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The Ohio State University, Ph.D., 1973
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THE INFLUENCE OF STUDENT FEEDBACK ON ACHIEVEMENT
DURING VARIED CONTEXTS OF LECTURING SESSIONS

DISSERTATION

Presented in Partial Fulfillment of The Requirement For Degree
of Doctor of Philosophy in The Graduate School of
The Ohio State University

by

Hayward Orlan Handy, B. S., M. A., Ed. S.

* * * * * *

The Ohio State University

1973

Approved by

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VITA

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Publications


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CHAPTER I

INTRODUCTION

In the twentieth century we have seen a remarkable change in the specific skills which we learn. The change is largely the result of technological innovations and the earnest pursuit of leisure-time activities. We are now witnessing the rapid introduction of machinery into the home and school. We are indeed confronted with an impressive array of tape recorders, stereo-high fidelity sets, still and motion cameras, and slide projectors which promise to keep our lives busy and which require the learning of new skills.¹

Various forms of listening centers are now being developed in schools and colleges in an effort to utilize to the fullest and the rich audio resources available for instruction. A combination of influences, technology as well as instructional, has produced new installations. Many of them employ "random access" circuitry to permit large numbers of students to listen at will. Learning stations may be located wherever

space is available—in libraries, corridors, classrooms, dormitories or private carrels.  

The "Telelecture" is a relatively recent addition to the fund of resources open to individuals interested in improving instruction. Today, well over 150 colleges and universities throughout the country utilize this procedure for bringing nationally and internationally known specialists and experts "in person" to the lecture halls and classrooms.

One example of the use of this technique is reported by Michael J. Clark, art teacher at Valley High School, Masquite, Nevada, as part of the Western Small State Project. Judging from the results of the two year "Art by Telephone" has now been in operation, this method of teaching is just as effective as the traditional classroom style.

Many universities and large colleges use a method of distributing class meetings between lectures and discussions. The chief competitor of the lecture is not the teaching machine, television or film, but rather—PRINT. Over a generation ago Green conducted an experiment

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3 Ibid., p. 352-353.
demonstrating that college students learned as much from reading a passage as from hearing the same material in a lecture.\footnote{E. B. Green, "Relative Effectiveness of Lecture and Individual Reading as Methods of College Teaching", \textit{Genet. Psychol. Monogr.}, 1928, 4; 457-563.} 

Although printed materials have been almost as popular as television for a much longer time, lectures have survived. Even the advent of picture-book textbooks did not dislodge the lecture. If we stop to think about this, the dozens of researchers have not had much impact upon lectures.

Textbooks, films, teaching machines, etc. must be organized to fit average students if they are to be economically feasible. The lecturer can not only plan his lecture for his own class but he can also respond to feedback from his class as he delivers it. This responsiveness to cues from the class is probably the reason the material can be covered less rapidly in "live" classes than in television classes. Because the instructor responds to feedback his presentation may appear to be unorganized. Yet one might hypothesize that this very responsiveness may make for greater effectiveness than that of a carefully organized, inflexible presentation.

Although there is little relevant evidence from research, we would thus expect live lecturing to be most effective in situations
where there is considerable variations among groups in ability, relevant background or motivation and where flexible adjustment to the group is thus important.

Probably the most careful attempts to measure attitudinal and motivational outcomes have been those comparing live instruction with television instruction in the research programs at Penn. State and Miami. In neither case does the live instructor seem to be very superior.

Few experiments have compared the effectiveness of classroom lectures with other teaching methods in achieving attitude change, but if we turn from classroom experiments to other research dealing with change of attitude, we find that there is substantial and growing literature relevant to differing techniques of lecturing.

The research of Hovland and his associates indicates that such variables as credibility of the lecture, order of presentation, "presentation of one side" vs "presenting both sides" of an issue, and the types of argument are important in determining the effects of a lecture. Hovland's group found that a group of college students were more likely to change their opinions (at least temporarily) when they considered highly credible then when the same communication came
from a less credible source.\(^5\)

Research on organization of materials is also relevant to lecturing aimed at cognitive changes. In a classroom experiment in a course in physics Laht, the instructor, started with a statement of a principle, and then illustrated and applied the principle. He found that for the students with poor backgrounds the inductive method was superior.\(^6\)

Hudelson reported fifty-nine well controlled experiments on size conducted at Minnesota indicated that large classes are actually superior to small classes. Although many of the differences were not statistically significant, the majority of significant differences favored large classes.\(^7\)

In experiments by Macomber and Siegel, the only statistical differences favored the smaller classes (particularly for high ability


\(^7\)E. Hudelson, *Class Size at the College Level*. Minneapolis: University of Minnesota Press, 1928.
students). On achievement test and on measure of change in misconceptions, in psychology, in test of problem solving, in a course in marketing, and the measures of student attitudes toward all the courses, large classes did not prove to be significantly inferior to small classes in any one course. In eight of the nine courses compared, however, differences favored the small class.  

Statement of the Problem

The present study is concerned with the problem of improving teacher effectiveness using the lecture within the classroom setting. The major purpose of this study is to make an assessment of student feedback as a significant variable for influencing lecturing performance, and its influence on student achievement during varied contexts of the lecturing sessions. This will be accomplished by determining the responsiveness of the lecturer to immediate feedback, with the use of individual responders and by determining if participants who give

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continuing feedback demonstrate a significantly greater gain in achievement than those who do not provide it.

**Significance of the Study**

Perhaps the pros and cons of the lecture arguments are seemingly rationalizations, for there is little research to support them.

As John B. Carroll has said, "Some critics of course would be tempted to argue that lecturing is not a central element in teaching, or even if it is, that it should not be . . . I would defend Gage and his colleagues against this argument on two grounds:

1. Lecturing is here to stay whether it's desirable or not, and actually there's not a great deal of convincing evidence against lecturing; and

2. even if straight monologue exposition by teachers is not or should not be a customary practice in teaching, there is certainly an element of verbal exposition in almost any live teacher-pupil interaction, whether or not it is a dialogue between teacher and pupils that include questions and answers or other repartee."

To date, all attempts to manipulate the lecture have usually been restricted to class size, organization, time, etc. The present study demonstrates the effects of using class responses as a measure
for lecture control.

Teachers in schools have a special need to be informed concerning all aspects of their own behavior, as well as about other devices that might be used in helping individuals toward greater achievement of their potential.

This study constitutes a significant step toward providing educators with a body of technology, permitting educators to enjoy the benefits of a more positivistic orientation to teaching. In addition, this study augments the theoretical body of knowledge concerning teacher effectiveness.

**Definition of Terms**

**Responder.**—Responder is an instrument used by the student to indicate whether or not he is understanding or not understanding the lecture.

**Feedback.**—Feedback is the responses given back by the decoder and picked up by the encoder.

**Experimental Approach to the Problem**

Of a population consisting of approximately 75 students enrolled in Education 435 at The Ohio State University during the 1972 autumn quarter, all were used as the sample in this study. The
students ranged from 19 to 22 years of age, and school levels ranging from sophomores to juniors in college. The sample was randomly divided into five equal size groups, four of which were experimental and one as control. They were designated (group A), (group B), (group C), (group D) and (group E) (control).

The methodology of this study was a model in the criterion-of-effectiveness paradigm suggested by Gage. He advocated reducing the complexity of the problem through the use of "Microcriteria" of effectiveness; rather than seek criteria for the overall effectiveness of teachers. In the many varied facets of their roles, this makes for better success with criteria of effectiveness in small, specifically defined aspect of the role. I also used programmed material (lecture) as a technique by which modifications were attempted. Both of these were incorporated into this study.

This study involved an experiment whose main purpose was to make an assessment of student feedback as a significant variable for influencing lecturing performance. Another purpose was to what influence does feedback have on student achievement during varied contexts of the lecturing session. Classroom procedure was structured specifically to provide for the two different levels required by the hypotheses.
The members of group A were given an academic learning task.

Classroom procedures for this group was designed to:

1. Take a pretest.
2. Give immediate anonymous feedback by pressing individual desk responders that lit a panel that was seen by the lecturer.
3. Allow lecturer to respond by repeating statements or phrases.
4. Take a post test.

The members of group B were given the same academic learning task. Classroom procedures for this group were designed to:

1. Take a pretest.
2. Give immediate anonymous feedback by pressing individual desk responders that lit a panel that was not seen by the lecturer.
3. See that lecturer did not respond by repeating statements or phrases.
4. Take a post test.

The members of group C were given the same academic learning task. Classroom procedure for this group was designed to:

1. Take a pretest.
2. Not give feedback.
3. Allow the lecturer to repeat statements or phrases as he considered need be.

4. Take a post test.

The members of group D were given the same academic learning task. Classroom procedures for this group was designed to:

1. Take a pretest.

2. Not to give feedback.

3. The lecturer completed the lecture without interruption.

4. Take a post test.

The members of group E were not given an academic learning task. Classroom procedures for this group was designed to:

1. Take the pretest.

2. Go to a regular class.

3. Take the post test.

Hypotheses

The major hypotheses to be tested in this study may be stated as follows:

1. Students who have opportunities to provide feedback during a lecture session will achieve greater gains on a test than students who do not have opportunities to provide feedback to a lecturer.
2. Lecturers who modify their oral performance from ongoing student feedback will effect greater gains in student test achievement than lecturers who do not modify their lecture.

Since lecturers typically provide few opportunities for students to respond, there is little opportunity for students or lecturer to receive feedback except through periodic test. Delay of feedback may not, however, be a major factor in acquiring knowledge if the learner is motivated and the material is not too difficult. We would, however, expect lack of feedback to be a greater handicap if the lecturer's goal was to develop concepts or to teach problem-solving skills. There is experimental evidence that when these are the goals, active participation on the part of the learner is more effective than passive listening or observing. Consequently the passive role of the student in the lecture would be expected to be a handicap in achieving these objectives.

**Limitations of the Study**

The study is limited to students enrolled in Education 435 (Theory and Practice in Secondary Education) at The Ohio State University at Columbus, Ohio, during the 1972 autumn quarter. Generalizations made from this study should be limited to similar populations as there
may be differences due to socioeconomic level and other variables not controlled in the present study.

Organization of Remaining Chapters

Chapter I has presented an introductory statement, the problem under investigation, significance of the study, definition of terms used, an explanation of the experimental approach to the solution of the problem, statements of the hypotheses to be tested, and limitations of the study.

Chapter II reviews related literature pertaining to various aspects of lecture. The literature is summarized.

Chapter III presents a complete description of the sample, a complete account of how the data were collected, a discussion of the instruments used, and an overview of the statistical design used to analyze the data, including a listing of the operational, or statistical hypotheses to be tested.

In Chapter IV the results of the investigation are presented. Each hypothesis is treated with reference to the data appropriate to it.

Chapter V presents an overall summary, and discussion of the findings of the study, conclusions, and recommendations based on the findings.
CHAPTER II

REVIEW OF RELATED LITERATURE

The purpose of this chapter is to review some of the studies that demonstrate what has been done using lecture as a teaching method and the effects of feedback on the instructor and the student.

The literature will be reviewed in order to give varied points of view and investigations related to some phase of lecture and feedback.

This study involved an experiment whose main purpose was to make an assessment of student feedback as a significant variable for influencing lecturing performance. Another purpose was to study what influence does feedback have on student achievement during varied context of the lecturing session.

