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LANGUAGE LABORATORY RESEARCH STUDIES IN NEW YORK CITY HIGH SCHOOLS--A DISCUSSION OF THE PROGRAM AND THE FINDINGS.

BY- LORGE, SARAH W.

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TO INVESTIGATE THE EFFECTS OF THE LANGUAGE LABORATORY ON FOREIGN LANGUAGE LEARNING, THE BUREAU OF AUDIO-VISUAL INSTRUCTION OF NEW YORK CITY CONDUCTED EXPERIMENTS IN 1ST-, 2D-, AND 3D-YEAR HIGH SCHOOL CLASSES. THE FIRST EXPERIMENT, WHICH COMPARED CONVENTIONALLY TAUGHT CLASSES WITH GROUPS HAVING SOME LABORATORY TEACHING, SHOWED THAT GROUPS WITH LABORATORY TRAINING SURPASSED THE NONLABORATORY GROUP IN SPECIFIC SKILLS AT CERTAIN LEVELS. THE SECOND EXPERIMENT DEALT SOLELY WITH LABORATORY GROUPS, WHICH DIFFERED, HOWEVER, IN THE TYPE OF EQUIPMENT USED AND THE TIME ALLOTTED TO LABORATORY PRACTICE. GROUPS HAVING DAILY PRACTICE WITH RECORDING-PLAYBACK EQUIPMENT MADE GREATER GAINS IN SPEECH AND LISTENING COMPREHENSION THAN THOSE HAVING LESS FREQUENT LABORATORY SESSIONS OR USING AUDIOACTIVE EQUIPMENT. PRONUNCIATION MATERIALS SEEMED MORE EFFECTIVE IN THE DEVELOPMENT OF FLUENCY AND INTONATION THAN "CONVERSATION" TAPES. PRIME FACTORS IN THE EFFECTIVENESS OF LABORATORY WORK WERE THE TEACHER'S ATTITUDE TOWARDS THE VALUE OF THE SESSIONS, HIS DEVELOPMENT OF NEW TECHNIQUES, AND HIS EASE IN HANDLING THE EQUIPMENT. SEVEN CHARTS TABULATE THE FINDINGS OF THE RESEARCH. THIS ARTICLE IS A REVISED FORM OF THE ADDRESS GIVEN AT THE ANNUAL CONVENTION OF THE DEPARTMENT OF AUDIO-VISUAL INSTRUCTION OF THE NATIONAL EDUCATION ASSOCIATION (ROCHESTER, APRIL 22, 9964) AND IS A REPRINT FROM "THE MODERN LANGUAGE JOURNAL," VOLUME 48, NUMBER 7, NOVEMBER 1964. (GJ)

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*Language Laboratory Research Studies in New York City High Schools: A Discussion of the Program and the Findings**

SARAH W. LORGE, *Bureau of Audio-Visual Instruction, Board of Education, New York City*

BACKGROUND OF THE STUDIES

RESEARCH in language laboratories, conducted by the Bureau of Audio-Visual Instruction in high schools of New York City, was intended to investigate and document certain hypotheses or hunches about the effects of language laboratory practice on foreign language learning. The object of the study was not to compare what a student learns from a teacher alone as opposed to what he learns from laboratory work alone. The question was whether the teacher improves the teaching-learning situation by using the laboratory as a teaching aid. The research was intended not to give the laboratory a passing or a failing mark—if it passes, use it; if it fails, rip it out—but rather to determine in which areas it had proved to be successful, and how its use could be made more effective.

Here was an electronic device which might have been invented especially for the foreign language class, so well did it lend itself to language learning. It provided easy, accurate, and immediate recording and playback of speech. Teachers could bring to their students pre-recorded foreign language materials, in a variety of native voices and speech patterns. Imitative practice could be recorded, judged, erased, re-recorded, to the point of learning. Intercommunication of the teacher with a single student permitted individual corrective teaching, unheard by other members of the class, who would not waste time listening to correction they did not need, nor perpetuate errors suggested to them when they heard their classmates' mistakes.

The foregoing sentences may sound familiar. This is just what the manufacturers and the advertisers say! They make it all sound very easy. Truly, the potential is there. But how would the remarkable capabilities of the laboratory equipment be made to serve as an instrument of learning?

Our concept of the language laboratory envisaged it as a teaching aid, to be used as part of class instruction for additional audial experience, somewhat as the blackboard provides additional visual experience.

It was our hypothesis, or hunch, that laboratory practice would affect favorably the ability to speak and understand the spoken language. How would it affect the usual conventional learnings? The only way to find out was to include in our testing program as many as possible of the skills commonly accepted as part of language learning (see Chart I). Unless our hunches had been 100% correct, which would have been most extraordinary, we would expect some of our investigations to show more favorable results than others.

DESCRIPTION OF THE STUDY

We conducted two successive experiments, comparing groups using the laboratory with groups not using the laboratory. In the first experiment, first, second, and third year French classes were studied. The weekly amount of

* This article is a revised form of the address given on April 22, 1964, in Rochester, New York, at the annual convention of the Department of Audio-Visual Instruction of the National Education Association.

