	31	30	33	31
E30	22	22	24	23	25	27	25	26	38	40	42	40
E31	21	15	19	18	17	23	19	20	36	33	39	36
E32	16	14	16	15	18	24	20	21	35	34	36	35
E33	28	24	25	26	31	37	37	35	39	38	42	40
E34	14	14	12	13	26	28	30	28	34	31	36	34
E35	20	15	20	18	25	17	23	22	30	32	35	32
E36	12	11	10	11	19	25	25	23	38	36	40	38

<u>Subject</u>	<u>Initial</u>				<u>Intervening</u>				<u>Final</u>			
	<u>A</u>	<u>B</u>	<u>C</u>	<u>AV</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>AV</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>AV</u>
C37	18	16	18	17	32	34	38	35	44	46	46	45
C38	25	23	29	26	27	29	25	27	35	40	38	38
C39	23	19	26	23	10	14	12	12	22	22	25	23
C40	13	11	17	14	20	25	22	22	35	37	40	37
C41	26	22	28	25	34	34	30	33	47	45	49	47
C42	14	18	18	17	16	23	17	15	50	51	53	51
C43	25	20	25	23	23	27	21	24	35	37	40	37
C44	25	17	19	20	16	20	18	18	42	40	46	43
C45	18	16	21	18	22	20	24	22	35	39	39	38
C46	14	16	16	15	21	21	25	22	40	44	47	44
C47	20	22	26	23	30	30	32	31	32	28	34	31
C48	21	17	23	20	22	26	28	25	30	33	31	31
C49	20	16	18	18	24	24	27	25	39	38	40	39
C50	22	18	24	21	30	35	31	32	41	44	45	43
C51	24	24	26	25	34	36	38	36	38	36	40	38
C52	12	12	14	13	26	27	25	26	40	43	45	43
C53	20	20	18	19	32	34	30	32	30	32	33	32
C54	24	20	28	24	34	36	39	36	37	39	42	39
C55	18	18	18	18	21	18	19	19	30	31	29	30
C56	17	13	13	14	28	30	26	28	38	36	40	38
C57	22	18	22	21	18	22	24	21	35	34	38	36
C58	15	19	17	17	28	24	26	26	34	32	36	34
C59	27	27	30	28	22	20	25	22	45	47	49	47
C60	13	11	13	12	18	22	22	21	30	33	35	33
C61	27	29	30	29	27	26	30	28	44	48	50	47
C62	16	20	18	18	29	28	27	28	36	37	40	38
C63	10	12	10	11	18	20	21	20	35	38	42	38
C64	16	14	18	16	28	30	32	30	44	40	46	43
C65	23	19	17	20	30	31	35	32	29	33	31	31
C66	15	15	17	16	22	26	28	25	12	16	14	14
C67	27	25	28	27	24	24	28	25	44	42	46	44
C68	30	26	32	29	35	40	38	38	46	50	48	45
C69	18	20	20	19	24	22	26	24	34	38	40	37

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