Lecturing, it seems, is here to stay whether its desirable or not; and actually there is not a great deal of convincing evidence against lecturing. To date, all attempts to manipulate the lecture have usually been restricted to class size, organization, time, etc. The present study demonstrates the effects of using class responses as a measure for control.
Galloway said, "Verbal language offers the marvelous facility of providing immediate feedback: one can hear oneself talk." Teachers often operate on the faulty assumption that students grasp the meaning of the teacher's verbal messages to the same extent as the teacher himself understands them.

Since lectures typically provide few opportunities for students to respond, there is little opportunity for students or lecturers to receive feedback except through periodic test.

Delay of feedback may not, however, be a major factor in acquiring knowledge if the learner is motivated and the material is not too difficult. We would, however, expect lack of feedback to be a greater handicap if the lecturer's goal was to develop concepts or to teach problem solving skills. There is experimental evidence that when those are the goals, active participation on the part of the learner is more effective than passive listening or observing. Consequently, the passive role of the student in the lecture would be expected to be a handicap in achieving these objectives.

Jones carried out one of the first systematic studies of the lecture method. He found that student's immediate memory for the

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classroom materials by testing students after the lecture was over; in a series of experiments designed to discover methods of improving the lecture, he found that notes made no substantial difference to the amount retained.\(^{12}\)

Another finding was made by McClendon, who studied 678 students with regard to their note-taking practices and their comprehending a lecture is not affected either by taking notes or not taking notes: where students only recorded the main points in contrast to making detailed notes.\(^{13}\)

The findings about note-taking was supported by the work of Freyberg who found that students who did not take notes at all but merely listened to a lecture, did better on a recall test taken immediately afterwards than did groups who took detailed notes, and others who took outline notes.\(^{14}\)

Hartley and Cameron compared the notes taken by students during a lecture with what the lecturer had actually said. The material

\(^{12}\)Jones, H. E. "Experimental Studies of College Teaching". *Archives of Psychol.*, 1923, p. 68.

\(^{13}\)McClendon, P. I. "An Experimental Study of the Relationship Between the Note-taking Practices and Listening Comprehension of College Freshman During Expository Lectures", *Speech Monogr.*, 1958, 25, p. 222-228.

in a transcript of the lecture was divided into informational units by the 
author, the student’s notes were then checked for the number units 
recorded. Approximately one-third of what the lecturer said was noted 
down by the student. The content agreement with a set of "ideal notes" 
prepared by the lecturer varied from about 70 percent during the first 
10 minute period to 20 percent during the final period. 15

De Cecco carried out an experiment which throws some light 
on criticisms made of comparative studies of the lecture (non-random-
ization, students' work as a confounding variable, inappropriate 
criteria) applied to a large proportion of these investigations. Students 
were randomly assigned to the normal introductory psychology course, 
to normal course instructors in various sizes of groups. In development 
of logical thinking and information acquisition about the subject, 
there were no differences between the large and small groups. However, 
student work for the examination was not controlled—The conclusion 
must therefore be expressed in the form that there is no evidence that 
students were disadvantaged by being taught in large lecture classes 
in this experiment. As far as the student’s opinions about their group 
go, however, significant differences were found in favor of the small

15 Hartley, J. and Cameron, A. "Some Observations on the 
Efficiency of Lecturing". Educ. Rev. Birmingham Institute of Education, 
groups, in that students related the small groups higher in assisting
them to compose critical reports, in an experimental project, and in
the general view that the small groups gained more than the large ones.
De Cecco concludes that the students declared preference for being
taught in small groups, and the belief that they benefit more, is
inconsistent with the facts. He assumes a kind of "halo effects"
based on stereo-typed thinking about teaching method. Alternatively,
the student's view may be a reference to the greater "warmth" developed
in small as opposed to the large group.16

Since it was believed that the intellectual differences of the
listeners are much more significant for understanding and retention
of material than are any differences arising because of the nature of
the medium employed, it is only logical to expect research in this
area.

Trenaman attempted to discover possible differences between
various groups in their assimilation of recorded broadcast talks.
The general outcome was the discovery that assimilation and retention
of "talk" material was minimal, even by interested and educated
groups. These conclusions were drawn from a very well designed and

16 De Cecco, J. P. "Class Size and Coordinated Instruction". 
systematic enquiry, where matched samples of listening groups were used and the three different media (television, radio and print) were compared. 17

Once having proved that intellectual differences of listeners are much more significant for understanding and retention than are any differences arising because of the medium employed, various components of effective listening and speed of delivery by the lecturer were investigated. Nichols identified various components of effective listening. These were: previous experience with the material; interest in the expended by the listener; his degree of adjustment to and emotion-arousing points; ability to recognize the central ideas of the discourse; note-taking efficiency; the reconciliation of the speed of reflective thinking by the listener and the speed of delivery by the lecturer. 18

Eisner and Rohde found no significant difference between students who take notes during a lecture and ones who write out summary notes after lecture. Their study covered immediate as well


as delayed recall.  

If students don't benefit much from taking notes of lectures, it is conceivable that they don't benefit very much from attending them. Milton found that 188 students who were examined in psychology without having attended the classes did as well on the subject. He found that attendance or non-attendance made no difference to the percentages of students withdrawing from courses, nor to the proportion of students taking further psychology courses.  

Marr, et al., established that students who attended a course of lectures scored more in the final examination than did other students who attended question-and-answer sessions with the same instructors (no discussion allowed). The authors concluded that lectures make a significant contribution to a college student's education. But if we look at the actual difference between lecture and non-lecture groups, they are so small that we must conclude that a more economic and more effective method could easily be devised for teaching students, replacing the lecture.  

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The lecture method of instruction in large classes seems to be a means of handling the increasing number of students seeking higher education. Informational and factual material can be presented efficiently and economically in large classes; lectures to large classes can serve motivational functions.

As summarized by Gagne: A lecture can accomplish a number of instructional objectives.²²

1. It can establish and augment motivation to achieve.
2. It can inform learners of the expected outcomes of learning.
3. It can attempt to provide prompting and guidance to learning.

Most financial support of public institutions of higher education is based upon the number of students and the credits they earn, therefore, large classes with low cost per student permit other instructional activities which are nearer the ideal of individualized instruction. Therefore, it is important that continuing efforts be made to improve large class instruction.

Maccoby, Nathan and Others indicated that verbal cues contribute significantly to the accuracy of judgment, while the presence of

non-verbal cues specifically visual ones, do not increase accuracy of judgment above chance expectancy. In the second phase of the study there is significant evidence that accuracy in judging student comprehension on the basis of non-verbal cues can be improved. Further, there is no evidence that teachers judge their own students more accurately than they judge other's students, supporting the assumption that visual cues of comprehension are common across students.

Churchill and John compared small lecture-discussion groups with a large lecture class where the instruction was in mathematics. The large lecture class expressed themselves as being less satisfied with the course.

Teaching in small groups does make a difference, as shown by Nachman and OPOCHinsky. In their experiment they compared the scores made by matched groups of students in a lecture course. Even

\[\text{\cite{Maccoby}}\text{,} \text{\cite{Churchill}}\text{,} \text{\cite{Nachman}}\]

\[\text{Maccoby, Nathan, Jon Jecker, Henry Breitrose and Ernest Rose. "Sound Film Recordings in Improving Classroom Communication". Institute for Communication Research, Stanford University, Stanford, California, 1964.}\]


in this case, it should be noted that there were individual differences such that although 13 students in the small (class of 21) group did better than their matched students in the large (150) group, 5 scored the same, and 3 scored less. It should be mentioned also that the actual difference between the groups was quite small, being in the order of 10 percent.

Holloway verified that attendance at lectures adds about 10 percent to 12 percent to the average student gain on multiple choice test. For those not attending the lecture a duplicated handout was available. On the same tests a difference of four percent to six percent in score was found in favor of attendance at morning lectures in comparison with afternoon lectures. But this difference was below statistical significance.

Keeling and Linz found that students preferred the lecture method to a programmed text in Statistics by a two-thirds majority. There was no perceptible difference in effectiveness. This finding is contrary to the results of previous comparisons.


Beach attempted to discover what kind of student benefits most from which kind of instruction. Five different teaching "treatments" were used on 160 student participants. A lecture group of 36, a discussion group of 13, five autonomous groups each of five students who met without an instructor, an independent study group of 24 which did not meet at all, and a control group of 52 sociology students who submitted to the pre- and post-testing without any other treatment were engaged as subjects in this experiment. Using a 60 item achievement test as criterion, Beach discovered that the lecture group performed significantly better than the other three groups. In Beach's study the instructors were allowed to choose the method most congenial to them, but the students were not.

Koening and McKeachie compared a traditional lecture-discussion method with a lecture-small discussion and a lecture-independent study method. In a mixed group of 35 men and 89 women, they discovered that women high in need for achievement preferred independent study and small group discussion to the lecture and large group discussion. The other women preferred the lecture method. They failed to verify their hypothesis that students high in affiliation need

would prefer small group discussion. 29

Tistaert compared the lecture and discussion methods in the teaching of geography. 30 Students in matched groups of 23 were taught by the same instructor. The discussion method was found to be superior in developing "reflective thinking" and retention of subject matter. The superiority of the discussion over the lecture method was demonstrable with both the very bright students and the more ordinary ones.

Eyestone discovered that there was nothing to choose between the methods of a lecture (with and without discussion), a bulletin, or a film in conveying factual information about research findings, except that subjects did better where there was no discussion. Neither was there an advantage in any of the three methods in terms of desirable changes in attitude in the 513 experimental subjects employed in his experiments. 31


Ruja, comparing lecture discussion methods in three college courses, discovered no differences so far as gains in subject matter are concerned: The same applied to gains in emotional and social adjustment. The main differences seemed to be that the students in discussion groups seemed to know a greater number of each others names and graded their instructors more favorably than the lecture groups. 32

Wispe found that most students preferred directive to non-directive teaching. 33 They enjoyed the latter, but did not consider the non-directive courses of much value. The bright students did equally well under both types of teaching but the duller ones benefitted more from directive teaching. The examination results were used as measures.

Ward also compared group study methods with lecture demonstrations. 34 He found that the group method resulted in improved retention of materials, better understanding of the work and the greater

---


expression of individual differences. In the case of academically
superior students. On the other hand, the lecture-demonstration method
produced similar results with the least capable students.

Joyce and Weatherall demonstrated that discussion groups are
superior in that they result in greater knowledge of subject-matter than
do lecture or practical methods of instruction. The least effective
method is unsupervised reading. Since they found that lectures are
only slightly inferior to discussion, and as they are considerably less
time consuming and more economical in the use of staff, they concluded
that the efficiency of the lecture, in terms of results obtained for equal
amounts of work, is highest.

In a second experiment, Joyce and Weatherall matched groups
in a course on the pharmacology of the nervous system and showed no
difference in knowledge when subjected to lectures with demonstrations,
or lectures with practical classes, or conventional seminars. The
students favored demonstrations and seminars. They used the interesting
technique of playing back tape-recordings in the discussion groups,
in the absence of the lecture.

35 Joyce, C. R. B. and Weatherall, M. "Controlled Experiments

36 Joyce, C. R. B. and Weatherall, M. "Effective Use of
Teaching Time". Lancet, 7072, p. 568-571.
Popham randomly assigned 36 students to two matched groups. One was taught by a standard lecture-discussion method, the other listened to hour-long taped lectures and then discussed these with a student leader. The various test used at the end of the course showed that there were no differences of any significance between the two groups. 37

Webb introduced a completely new dimension of thought into the argument about the effectiveness of the lecture as a teaching method. His technique consisted of having students prepared tape-recorded lectures, in four psychology courses. Control groups were subjected to traditional lectures as a basis for comparison. The technique showed promise. 38

In a review of research evidence comparing the lecture discussion method, Wallen and Traver made the following observations:

With respect to immediate mastery of factual information, most studies find no significant differences between lecture and discussion methods . . . . a few studies do report differences usually in favor of the lecture . . . . but not always. Of three studies


which dealt with . . . (the important question of retention) two found retention of material to be superior in groups taught by the discussion method and one found no difference . . . . Further, students of less ability showed greater immediate recall of information under the lecture method whereas the "method" made little difference in such performance on the part of the more able students. It should be noted that all of these studies have been taken at the college level.39

Since large class instruction using the lecture-method—especially when augmented by instructional media—presents the possibility of effectiveness, efficiency, and economy, investigation of the interaction between the instructor, student, and Instructional Media is indicated.

A. A. Lumsdaine says that the presence of the students acts as a stimulus to which the instructor responds by attempting to provide instruction.40 He measures the success of this response by the feedback that he is able to receive from the class. This feedback must be as immediate as possible if future instructor response to the


student stimulus are to be effective. In addition to the benefit of immediacy of response, research has indicated that the knowledge of both the correctness and incorrectness of a particular behavior is the most effective feedback.

Harold J. Leavitt and Ronald A. Mueller has done research which directly considers the problem of feedback from "B" to "A". They say, "Our problem deals with only one of the many relevant variables, the problem of feedback. The question becomes: How is the transmission of information from "A" to "B" influenced by the return of information from "B" to "A"? . . . But when the human being "A" seeks to transmit information to another human being "B", A's own sensory system is hardly an adequate source of information unless "B" takes some action which will help "A" to keep informed of "A's" own progress. 41

One experiment done with the effects of feedback on communication done by Leavitt and Mueller, involved having an instructor describe geometric patterns of students in an effort to have the students recreate these geometric patterns. The experiment was done under four conditions of feedback.

1. Zero feedback in which instructors were hidden from the students and no questions or noises were permitted from the students.

2. Instructor and student could see one another, but no speaking by students was allowed.

3. The students and instructor could see one another, and the student was permitted to give a yes or no response to questions from the instructor.

4. The instructor and students were permitted to ask questions, interrupt and in general freely verbally interact.

The Conclusions:

1. A completion of the circuit between sender and receiver (feedback) increases the accuracy with which information is transmitted.

2. Feedback also increases receiver and sender confidence in what they have accomplished.

3. The cost of feedback is time, but the difference in time between free feedback and zero feedback appears to decrease.

4. A sender and a receiver can improve without what we have defined as feedback experience.
5. Free feedback experience improves subsequent zero feedback trials measurable.

6. Sender experience contributes more than receiver experience to improve accuracy of communications.

7. Zero feedback engenders some hostility in the receiver that becomes clearly perceptible when the situation changes from zero to free feedback. This hostility is short lived, lasting through only one or two free feedback trials.

8. Zero feedback engenders doubt in the sender.

In order to organize and describe the interaction among instructor, student, and instructional media, Carpenter has constructed a three-phase model of the instruction-learning cycle.42

1. Phase one is the display-perception phase.

2. The second phase is learner interaction and response.

3. Phase three requires that conventional testing and evaluating functions be made integral parts of the instructing and learning processes.

Electronic student response systems have been developed to serve Carpenter's phase two (learner interaction and response).

The advantage of an electronic student response system is the ability of it to provide the instructor, directly and immediately, with knowledge of the student's comprehension of the instruction. In the general classroom setting, the instructor knows only by reading students verbal or non-verbal cues or after giving him some kind of test. The electronic student response system will give feedback systematically and immediately.

This system can be used in many ways:

1. It could be used to get responses to questions asked during a lecture presentation. The questions can be designed to elicit student's understanding of the material just presented.

2. The system could allow students to indicate how well they felt they were understanding the material being presented. The code be very elaborate or less elaborate, such as I do, or do not understand. The instructor could continually watch the responses as they are displayed on the instructors console.

As the instructor gets feedback from the class, he should be able to adjust his presentation to fit the needs of the class. If
maximum use of this immediate student response system is obtained, the instructor will change his behavior while the class is in session. This change in behavior should be perceivable by the students and therefore a change in the level of student achievement.

Present electronic student response systems was begun and widely used in the early fifties. Research involving the classroom communicator established that students could accurately and reliably indicate their level of comprehension during a film presentation. Herbert P. Froehlick. 43

Froehlick found out that the instructor could know whether his class was keeping up instead of calling on one or more students. He may now get knowledge of the results from the entire group.

Richard L. Muller stated that the system is based on the premise that feedback to a teacher about student comprehension of his material while it is being presented would allow an instructor to modify his behavior in response to student reactions.

Charles Bridgeman, describing research at the University of California School of Medicine, reported that an instructor using a


lecture response system could sense the need of the class and adjust his presentation accordingly.  

John McNeil used a device to give feedback to student teachers by means of four differently colored lights. Ten student teachers were used and a questionnaire of appropriate teaching procedures were administered to in the students in the classes at the beginning and end of a five-week period. The score on the questionnaire was used as measure and correlations were calculated at the beginning and end of the five week period. One group was taught by a lecture presentation with multiple-choice questions designed to measure the student's comprehension of the lecture presentation. The second group was given the questions but no answer was required of them on the feedback device. The third group was given only the pretest and posttest. No analysis of variance was made. McNeil concluded that correlations of evaluation means for each group indicated that there was no significant change with respect to teaching behavior in either the control or experimental groups.


Martha W. Bradley in a comparison of an electronic student response system with a simple display of colored cards in answer to an instructors questions during a presentation indicated the superiority of the electronic system.\textsuperscript{47} The study concluded that students using the electronic response system achieved higher scores than students using the colored card response. The difference was significant for the end of the semester evaluation instrument. It is believed that the electronic system modified the instructor's behavior to benefit the student more effectively than did the colored cards.

Peyton H. Phillips describes the work of Steve Nelson. Nelson used a student response system then gave his students a questionnaire in which he asked them to give their perception of the use of a student response system with respect to their interest and understanding of subject matter and their involvement and participation in the class activities.\textsuperscript{48} His results indicated that: "Students interest was increased in 73 percent of the students while 77 percent felt an increase increased involvement. An increase in participation was felt

\textsuperscript{47}Bradley, Martha W. \textit{A Comparison of Student Achievement in Experimental Classrooms with Visual Display of Verbal Stimuli and An Electronic or Mechanical Student Response System}. Unpublished Dissertation, Syracuse University, New York, 1968.

by 68 percent of the students, and 78 percent indicated that their understanding of the subject matter had also increased."

F. Craig Johnson and others, in an experiment related to the use of a student response system to provide immediate feedback, instructors were allowed to view video tapes of their teaching presentation while simultaneously viewing a frequency distribution on a five-point scale of teaching effectiveness presented by an array of lighted lamps.49 The instructor could determine at any point in his presentation what the students thought of the presentation. The Experiment was also repeated with peer evaluations of teaching performances instead of student evaluation of teaching performance.

Correlations between peer and student ratings ranged from .47 to .78 indicating that the students could rate teaching performance at least as well as other teachers. The teacher gaining this feedback through the program analyzer initially lost in teaching effectiveness, but gained it back by third session of the treatment.

T. T. Amato and T. H. Ostermeier used student response system as the source of feedback to an instructor during the presentation of

the lecture.\textsuperscript{50} To start with a very simple design, a recent experiment had the members of an audience indicate their agreement, neutrality, or disagreement with speakers by holding up various colored cards. The speakers were beginning students in a public speaking class and the audience were the rest of the students in the class. The experiment utilized secret instructions to members of the audience as to the feedback given to the speaker. Favorable audience feedback seemed to result in a deterioration of delivery as determined by ratings of speech teachers.

\textbf{Summary}

Throughout the research literature, one is confronted with conflicting comments, i.e., students were bored—students were captivated; students learned faster through programmed instruction—students learned faster through television; students learned more—students learned less; students learned better by linear programmed instruction; etc. Because of their varied abilities, interests, and prior experiences some students will learn better and faster in certain subject areas through one mode or combination of modes while other students

will learn better faster in the same subject area through a different mode or combination of modes. The teacher should manipulate the learning environment for each student in order to facilitate learning rather than spend his time presenting the course content which limits the student to one mode of learning. These methods necessitate the efficient utilization of a variety of media and materials for presenting course content: programmed instructional materials, films, slides, demonstrations, face to face lectures, etc. It is not an efficient use of learning time to have a student go through an hour of the stereotyped, textbook form of programmed material when the same learning objectives could be accomplished by having him read a regular textbook for ten minutes or view a five-minute demonstration; or have teachers and students in a lecture situation for an hour when the same learning objectives could be accomplished in 15 minutes through independent study of a programmed text.

Yet, in the classrooms, it is continually assumed that all students are motivated in the same manner with no individual differences. The teacher is the presenter of information, and is generally the focus of attention.

A major factor influencing the use of lecture methods is the absence of any clear research evidence which indicates the superiority or inferiority of the lecture method to other teaching methods.
As can be seen from the foregoing review, the bulk of previous research efforts have primarily restricted itself regarding lecture to: differences between various groups, comparative studies of the lecture, verbal and non-verbal cues, various components as listening, note-taking and lecture comprehension, attendance and achievement, class size, lecture versus discussion and other methods, and use of a student response system to provide feedback.

The literature shows that student feedback to the instructor is not clearly separated from the effect of instructor feedback to the student. The literature leaves unanswered the main question, "What is the potentially significant influence of immediate feedback upon student achievement?" Of course, the related questions as to (1) whether there is an optimum condition in which immediate feedback can effect change and (2) whether the lecturer has any effect on modification efforts also remain unanswered. A shift of the focus of research on these subjects, especially within the realm of education seems to be in order at this time.

In this study five groups were compared to examine the above questions. The following chapter describes the procedures used in an attempt to answer these questions.
CHAPTER III

PROCEDURE AND DESCRIPTION OF THE SAMPLE

The broad purpose of this study was to make an assessment of student feedback as a significant variable for influencing lecturing performance and its influence on student achievement during varied contexts of the lecturing sessions. The main task of this investigation was to determine the responsiveness of the lecturer to immediate feedback, with the use of individual responders and to see if participants who give continuing feedback demonstrate a significantly greater gain in achievement than those who do not provide it. The second task involved the selection of lectures, selection of lecturers and the training of lecturers to work in the system effectively.

The basic methodology for this study involved from a reduction of the complexity of the problem through the use of "Microcriteria" of effectiveness; rather than criteria for the overall effectiveness of teachers. Fundamentally this study is experimental. The investigator decided that the statistical treatment of the data was appropriate for the purpose of this study.
This chapter consists of detailed descriptions of the samples, a complete account of how the data were collected, a discussion of the instruments used, and an overview of the statistical design used to analyze the data, including a listing of the operational or statistical hypotheses to be tested.

After subjects had been registered in the course as part of the regular registration procedure, they were informed that they had been selected to participate in a scientific experiment. They were additionally told that:

1. The experiment was designed to find out how well they learned new material and to evaluate the response system to be used in some large lecture halls.

2. The experiment would not involve any special monetary rewards.

3. Anyone who definitely did not want to participate could and should decline at the outset, but once the experiment was under way it was extremely important that each person continue to the end.

The lecturers in the study were three Graduate Teaching Associates at The Ohio State University. Each instructor was teaching two sessions of Education 435. These particular instructors were chosen because they had two sections of the same subject, the time of the classes did
not conflict so that they could be scheduled with their students and the response system. They also agreed to participate in the study. They were two male and one female instructors. They were all experienced instructors with Education 435 students.

Each lecturer was given a variety of lectures to look over and select the ones they felt most comfortable using as a lecture. A training session of about an hour was conducted for the lecturers. The investigator related his reasons for developing his system and described the rationale for it. Each lecturer was given the scripts the investigator wished him to give. The selection was made from their selections from the general list. The three categories for the lectures were:

1. A lecture where students' attention must be focused on grasping new and surprising concepts and how each factual detail related to those concepts.

2. A lecture where students are required to reflect and evaluate, compare the ideas of the lecture with that of your own.

3. A lecture with a special slant on a very familiar topic.

It so happened that one of the categories was selected by each lecturer. Selecting the topics that fit the category led to a short
discussion on the presentation of the lecture. The lecturers\textsuperscript{51} were given one week to familiarize themselves with the material.\textsuperscript{52}

The pre and post test were questions asked about the selections prepared by the editors of the material, \textit{(Readers Digest)}.\textsuperscript{53} The lecturers did not see the questions or answers.

Of a population consisting of approximately 75 students enrolled in Education 435 (Theory and Practices in the Secondary School) at The Ohio State University during the 1972 autumn quarter, all were selected and used as the sample in this study. The students ranged in age from 19 to 22 years, and school levels ranging from sophomores to juniors in college. The population was randomly divided into five equal size groups, four of which served as experimental and one as control subjects. They were designated, group A, group B, group C, group D, and group E (control). There were approximately 15 in each group.

\textsuperscript{51}The three persons chosen were graduate students during autumn quarter 1972 in the College of Education, The Ohio State University: Charles Bridges, Nancy Zimpher and Timothy Riordon. (Curriculum and Foundations).

\textsuperscript{52}See Appendix B for a transcript of the complete lecture.

\textsuperscript{53}\textit{Readers Digest}, "Help Yourself to Improve Your Reading", Part 1, 2, & 3. Educational Division, Pleasantville, New York.
The experiment was conducted using the student Response System developed by the writer. It was portable and could easily be transported room to room. 54

The courses were not scheduled to accommodate any particular group of students. There was no reason to believe that a particular group of students selected one of the sections in such a way as to create a substantial variation between sections. The students were all general secondary education majors. The courses met for two weeks, then the instructors exchanged groups.

During the first day of each new session, the classes met in a conventional classroom and were given the academic learning task described in Chapter I. The selection of the task was done randomly.

The members of group A were given an academic learning task, (a lecture). They were to listen to the lecture and if they did not clearly understand, or would like to hear a repeat of the statement or phrase, he was to signal by pressing the responder switch at his desk. The responder switch caused a panel at the lecturer's desk to signal with a light. At this point the lecturer repeated the statement or phrase. The lecturer continued to respond to the lights until the

54 See Appendix A for a description of the complete detail of the system.
# Schedule of Classes Used in Experiment

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Group</th>
<th>Time</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Beehive</td>
<td>C</td>
<td>8 AM</td>
<td>C. B.</td>
</tr>
<tr>
<td>&quot;</td>
<td>D</td>
<td>9 AM</td>
<td>C. B.</td>
</tr>
<tr>
<td>&quot;</td>
<td>A</td>
<td>2 PM</td>
<td>C. B.</td>
</tr>
<tr>
<td>&quot;</td>
<td>B</td>
<td>3 PM</td>
<td>C. B.</td>
</tr>
<tr>
<td>&quot;</td>
<td>E</td>
<td>11 AM</td>
<td>C. B.</td>
</tr>
<tr>
<td>On Being Human</td>
<td>C</td>
<td>9 AM</td>
<td>N. Z.</td>
</tr>
<tr>
<td>&quot;</td>
<td>B</td>
<td>10 AM</td>
<td>N. Z.</td>
</tr>
<tr>
<td>&quot;</td>
<td>A</td>
<td>11 AM</td>
<td>N. Z.</td>
</tr>
<tr>
<td>&quot;</td>
<td>D</td>
<td>8 AM</td>
<td>N. Z.</td>
</tr>
<tr>
<td>&quot;</td>
<td>E</td>
<td>12 N</td>
<td>N. Z.</td>
</tr>
<tr>
<td>Genius of Democracy</td>
<td>D</td>
<td>2 PM</td>
<td>T. R.</td>
</tr>
<tr>
<td>&quot;</td>
<td>B</td>
<td>3 PM</td>
<td>T. R.</td>
</tr>
<tr>
<td>&quot;</td>
<td>C</td>
<td>10 AM</td>
<td>T. R.</td>
</tr>
<tr>
<td>&quot;</td>
<td>A</td>
<td>11 AM</td>
<td>T. R.</td>
</tr>
<tr>
<td>&quot;</td>
<td>E</td>
<td>1 PM</td>
<td>T. R.</td>
</tr>
</tbody>
</table>
lecture was completed. A pretest on the lecture was taken before the lecture and the same test was given immediately after the lecture.

The members of group B were given the same academic learning task (a lecture). They were to listen to the lecture and if they did not clearly understand, or would like to hear a repeat of the statement or phrase, he was to signal by pressing the responder switch at his desk. The responder switch caused a panel at the lecturers desk to signal with a light. The lecturer for this group ignores the lights on the panel and continues until the completion of the lecture. They also take a pretest and post test.

The members of group C were given the same academic learning task, (a lecture). They were to listen to the lecturer. They were not allowed to use the responders, ask questions or raise their hands. The lecturer repeated statements and phrases as he deemed necessary. They took the pretest and post test.

The members of group D were given the same academic learning task, (a lecture). They were to listen to the lecturer. They were not allowed to use the responders, ask questions or raise their hands. The lecturer did not repeat statements or phrases. He merely completed the lecture without interruptions. They took a pretest and a post test.

The members of group E were given a pretest on the same lecture as groups A, B, C, and D at the beginning of their normal
Education 435 class. At the end of the period they took the post test.

The instructors (lecturers) were asked not to modify their lecture such as mannerism, gestures, eye contact or tone of voice. This was monitored by the writer.

First, the instructor gave a ten item multiple-choice questionnaire designed to measure how well the students were familiar with the lecture material (pretest). Secondly, for groups A and B the instructor was asked to have the students continually monitor their perceived level of comprehension by pressing the response switch according to the following instructions: "Please indicate how well you are comprehending the material being presented by pressing the switch as soon as you feel you are not comprehending the material adequately."

Since three different instructors participated in the experiment and carried out all five criteria for the lectures, an attempt was made to determine to what extent the results of the student achievement could be generalized.

Student achievement was measured using the pretest - post test results. The mean score on the tests taken was used as the measure of student achievement. The null hypothesis tested was that there would be no differences in the mean scores between the experimental groups and the control group when those scores were adjusted for
the variance. The F-ratio at the 0.05 level of significance was applied.
Also, a t-ratio for Independent Groups was done.

In order to facilitate statistical treatment of the data, the
hypotheses to be tested were simplified into operational terms and
restated in the null form. The resulting experimental hypotheses are
as follows:

Groups A and B

1. There will be no significant differences among the
scores of students who gave feedback to the lecturer
and received a response and students who gave
feedback and did not receive a response.

Groups A and C

2. There will be no significant differences among the
scores of students who gave feedback to lecturer and
received a response and students who gave no feedback
and the lecturer gave responses as he deemed necessary.

Groups A and D

3. There will be no significant differences among the
scores of students who gave feedback to lecturer and
received a response and students who gave no response
and received only the lecture.
Groups B and C

4. There will be no significant differences among the scores of students who gave feedback and did not receive a response and students who did not give feedback and received responses as lecturer deemed necessary.

Groups B and D

5. There will be no significant differences among the scores of students who gave feedback to lecturer and did not receive a response and students who gave no response and received only the lecture.

Groups C and D

6. There will be no significant differences on mean scores between students who gave no feedback and the lecturer gave responses as he deemed necessary and students who gave no response and received only the lecture.

After all the data were collected on each lecture under the four experimental conditions and the control, an analysis of variance was performed on the pretest scores to verify the randomness of the sampling process. An analysis of variance was then performed on the posttest scores to ascertain whether the scores from experimental groups were significantly higher than the posttest of the control groups. Removing the control group scores, a third analysis of variance was
performed to measure whether there were significant differences among the experimental treatments. On those analyses showing significance among treatments orthogonal contrasts were drawn to specify the significant treatment.

This chapter has presented a description of the sample used in the study, an overview of the methodology and design, a detailed discussion of experimental and data collection procedures, and an outline of the statistical procedures used.

A sample of 75 students were divided into five groups. One group was designated as a control and the other four were placed in achievement situations featuring the learning of subject matter under classroom conditions structured to differentially control feedback and contexts of the lecture.
CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

Introduction

This study involved an experiment where the main purpose was to make an assessment of student feedback as a significant variable for influencing lecturing performance. Another purpose was to determine what influence feedback has on student achievement during varied contexts of the lecturing session.

Lecturing, it seems, is here to stay whether it is desirable or not; and actually there is not a great deal of convincing evidence against lecturing. To date most attempts to manipulate the lecture have usually been restricted to class size, organization, time, etc. The present study demonstrates the effects of using class responses as a measure for control.

Since lectures typically provide few opportunities for students to respond, there is little opportunity for students or lecturers to receive feedback except through periodic testing. Delay of feedback may not, however, be a major factor in acquiring knowledge if the
learner is motivated and the material is not too difficult. We would, however, expect lack of feedback to be a greater handicap if the lecturer's goal was to develop concepts or to teach problem-solving skills. There is experimental evidence that when these are the goals, active participation on the part of the learner is more effective than passive listening or observing. Consequently, the passive role of the student in the lecture would be expected to be a handicap in achieving these objectives.

This chapter presents the data obtained from the study and organizes it in relation to the research hypotheses. The statistical design for the study was discussed in Chapter III. The achievement tests described in Chapter III and shown in Appendix B were administered as a pretest at the beginning of each lecture. This instrument was also administered at the end of the lecture.

Concerning the achievement test segment of the assessment, tables are presented. Since the investigation was essentially three replications of the same experiment, the data are treated separately for each lecture.

Analysis of the Data Relative to the Lecture "Genius of Democracy"

Table I presents the analysis of variance on the pretest scores
among all the groups hearing the lecture "Genius of Democracy".

This analysis was performed in order to assess whether the groups were equivalent after the random assignment of subjects. The value of $F$ was 1.44. In order to have a value of $F$ significant at or beyond the .05 level of confidence, a 2.51 value would have to be attained. Thus, pretest differences were not measured among the three groups hearing the lecture "Genius of Democracy".

<table>
<thead>
<tr>
<th>TABLE 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>THE ONE-WAY ANALYSIS OF VARIANCE SUMMARY TABLE FOR GROUPS A, B, C, D GENIUS OF DEMOCRACY</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>1134.1</td>
<td>4</td>
<td>283.52</td>
<td>1.44</td>
</tr>
<tr>
<td>Within groups</td>
<td>12774.5</td>
<td>65</td>
<td>196.53</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>13908.6</td>
<td>69</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$F_{.95} = 2.51$

Table 2 presents analysis of variance on the post-test scores. For those students presented the lecture "Genius of Democracy", the value of ($F = 2.53$) was significant at the .05 level. In order to ascertain the groups from which significant differences were obtained.
TABLE 2
THE ONE-WAY ANALYSIS OF VARIANCE SUMMARY TABLE
FOR GROUPS A, B, C, D AND E (POST-TEST)
GENIUS OF DEMOCRACY

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2511.2</td>
<td>4</td>
<td>627.8</td>
<td>2.53*</td>
</tr>
<tr>
<td>Within groups</td>
<td>16073.1</td>
<td>65</td>
<td>247.2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>16584.3</td>
<td>69</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ F_{.95} = 2.50 \]

* \( P \leq .05 \)

The third analysis of variance presented in Table 3 presents the comparisons among the four experimental treatment groups. The F value from this analysis was 0.34 under conditions requiring an F of 2.79 for significance at the .05 level. Thus, the variance which appeared to be significant can be attributed to the effects of the control group scores being significantly lower than the scores of the groups among the four experimental treatments.
TABLE 3

THE ONE-WAY ANALYSIS OF VARIANCE SUMMARY TABLE
FOR GROUPS A, B, C, D AND E (POST-TEST)
GENIUS OF DEMOCRACY

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>281</td>
<td>3</td>
<td>93.6</td>
<td>.34</td>
</tr>
<tr>
<td>Within groups</td>
<td>14303</td>
<td>52</td>
<td>275.0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>14584</td>
<td>55</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( F_{.95} = 2.79 \)

Analysis of the Data Relative to the Lecture
"On Being Human"

Table 4 presents the analysis of variance on the pretest scores
from those groups hearing the lecture "On Being Human" and the control
group. The value of \( F \) is .50, which is considerably less than the
value of \( F (2.50) \) required for significance at the \(.05\) level. Thus,
there were no measurable differences among the scores on the pretest
of any of the groups, confirming the random assignment of subjects to
treatments resulted in approximate equality of treatment groups.
TABLE 4

THE ONE-WAY ANALYSIS OF VARIANCE SUMMARY TABLE
FOR GROUPS A, B, C, D AND E (PRETEST)
ON BEING HUMAN

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>444.8</td>
<td>4</td>
<td>111.2</td>
<td>.50</td>
</tr>
<tr>
<td>Within groups</td>
<td>14705.2</td>
<td>67</td>
<td>219.4</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>15150.0</td>
<td>71</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F .95 = 2.50

Table 5 presents the analysis of variance on the post-test scores for those subjects who listened to the lecture "On Being Human" and the control group. The value of F (9.67) is greater than the value of F (3.62) required for significance at or beyond the .01 level. Thus, an additional analysis of variance was performed to see whether this significance was accounted for mostly by the presence of the control group's scores.
Table 5 presents the analysis. The results of the analysis of the post-test scores among the four experimental groups was 1.72 which was not significant. Therefore, the primary measurable variance among groups was between the experimental groups and the control group.
TABLE 6
THE ONE-WAY ANALYSIS OF VARIANCE SUMMARY TABLE
FOR GROUPS A, B, C AND D (POST-TEST)
ON BEING, HUMAN

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>1080</td>
<td>3</td>
<td>360</td>
<td>1.72</td>
</tr>
<tr>
<td>Within groups</td>
<td>11714</td>
<td>56</td>
<td>209</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>12794</td>
<td>59</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$F_{.95} = 2.76$

The Analysis of Data Relative to Students Who Heard
The Lecture on "The Beehive"

The pretest scores of experimental and control groups were analyzed with analysis of variance presented in Table 7 in order to ascertain whether random assignment to treatments resulted in approximate equality. The value for F produced (.68) was considerably less than the value of F (2.50) required for significance. Thus, there were no significant differences in the pretest scores among all the groups.
TABLE 7

THE ONE-WAY ANALYSIS OF VARIANCE SUMMARY TABLE
FOR GROUPS A, B, C, D AND E (PRETEST)
THE BEEHIVE

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>536.2</td>
<td>4</td>
<td>134.05</td>
<td>.68</td>
</tr>
<tr>
<td>Within groups</td>
<td>12751.0</td>
<td>65</td>
<td>196.16</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>13287.2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F.95 = 2.51

An analysis of post-test scores was conducted to determine if there were significant differences among the post-test group scores.

Table 8 indicates the value for F of 13.27 was derived which is significant beyond the .01 level of confidence.

TABLE 8

THE ONE-WAY ANALYSIS OF VARIANCE SUMMARY TABLE
FOR GROUPS A, B, C, D AND E (POST-TEST)
THE BEEHIVE

<table>
<thead>
<tr>
<th></th>
<th>E_A</th>
<th>E_B</th>
<th>E_C</th>
<th>E_D</th>
<th>E_E (control)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N:</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>M:</td>
<td>84.0</td>
<td>92.6</td>
<td>93.3</td>
<td>90.8</td>
<td>70.0</td>
</tr>
<tr>
<td>SD:</td>
<td>9.85</td>
<td>6.79</td>
<td>8.99</td>
<td>8.05</td>
<td>10.80</td>
</tr>
</tbody>
</table>
TABLE 8—Continued

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>5128.7</td>
<td>4</td>
<td>1282.17</td>
<td>13.27**</td>
</tr>
<tr>
<td>Within groups</td>
<td>6278.5</td>
<td>65</td>
<td>96.59</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>11407.2</td>
<td>69</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F.99 = 3.62

** P .01

An analysis of variance was done among the four experimental treatment groups, and presented in Table 9. The value for F resulting from this analysis was 2.96 which is greater than the F of 2.78 required to indicate significance at the .05 level. Thus it indicates that there is at least one significant pair wise contrast among the five groups. A post hoc analysis demonstrated Group E, the control, was significantly different from the other four groups. That is, Group E subjects displayed inferior knowledge of the content, compared to subjects in the four experimental treatment groups.
TABLE 9

THE ONE-WAY ANALYSIS OF VARIANCE SUMMARY TABLE
FOR GROUPS A, B, C AND D (POST-TEST)

THE BEEHIVE

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>819</td>
<td>3</td>
<td>273</td>
<td>2.96*</td>
</tr>
<tr>
<td>Within groups</td>
<td>4880</td>
<td>53</td>
<td>92</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>5699</td>
<td>56</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F.95 = 2.78

* P .05

t-Ratio for independent groups were drawn between each pair of experimental treatments. The results of these pair comparisons are presented in Table 10.

TABLE 10

A t-RATIO FOR INDEPENDENT GROUPS

THE BEEHIVE

POST-TEST

<table>
<thead>
<tr>
<th>Group</th>
<th>No.</th>
<th>Mean</th>
<th>Variance</th>
<th>df</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>15</td>
<td>84.0</td>
<td>97.14</td>
<td>28</td>
<td>2.78**</td>
</tr>
<tr>
<td>B</td>
<td>15</td>
<td>92.6</td>
<td>46.22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>15</td>
<td>84.0</td>
<td>97.14</td>
<td>28</td>
<td>2.70*</td>
</tr>
<tr>
<td>C</td>
<td>15</td>
<td>93.3</td>
<td>.8095</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TABLE 10—Continued

<table>
<thead>
<tr>
<th>Group</th>
<th>No.</th>
<th>Mean</th>
<th>Variance</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>15</td>
<td>84.0</td>
<td>97.14</td>
<td>25</td>
<td>1.93</td>
<td>P &gt; .05</td>
</tr>
<tr>
<td>D</td>
<td>12</td>
<td>90.8</td>
<td>62.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>15</td>
<td>92.6</td>
<td>46.22</td>
<td>25</td>
<td>0.66</td>
<td>P &gt; .05</td>
</tr>
<tr>
<td>C</td>
<td>15</td>
<td>93.3</td>
<td>80.95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>12</td>
<td>90.8</td>
<td>62.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>15</td>
<td>92.6</td>
<td>46.22</td>
<td>25</td>
<td>0.63</td>
<td>P &gt; .05</td>
</tr>
<tr>
<td>D</td>
<td>12</td>
<td>90.8</td>
<td>62.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>15</td>
<td>93.3</td>
<td>80.95</td>
<td>25</td>
<td>0.75</td>
<td>P &gt; .05</td>
</tr>
</tbody>
</table>

Among all the contrasts subjects in group A demonstrated significantly inferior performance than subjects in group B and group C on the posttest. Group A gave immediate anonymous feedback and the lecturer responded by repeating. Group B gave immediate anonymous feedback and the lecturer did not respond. Group C did not give feedback and the lecturer completed the lecture without interruption.

The null hypotheses which compared group A and group B stated there will be no significant differences among the scores of students who gave feedback to the lecturer and received a response and students who gave feedback and did not receive a response. This hypothesis is rejected by the statistical analysis (P > .01). And thus one can infer that students who provided feedback who did not receive
a response scored higher on the post-test than those students who provided feedback and received the response of repetition of parts of the lecture.

Similarly a significant contrast was found between groups C and A. The null hypothesis states: There will be no significant differences among the scores of students who gave feedback to the lecturer and received a response and students who gave no feedback and the lecturer gave responses as he deemed necessary.

This hypothesis was rejected and thus the inference is made that the students who provided no feedback to the lecturer but received responses from the lecturer as the lecturer determined to be appropriate scored higher on the post-test than those students who provided feedback and heard repetitions of portions of the lecture based on that feedback.

Summary

On two of the three lectures, "On Being Human" and "Genius of Democracy", there was significant learning on the part of the students who heard the lecture; but there was no measurable difference in learning under the four experimental treatments.

In the lecture "The Beehive" there was learning because of the lectures, but also there were significant differences between those
learners who provided feedback to the lecturer and received a response of repetition of a portion of the lecture. Two other conditions in which students provided response (feedback to the lecturer) but received no response from the lecturer and students who were not able to provide feedback to the lecturer but who heard the lecturer provide repetitions of portions of the lecture that the lecturer thought were appropriate scored higher comparison-wise. In each case those students who both provided feedback and received responses scored lower on the post-test than students who were either given no response or not given the opportunity to provide feedback.
CHAPTER V

SUMMARY

Introduction

This study investigated the influence of feedback on achievement during varied contexts of lecturing sessions. The study involved an experimental design in which 75 students in Education 435 at The Ohio State University were randomly divided into five technique groups and used as the sample. One group served as control and the other four were placed in separate achievement situations consisting of a special learning task under classroom conditions designed to differentially reinforce their orientation to the task.

The study involved an experiment whose main purpose was to make an assessment of student feedback as a significant variable for influencing lecturing performance. Another purpose was to determine if feedback influences student achievement during varied contexts of the lecturing session.

The major hypotheses were: Students who have opportunity to provide feedback during a lecture session will achieve greater gains on
a test than students who do not have opportunities to provide feedback to the lecturer. And, lecturers who modify their oral performance from ongoing student feedback will effect greater gains in student test achievement than lecturers who do not modify their lecture.

This study reduced the complexity of the problem by using program material (lecture) as a technique by which modification was made. This study involved an assessment of student feedback (student pressing a switch which lighted a panel) as a significant variable for influencing the lecturer's performance (repeating a statement or phrase).

Each lecturer was given the scripts the investigator wished him to give. The lecturers were given one week to familiarize themselves with the material.

Of a population consisting of approximately 75 students enrolled in Education 435 (Theory and Practice in the Secondary School) the students ranged in age from 19 to 22 years, and school levels ranging from sophomores to juniors in College. The population was randomly divided into five equal size groups, four of which served as experimental groups and one as a control group. They were designated, group A, group B, group C, group D and group E (control).

The members of group A were given an academic learning task (a lecture). They were to listen to the lecture and if they did not clearly understand, or would like to hear a repeat of the statement or
phrase, they were asked to signal by pressing the responder switch at his or her desk. The responder switch caused a panel at the lecturer's desk to signal with a light. At this point the lecturer repeated the statement or phrase.

The members of group B were given the same academic learning task (a lecture). They were to listen to the lecture and if they did not clearly understand, or would like to hear a repeat of the statement or phrase, they were to signal by pressing the responder switch at their desk. The responder switch caused a panel at the lecturer's desk to signal with a light. The lecturer for this group ignores the lights on the panel and continues until the completion of the lecture.

The members of group C were given the same academic learning task (a lecture). They were to listen to the lecturer. They were not allowed to use the responders, ask questions or raise their hands. The lecturer repeated statements and phrases as he deemed necessary.

The members of group D were given the same academic learning task (a lecture). They were to listen to the lecturer. They were not allowed to use the responders, ask questions or raise their hands. The lecturer did not repeat statements or phrases. He completed the lecture without interruptions.

The members of group E were given a pretest on the same lecture as group A, B, C, and D at the beginning of their normal
Education 435 class. At the end of the period they took the post-test.

A pretest on the lecture was taken before the lecture and the same test was given immediately after the lecture.

The data was obtained for the research hypotheses. Each hypothesis dealt with the singular and combined effects of the lecture context and student achievement. These hypotheses were tested by means of an analysis of variance.

On two of the three lectures, "On Being Human" and "Genius of Democracy", there was significant learning on the part of the students who heard the lecture. But, there was no measurable difference in learning under the four experimental treatments.

In the lecture "The Beehive" there was learning because of the lectures, but also there were significant differences between those learners who provided feedback to the lecturer and received a response of repetition of a portion of the lecture.

Two other conditions in which students provided response (feedback to the lecturer), but received no response from the lecturer, and students who were not able to provide feedback to the lecturer, but who heard the lecturer provide repetitions of portions of the lecture, scored higher comparison-wise. In each case those students who both provided feedback and received responses scored lower on the post-test than students who were either given no response or not given the opportunity to
provide feedback.

This investigation produced some evidence that student achievement was affected by student and lecturer feedback through the use of student response system. The results of this investigation indicated that the effect of systematic student response varied significantly for the different lectures and therefore generalizations to other lectures should be made with caution. Within this limitation, the results do not support the hypothesis that the achievement of students on pretest-post-test examination was effected by the feedback system.

Implications

The lecture is open to serious criticism if used as an all-purpose teaching method. The lecture has its own specific virtues as a teaching method. The lecture method enables one to achieve ends with the utmost economy of means.

The art of lecturing is a difficult one. To achieve the required standard of performance it seems obvious that training and practice are essential. The lecturer needs to have at his disposal a variety of skills which do not come together as a result of natural endowment. There are, of course, ways of energizing the lecture and improving its efficiency. It is even possible to humanize the system by incorporating ancillary techniques.
The feedback technique developed and used in this study was adequate to the demands placed on it. And similar techniques are recommended for similar studies.

The use of this system allows the student freedom from recognition by his peers. The apprehensiveness of the asking of a question is not there which may cause distraction within the group.

The most direct and outstanding implication to be derived from the study is that one of the most vital areas of instruction, the one which needs most the development of those skills and attitudes that are learned through teaching method, is the process of lecturing.

If lecturing is needed, at all levels and in all areas, what exactly is lecturing? This question is not so simple as it may appear and there are many variations to the answer. As is the case with any teaching method, there are problems involved. One of the basic difficulties lies in the fact that most lecturers simply do not possess the skills necessary to promote maximum grasping of material. With studies of this nature a lecturer can determine the relative importance of facts, grouping of behaviors, those that must be considered, and with what type of material.

The implications presented above are derived from this study and subject to its limitations. Many of the implications, however, seem applicable to other aspects of the study of lecturing.
Discussion

This study involved an assessment of student feedback (student pressing a switch which lighted a panel) as a significant variable for influencing the lecturer's performance (repeating a statement or phrase).

The investigator was able to develop a rapport with the students and they seemed eager to relate to the investigator. There is some question as to whether repeating is considered desirable feedback should a question arise in the student's mind causing him to signal for a response. This inference was supported by remarks made by students themselves when interviewed by the investigator. This was an informal interview after the session.

It is also important to note here that the investigator noticed a sense of apprehensiveness during the sessions when the lecturer repeated the statement or phrases. This behavior is understood as dissatisfaction with the lecturer's feedback when students signaled. An influential variable which was not measured was the effect and impact on students who heard statements repeated by the lecturer when other students had requested feedback. The effects on students who have to endure lecture clarifications given for other students is unknown.


Recommendations for Further Research

The results of this study show that feedback using a response system as a technique for modifying lecture sessions can be useful. The results are inconclusive, however, and further study of the area of lecturing behavior are needed.

The findings from the present study suggest the following recommendations for further research.

1. Two possible factors are suggested to account for the ineffectiveness of the response system procedures in achieving greater achievement scores by students. These factors are (1) the relative brevity of the period of the experiment (even though the technique represented a concentrated effort), and (2) the relatively small proportion of the possible lecture contexts. Further research on the system within the school should cover a longer period of time (at least a quarter or more and involve the complete context of a course). It would appear that large lecture halls would lend themselves well to such an effort.

2. Modification of the response system should be made. As the students indicate whether or not they feel they are understanding the presentation, these scores could be periodically recorded. This might show differences or levels of understanding such as percentages
of responses indicating that the students feel they are understanding. This sort of investigation would give more support to whether the lecturer is actively responding to the feedback he is receiving.

3. A further investigation might determine if the student's feedback to the lecturer changed more or less for the less able students.

As to the main question which gave occasion to this study as to the influence of student feedback on achievement during varied contexts of lecturing sessions, there is still no conclusive answers as to how feedback might be useful as to influence student achievement within the school setting. The study did suggest, however, that the perceived possibility of feedback in an academic situation tends to influence certain patterns of achievement with certain types of lectures. It is hoped that this study will encourage further investigation into techniques of modifying student-teacher communication.

Chapter Summary

This chapter has summarized the present investigation. It inferred from the study that student achievement was affected by student and lecturer feedback through the use of a student response system in one of three types of lectures.

Implications derived from the study suggest that perceived possibility of feedback in an academic situation tends to influence
certain patterns of achievement with certain types of lectures. It is also implied that with studies of this nature a lecturer can determine the relative importance of facts, grouping of behaviors, those that must be considered.

Recommendations for further research included the need for more research in the area of modification of the response system. This might show differences or levels of understanding such as percentages of responses indicating that the students feel they are understanding. This sort of investigation would give more support to whether the lecturer is actively responding to the feedback he is receiving.
APPENDIX A

THE RESPONSE SYSTEM
THE RESPONSE SYSTEM

Complete System

The complete system is illustrated in (figure 1). The system consists of two portions. These are the instructor's console and the student units. The wiring has been designed around groups of not more than five seats. The five seats need not necessarily be in one row. For the instructor, the seat identification may or may not be directly correlated to his console display or of the student's names. He can connect the responders to a particular student's name or seat light. The seat and light correlation is of little value to the lecturer. At each of the locations, there is a student unit (figure 3). Through student units an electronic signal causes a light to glow on the instructor's console (figure 2).

Instructor's Console

The instructor's console, (figure 2), is placed so that it is convenient for the instructor. It is through this unit, the control center of the entire system is controlled and the determination of the level of understanding of his class. The major portion of the display
panel is an array of small lights having the same configuration as the students' seating positions. This light pattern indicates whether or not the students wish a statement or phrase repeated. The miniature light bulbs used in this panel operate at a very low voltage that assumes very long life expectancy and safety. The main power is controlled by a transformer. The corresponding indicator lights on the instructor's console will light when the activation switch has been pushed indicating that a student has set his unit to transmit the signal.

**Student Unit (Figure 3, Full Size)**

At each student position, there is located a student unit. When the switch is in the on position, the instructor's display console lights, which shows that a repeating of the phrase or statement is desired. In either position the light is on or off, and remains until the student moves the switch. The light is only visible to the instructor. The student does not have assurance that his request has been entered into the system.
FIGURE 1—STUDENT RESPONSE SYSTEM
FIGURE 3

STUDENT UNIT

INSTRUCTOR'S CONSOLE DISPLAY

FIGURE 2
When the public opened its favorite almanac for the year 1733, it found a newcomer among the usual weather news and herb remedies. His name was Poor Richard. He was poor only in purse, not in wit, good cheer or good sense. His sayings were to make men smile now and then. "Three removes are as bad as a fire." "A house without a wife and firelight is like a body without soul or sprite." This poor scholar supposedly handed in his copy to the printer, one Benjamin Franklin.

With each year the fame of Poor Richard's Almanack grew by leaps and chuckles. Soon 10,000 copies a year were sold—one to every hundred Americans. There were probably ten times that many readers. Some of these wrote Richard to ask how he could keep on pretending to be poor. Richard took revenge on the man who created him by answering that Benjamin Franklin, printer, editor, author, humorist, moralist and businessman, was in himself a whole crowd of men. But Poor Richard and Benjamin Franklin are far from being the same person. Richard was thrifty. Ben enjoyed his money when he had it, though he was the same generous, contented man without it. Richard believed in temperance and silence. Ben loved wines and talk. These are some of the human weaknesses of the most human of great men. Ben—of—all—trades.

Benjamin Franklin was born in Boston in 1706, of what he called the "middling people". His father was a candlemaker. His grandfathers before him had been honest farmers of Oxfordshire, England. Ben's mother was a tidy Nantucket woman. Her mother had come to this country as a servant. Ben grew rich and famous without ever feeling that he need rise higher than the honest folk who made him.

No learned man ever learned less from school. He had only two years in school. Later, he taught himself mathematics, French, Spanish and Italian.
In fact, Franklin taught himself almost everything that ever entered his mind—except printing. He learned printing while working for his older brother, James, who was then the best printer in America. Ben was soon an expert, too. Because James was jealous and Ben was independent, the younger brother ran away to Philadelphia at the age of 16.

Ten years later Benjamin Franklin was the best and biggest printer in America. He printed almanacs, religious books, textbooks, reprints of classics and the best in current English literature. He did all the government printing for Pennsylvania, Delaware, Maryland and New Jersey. He had founded the first German-language newspaper in this country. He was editing the magazine that later became The Saturday Evening Post.

Within 20 years Ben Franklin became Philadelphia's most important citizen. He was clerk of the colony's Assembly, alderman of the city's Common Council, and organizer of the first fire brigade. A few years more, and he was founder of the Philadelphia Academy, the colony's postmaster and its most powerful politician behind the scenes.

He had started the American Philosophical Society, formed to link scientists together. Many of the most famous names in our scientific history are on its rolls.

Franklin also had invented a stove that gave twice as much heat for a fourth as much fuel. The Franklin stove made the inventor's own name as familiar as that of Poor Richard.

When he was 40, world fame burst upon him. From a traveling "professor," he bought a bit of parlor magic. It was a jar for condensing electricity produced by rubbing with the hand. Only a small boy would have taken the "magic" apart to see what made it work. Only a philosopher would have succeeded. With so much of both in him, Ben Franklin in a few months found out more about electricity than all scientists before him.

Benjamin Franklin was the first man ever to understand that electricity is a current. He was the first to conduct an electric current where he wished and the first to understand that electricity is energy. Before him, no man ever turned a wheel by electricity or made a bell ring by it.
Franklin's experiments startled European scientists and brought him degrees from the greatest universities, carrying with them the title of "Doctor" Franklin. But more, Franklin's genius started the electrical age.

Ben wished that he could wake up every hundred years after his death to see how his country was getting on. Could he do so now he would find his people living by electricity. How he would chuckle with delight!

In 1753, Franklin was appointed Postmaster for all the American colonies. Mails were few, slow and uncertain. Franklin started a system of accounting that the simplest postmaster could use. In a short time his department showed a profit, and the mails were traveling day and night every day in the year between the principal cities. Franklin's improved mail service did more than anything else to link together the colonies for their coming struggles.

When General Braddock came over from England with his Red-coats to fight the French and Indians, he could not get the wagons he needed. Franklin in two weeks collected 150 wagons, complete with horses and drivers. He loaded them with supplies and sent them to the grateful commander.

After Braddock's defeat, the colony lay open to French vessels by sea and Indians on the frontier. Ben Franklin organized the first militia, serving in it himself as a common soldier who shouldered a musket. He got up a lottery and bought cannon with the money raised. He worried the Assembly into arming the Colony.

When some hotheads took revenge for Indian outrages by killing the women and children of peaceful Indians, these red men fled to Philadelphia. They were followed by a howling mob. The Governor called on Franklin to take command of the militia and put down the riot. Instead, Franklin went out unarmed to meet the crowd. With words alone, he turned it back. As he wrote to a friend in London: "Within 24 hours your old friend was a common soldier, a councilor, a kind of dictator, and ambassador to a country mob and, on his returning home, a nobody again."

This "nobody" was sent to London in 1764. There he stood up to Parliament, King and the ruling Tory class. He spoke for the rights first of Pennsylvania and then of all the colonies.
Franklin’s appearance before Parliament in 1766 to fight the hated Stamp Act became famous. He never grew angry and always replied in two or three clear sentences. His facts unshakable, Franklin in one day answered 174 questions. To its own surprise, Parliament repealed the Stamp Act quickly.

Franklin’s testimony, spread in print all over Europe and America, made him one of the great politicians of the age. The world for the first time heard the true voice of America.

After 11 years, Franklin left England just a month before the mother country and her colonies came to blows. In the hot first days of July 1776 the Continental Congress met in Philadelphia. Franklin was appointed with Adams and Jefferson to draw up the Declaration of Independence. Although Jefferson is the chief author of it, Franklin changed some of the wording. He made it calmer and more exact in many places.

Now what the newborn nation needed was recognition and help by foreign powers—above all by France, then the foe of England. To Franklin fell the task of getting great loans out of the almost empty treasury of Louis XVI. The infant nation had no credit or security, but Franklin got the loans.

Even when Washington was defeated on Long Island, even when the British took Philadelphia, Franklin could get fresh loans. He succeeded because he was Benjamin Franklin, the "good Doctor". Honest men found him honest. Scheming men found him smarter than they were. Learned men found him scholarly. Simple men found him one of themselves.

Benjamin Franklin is probably the most able diplomat we have ever had. To him more than to any other man, Washington and Lafayette not excelled, was due the treaty with France. This treaty cheered the troops at Valley Forge, and, in the end, brought victory to the American Revolution.

At last Franklin was presented at Versailles as the ambassador of a recognized national. He appeared not in the satin and wig and sword of fashion but in his old brown coat, carrying his walking stick. He wore his square-rimmed spectacles, and his gray hair flowed out from under his fur cap.
After Yorktown, at the peace talks, Franklin was ahead of every trick of foreign politicians. He got America the boundaries she asked for—west to the Mississippi. He won the peace as definitely as Washington won the war.

The roar of cannon announced his return to the United States. Bells rocked their steeples. Every organization in Philadelphia turned out to greet the treat civilian hero of the American Revolution. The Union Fire Company, which he had founded 50 years before, contained only four other members of the original roll call. They were there to welcome him. Franklin told them that he would have his bucket and axe in order by the next meeting.

Elected to the Pennsylvania legislature, Franklin was soon in its president's chair. There, though he was rich and old now, he remained a liberal. He was eager to protect small groups and always put human rights ahead of property rights.

These principles he brought with him to the convention that met in 1787 to draw up a Constitution for the United States. Long before, Franklin had declared that the colonies should form a union. Now the living spirit of our nation was to be given a body.

Tempers flared those hot days. Over and over, Franklin's good humor restored better feeling. Like Lincoln, he had a habit of turning away anger by telling a funny story. Thus he did much to keep the convention from failure.

Franklin successfully fought property as a qualification for voting or officeholding. In the end it was he who untied the convention's worst knot. The big states wished proportional representation—that is, representation according to population. The little states wished equal votes for all.

For weeks the delegates were deadlocked. Then the plan was proposed that is built into our system of government. This plan permitted proportional representation in the House but equal representation in the Senate. It was Franklin who put through the plan.

At last those farseeing eyes of Franklin's began to fail. So he invented bifocal lenses. He grew too old to climb up for a book on the top shelf. So he made the hook and pole still used today in libraries and groceries. In 1790, when death came as a not unwelcome visitor, he was 84.
Behind him he left a special gift of 2000 pounds to help scholars and research in Boston and Philadelphia. In many cases these were loans to be repaid with interest. By now this little nest egg of Franklin's has grown to several million dollars. Also, 100 pounds was willed to provide silver medals for outstanding boy scholars in the high schools of Franklin's Native Boston. About 30 medals a year are awarded.

The boy who lived to become a printer, editor, humorist, inventor, scientist, businessman, lawmaker, diplomat, patriot, and many-sided genius is thus still hopefully looking for some American lad of today to fill his square-buckled shoes.
Pretest – Post test

Genius of Democracy

Test No._________ Type_________ Name_________________

UNDERLINE THE BEST CHOICE TO COMPLETE EACH STATEMENT.

1. The lecturer's chief point is that Benjamin Franklin was
   (a) a poor boy who became rich, (b) a famous person when he
died, (c) a man who put his many talents to good use,
   (d) an American whom Europeans liked and respected.

2. Franklin performed outstanding service to his country in all
   but one of the following ways: (a) U. S. Ambassador to
   France, (b) member of the Convention that drew up the Consti-
tution of the United States, (c) Commander in Chief of the First
   Militia, (d) co-author of the Declaration of Independence.

3. Franklin fought for all but one: (a) the rights of small groups,
   (b) ownership of real estate as qualification for voting,
   (c) improvement of the mail service, (d) proportional representa-
tion in the House of Representatives.

4. Poor Richard was poor only in one: (a) good cheer, (b) purse,
   (c) good sense, (d) wit.
5. Franklin went to England in 1766 to (a) borrow money, (b) display his experiments in electricity, (c) fight the Stamp Act, (d) buy a printing press.

6. Franklin served as all but one of these: (a) President of the United States, (b) alderman, (c) postmaster, (d) clerk of the assembly.

7. Richard believed in **temperance**. Temperance here means (a) living in a mild climate, (b) moderate or no use of alcoholic drinks, (c) keeping one's temper, (d) manufacturing steel.

8. If for weeks the delegates were deadlocked, they were (a) imprisoned, (b) unable to reach agreement, (c) seriously ill, (d) slow about writing a law.

9. Franklin's influence lives today in all but one: (a) woman sufferage, (b) loans of money to needy scholars, (c) silver medals awarded to outstanding high school students, (d) gifts of money to pay for research.
San Francisco was almost destroyed by earthquake and fire on the morning of April 18, 1906. Thousands of refugees were struggling to get out of the burning city, but a man with rumpled hair, keen eyes and a hawklike nose came into the city on the only train to reach it that day. The remarkable arrival was William James, who was then teaching at nearby Stanford University.

Though he was in his 64th year, James spent the next 12 hours scrambling amid roaring flames and falling buildings. Notebook in hand, he eagerly questioned the panic-stricken inhabitants. "How did you feel when the shaking began?" "What thoughts flashed through your mind? Did your heart beat any faster?"

This passion for delving into human experience made William James one of the most stimulating and influential Americans who ever lived. He was the founder of modern experimental psychology, an original philosopher, a great teacher and an even greater human being.

Experiment! Explore! Change! Grow! That is the heart of his teaching and also of his own personality. All his life William James was driven by an enormous curiosity to learn about every aspect of human life. His teachings stressed self reliance and creative character-building.

His ideas and his style were exciting. At Harvard, where he taught for 35 years, students frequently followed him down the street after class. They eagerly continued the discussion of points he had raised in the classroom, and generally wound up at his home for lunch or dinner.

He was famous for the wit and charm of his lectures. His illustrations were often so comic that on one historic occasion a student interrupted a learned discussion with, "But, Doctor! Doctor! To be serious for a moment ... !" James loved to tell this story on himself.
James' lively personality was of his own making. Always frail in health, he was dragged around Europe and America by his restless father and never stayed in one school longer than a few months. As a boy he suffered periods of depression so deep that he thought of suicide. In later life he strained his heart so badly that he was almost an invalid. There were times when even the exertion of writing a letter would send him to bed for the rest of the day.

His struggle to overcome these handicaps was always in his mind as he lectured on psychology. As one result of the struggle, he has left us much practical advice. He showed us how to live our lives better, how to spend our energies usefully, and be productive and creative at our work.

Control your emotions by your actions. You can easily demonstrate to your self one of James' most important discoveries. Stand in front of a mirror, double up your fists, scowl with anger and think about someone whom you bitterly dislike. In a minute you feel rage rising.

James discovered that when you clench your fists, your brain automatically gets signals from your hands which say, in effect, "The situation is tense. Get ready for trouble." When you smile or weep, the brain gets happy or sad signals from your facial muscles. And so the things you do help determine the way you feel. You are angry at least partly because you strike a blow; you are afraid partly because you run away.

This scientific discovery has great practical value. "To feel cheerful," James says, "sit up cheerfully, look around cheerfully and act as if cheerfulness were already there. To feel brave, act as if we were brave, and the emotion of courage will very likely replace fear."

Build your own character. James was one of the first psychologists to hold a theory now widely accepted. He believed that every physical sensation, every contact with the outside world, leaves a permanent trace among the ten billion cells of the brain. This is because electrical currents, in a way not yet fully understood, record all that has happened to us by creating pathways among the cells of the brain.

Therefore, James tells us, it is a form of insurance to make only desirable pathways in our brains.
"We are spinning our own fates, good or evil, and never to be undone," he wrote. "Every smallest stroke of virtue or of vice leaves its never-so-little scar." According to James, nothing we do is ever really wiped out.

**How to break a habit.** The most familiar of James' ideas--one that has profited thousands--is his advice on overcoming bad habits. Break off suddenly and with all possible emphasis, he said. Let everyone know about it, and never let an exception occur.

**Do something hard every day.** "If we often fail to make an effort, before we know it the effort making capacity will be gone," said James. "If we allow the wandering of our attention, soon it will wander all the time.

For this reason it is necessary to "keep the faculty of effort alive in you by a little gratuitous exercise every day. Be systematically ascetic or heroic in little unnecessary points. Do every day or two something for no other reason than that you would rather not do it, so that when the hour of dire need draws nigh it may find you not unnerved and untrained to stand the test."

**Learning isn't always fun.** James agreed only partially with the ideas of some later educators that the most successful education comes from the natural interest of the pupil, who learns in the course of satisfying his curiosity.

James said, "It is nonsense to suppose that every step in education can be interesting. The fighting impulse must often be appealed to. Make the pupil feel ashamed of being scared at fractions, of being 'downed' by the law of falling bodies; rouse his pugnacity and pride, and he will rush at the difficult places with a sort of inner wrath at himself that is one of his best moral faculties. A victory scored under such conditions becomes a turning point in his character."

**Live up to your better self.** James made a habit of expecting every individual to live up to his better self, as he did. "If you will believe well of your fellow men," he said, "you may create the good you believe in." This worked surprisingly often. Students and other professors tried to live up to the good that James thought of them.
The whole meaning of James' teaching is that man can rise above circumstances that we are not the victims of heredity and environment. We can, by courage and self-discipline, improve not only our output but our very character.
1. At the San Francisco earthquake, James (a) helped refugees to flee, (b) asked individuals how they felt, (c) rescued several persons.

2. James' students considered him (a) a great teacher, (b) humorless, (c) too strict.

3. James' advice is especially noted for being (a) unusual, (b) difficult to follow, (c) practical.

4. In order to feel cheerful, according to James, (a) avoid annoying situations, (b) look cheerful, (c) get plenty of sleep.

5. To break a habit, James recommended (a) slowing down gradually, (b) stopping suddenly, (c) relaxing.

6. James advised people to do something every day that they would rather not do, so that (a) they can do their work more efficiently, (b) people will like them, (c) they will be prepared to meet crises.

7. James believed that teachers must sometimes appeal to their pupils' (a) envy and temper, (b) greed and pride, (c) pride
and fighting instinct.

8. One of James' principles was that we should (a) not expect much of human beings, (b) expect people to do what is right, (c) be prepared for some people's dislike.

9. As a boy, James (a) was very vigorous, (b) was deeply anxious, (c) was generally happy.

10. The chief message of James' teaching is that our characters (a) are determined by heredity, (b) are determined by the happenings of childhood, (c) can be improved by our own efforts.
Lecture III

The Beehive
(Jean George)

The tiny honeybee dived onto a blue alfalfa blossom and began to drink nectar. Glistening on her back as she drank was a red dot, placed there by a scientist. After her drink the bee turned her eyes toward the sun, took a bearing on it and started home. At her hive a quarter of a mile away, the scientist was waiting, for this honeybee might well add to the facts being found in new and amazing bee research.

Today the beehive is no longer thought of as a mere collection of insects: it is considered a single organism of many glittering parts. An infant when it is swarming, the hive progresses through adolescence to maturity, gives birth to new swarms, finally settles down into the quiet of winter. A wounded or starving hive can actually suffer, moan in agony and then, in its drive to live, repair itself by a healing process like that of any other feverish creature.

This concept is founded on a set of amazing discoveries. Any single bee, it is now known can grow old quickly or grow young! The sterile can lay eggs; the old can rejuvenate glands that have dried up. A single bee can, in short, do the "impossible," in order to maintain the wholeness of the hive.

To understand the new bee research we should look into a typical wild hive inside a hollow tree. There is always a main entrance with several combs of shining waxen cells hanging inside the door. Some combs contain honey, others hold pollen. A third type of comb, the brood comb, contains the larvae—young bees in the wingless and footless state. Each hive has one queen, a large bee that lays up to 3000 eggs a day. There are also a number of drones who exist only to mate with the young virgin queens as they hatch during the hive's sexually productive time of life.

Most of the other 20,000 to 40,000 bees in a hive are "workers" who perform a variety of tasks. One task is nursing: feeding protein-rich "bee milk"—formed by special glands in the nurse bee's head—
to the queen and the larvae. Making wax is another. In this process, the bees eat honey which is changed by special glands into beeswax. With the spines on their hind legs, they pick up wax scales from pockets on their abdomens and pass them to their mouths. Then they chew and fashion the wax into six-sided cells which form the combs. The workers also forage for pollen and nectar. The nectar is fed to "receiver" bees who convert it--by using the secretions of special glans--into honey and store it in the comb.

Some workers act as hive guards, admitting only bees that belong to the hive--they are recognized by odor, sensed through the 12,000 scent organs on the antennae. Strange bees are killed on the spot. Air-conditioning the hive (by standing inside the entrance and fanning their wings), building cells and cleaning the hive complete the list of duties.

As beekeepers watched all these jobs being done year after year, the question arose: How did the bees know what to do? How did they know that the hive needed more brood cells, or new guards?

In 1925 a German scientist, G. A. Rosch, had a hunch that the age of the bees had something to do with their work. He daubed with paint a group of bees as they emerged from the brood comb. No sooner had their twinkling wings hardened than they started cleaning the cells, then moved toward the oldest larvae in the bombs and began feeding them bee milk. Rosch examined one of the marked bees under the microscope to see if her physical development fitted her job. It did: the bee-milk glands that lie in front of the brain were enlarged. She was physically a "nurse".

In a few days, the marked nurses abandoned their original charges and began to feed the youngest larvae. After repeated studies, Rosch was convinced that young nurses fed the older larvae, old nurses fed the younger.

As days passed, the marked bees gave up their nursing duties and began taking nectar from the foragers and storing it. Examination showed that their bee-milk glands had begun to shrink, and the honey sacs in their bellies were filled with nectar. These bees were about 11 days old. Around the 15th day, they began making wax. The microscope showed that their bodies had changed once more to fit the job--their wax-making glands were highly developed.
On the 18th day, the bees did guard duty; after the 21st day, their wax glands ceased to function. Now the bees became foragers. Rosch found that worker bees died when they were around 38 days old.

With the publication of Rosch's findings, other scientists joined the investigation. In Munich, Dr. Martin Lindauer noted certain variations in Rosch's time schedule—he had watched a marked bee stand guard duty for an unheard of nine days. In Russia, Mrs. L. I. Perepelova reported that she had several early developers—one two-day-old bee was making wax, ordinarily a job for the 15 day-old.

Obviously a beehive was extremely adaptable. Jobs could be done earlier if the well-being of the hive demanded it. Bee students everywhere set out to discover just how adaptable bees were.

The most spectacular experiments were performed by Mrs. Perepelova. She removed the queen, larvae and eggs from the hive and watched to see what the workers would do. For several hours the hive did not miss the queen. Then one of the attendants lifted her antennae and began to circle. She exchanged food with a nearby wax maker, and the wax maker drummed her wings. She approached and exchanged food with others. These bees moaned. The moan spread throughout the hive, and the whole group began to throb as if suffering from fever.

Several weeks passed. Then Mrs. Perepelova noticed some of the workers rushing over the empty brood cells and thrusting their heads far down into them. Then came the impossible, the impossible, the supreme effort to heal the wound—a few "sterile" workers began to lay eggs! Nurses clustered around the egg-laying workers, feeding them bee milk. Slowly, with effort, the workers gave forth eggs—six to eight a day as compared to a queen's 2000 to 3000. Mrs. Perepelova's conclusion: "When the queen is gone, something that prevents the workers from laying is missing from the hive."

Around the world, bee experts pressed on to find what else a hive could do to heal itself. Mykola H. Haydak, now of Minnesota's Agricultural Experimental Station, removed the brood comb from a hive and isolated it. Then he put upon it newly emerged bees. There were no nurses, hive cleaners, guards, wax makers, foragers. He waited.

The adjustment was violent! Development was speeded up so dramatically that three-day old bees took survey flights from the hive while others of this age built cells, a job normally for the 16th
day. On the fourth day the bees collected pollen. After a desperate
week, the hive began to function as usual.

Reading about Hynah's findings, experts wondered whether bees
could also reverse their development. In Yugoslavia, Mrs. Vasilja
Mackovljevic, placed 503 marked foragers, all about 20 days old,
with dried-up bee-milk glands, onto an isolated brood comb with the
queen. The bees would either have to produce bee milk or let the
hatched larvae die. Days passed; no brood was reared. Then one after-
noon Mrs. Mackovljevic noticed a forager leaning into a cell. The
scientist looked closely. A glittering drop of bee milk was deposited
near the mouth of a hatched larva. Quickly Mrs. Mackovljevic placed
the foragers' glands under a microscope, and there was the proof.
The old dried glands were swollen and filled with bee milk! The
impossible had been achieved! youth had been removed!

Meanwhile, in Austria, zoologist Karl von Frisch discovered a
"language" used by foragers to tell others the distance and direction
to sources of pollen. A bee that had found some flowers returned to
the hive and performed a dance for her fellow foragers. A lively
figure-eight dance meant that the flowers were near. A feeble tail-
wagging dance meant the flowers were far away (distance, near or far,
could be spelled out exactly). If the bee's body was pointed straight
up on the comb, the flowers were in the direction of the sun. Body
pointed down on the comb meant that the flowers were in the direction
opposite to the sun. A bee dancing at a 60-degree angle from the sun. The
kind of flower was communicated by a taste of the forager's nectar or
pollen.

Next, Martin Lindauer discovered that this dance language was
also used by forager "scouts" to inform a swarming hive of the location
of a new home. On several occasions he noted the angle and the rapidity
of the dance movements and was able to get to the new location in time
to observe the arrival of the bees!

The final question: What stream of intelligence flowed through
the hive that told its separate parts what to do?

England's bee experts Dr. C. R. Ribbands tackled this one. He
noted an aspect of hive life that no one had seriously studied - the
constant circulation of food in the hive. Food moved steadily from
nurse to queen, from nurse to the wax makers, to the cell cleaners,
to the receivers, to the foragers, and back from the foragers to the
receivers, the cell cleaners, the wax makers, the nurses, and the queen.
Ribbands became convinced that each stage of bee development con-
tributed a distinct glandular secretion which, if all were present and
in sufficient supply, would tell the individuals that the hive was
balanced.

Dr. Ribbands kept coming back to Mrs. Peregloveva's idea that some-
thing preventing workers from laying eggs was missing when the queen
was gone. He also saw that it took the hive several days to make the
adjustment - the time necessary to circulate the food with the missing
ingredient. Could the food be a kind of circulatory system, a blood-
stream of sorts?

Thus Ribbands conceived the idea of the hive-animals of many living
parts, controlled by the essence of a hive - its golden food. Much study
remains to be done; the chemical properties of the food, for instance,
still need to be identified. But most bee researchers think the concept
is sound.
1. _____ Today many scientists who study bees regard a beehive as a single organism.

2. _____ A single bee can grow young quickly.

3. _____ Each hive has one queen.

4. _____ There is no relation between a worker bee's physical development and her job at a particular time.

5. _____ Hive guards can distinguish by odor between foragers from their own hive and those from other hives.

6. _____ Worker bees usually live for a number of years.

7. _____ A beehive can repair itself by a healing process similar to that of a feverish animal.

8. _____ Returning foragers perform a dance that tells other foragers the direction and distance to sources of pollen.

9. _____ Bees make honey from beeswax.

10. _____ The controlling essence of a hive appears to be the golden food that circulates within the hive.
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