The studies described here were conducted by the Bureau of Audio-Visual Instruction, first in two, then in ten high schools of New York City, with the partial support of a research grant of the New York State Education Department. The writer of this paper was the principal investigator. Dr. Edward G. Bernard, Director of the Bureau, was chairman of the Executive Committee for the research studies and had a great part in planning and directing the study.

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time for laboratory work was prescribed but not the kind of utilization. In the second experiment, conducted in second year classes, type of utilization, as well as time, was specified for each experimental group. Since the experimental factor was the use of the laboratory, all other conditions were kept the same, as far as possible. The total amount of class time had to be the same. Laboratory work was conducted within the framework of the five weekly class periods, replacing for the assigned amount of time other types of classroom exercises conducted in comparison groups.

Course content also had to be the same for experimental and comparison groups. If the courses were different, we would not know whether differences in results were due to the techniques of laboratory study or to the differences between old and new materials. Work in experimental and comparison groups included both conventional and speaking-listening activties, as prescribed by the course of study. Lesson tapes were prepared in accordance with course requirements, with adaptations appropriate for audial presentation.

Chart I shows the design of this first phase of our experimentation.

The First Experiment

In the first experiment, laboratory practice was conducted for sixty minutes a week to be distributed as the teacher found best. Generally the preferred time pattern was two thirty-minute laboratory periods often divided into two fifteen-minute segments with a brief intermission between, to allow pupils to relax from the unaccustomed concentration of listening-only experience. The laboratory lesson might begin with a short period of "live" teaching, for which the lesson-tape would provide follow-up reenforcement; or a "live" summary of the lesson might follow. At first it was necessary also to spend some time training the pupils to operate the equipment: which button to push, which knob to turn for each laboratory function.

Comparability of groups was established by the Stanford Reading Test score, and the Gallup-Thorndike Vocabulary Test which has a high correlation with intelligence. There was no significant difference between groups in either of these tests.

The complete battery of tests was administered to both experimental and comparison groups. The testing program is outlined in Chart II.

The Testing Program

Speech production was tested in response to 1) a visual stimulus: pupils sight-read a passage describing the launching of a rocket at Cape Canaveral (Kennedy) from an article in a French newspaper, and 2) an audial stimulus: oral responses to taped questions which did not call for learned information, but which induced the

Chart I

Experiment Comparing Language Learnings With and Without the Use of the Laboratory Sixty Minutes Weekly, for One Year

Conditions of Learning	Types of Linguistic Skills	Defined as	As Shown in
5 periods weekly: all in conventional classroom (comparison groups)	conventional skills	Vocabulary, Grammar, Silent reading	Standardized Test
5 periods weekly: of which 60 minutes are for laboratory experience (experimental groups)	audio-lingual skills	Listening	Comprehension Test (fast); Comprehension Test (slow)
		Speaking	Sight Reading; Answering Questions

CHART II

THE TESTING PROGRAM

TESTS ADMINISTERED TO LABORATORY AND COMPARISON GROUPS, AT BEGINNING AND END OF EXPERIMENTAL YEAR

Area Tested	How Administered	Pupil Response	Score Obtained in:
Speech			
a) Sight-reading	Individually: Proctor, pupil, mimeographed passage, tape recorder	Pupil sight-reads passage into microphone for 70 seconds; uses code number	Pronunciation Fluency Intonation
b) Answering questions asked in French	Individually: Proctor, pupil, taped French questions	Pupil hears taped question, records oral reply in timed spaces on tape; uses code number	Appositeness Fluency Structural correctness Overall quality of speech
Comprehension			
a) Listening-Picture-Directions Test, rapid form	Group Test: Each student has copy of picture; tape describes objects in picture, fluent speech	Student follows direction, placing a number on a specified part of picture	Comprehension of rapidly spoken French
b) Listening-Picture-Directions Test, slower form	Group Test: Administered immediately after rapid form. Each student receives a second copy of same picture; tape describes objects as previously, but more slowly	Student follows direction, placing a number on specified part of picture	Comprehension of more slowly spoken French
Conventional Skills			
Cooperative French Test	Group Test: Pencil-and-paper test	Student records multiple choice responses (2 parts) and fill-in forms (1 part)	Reading comprehension, vocabulary, grammar, total score

student to formulate a reply requiring more than merely changing the word order of the question.

The difficulties of rating speech tests are well known. Subjective judgment enters subtly and unconsciously into the rating, however impersonally the standards are arrived at, however detailed the rating scale, and however conscientious and impartial the raters may be. For example, a certain bias is almost inevitable when the rater knows whether the test was given at the beginning or at the end of the year. To avoid such unconscious bias, which gives a different measure at different times of the year, all tapes were held until the end of the year, when tapes of laboratory and non-laboratory students, recorded in October and in June, were dubbed in undetermined mixed order on to fresh reels of tape. The judges, who worked from these reels, had no way of knowing when or by which group any recording was made. This process of redubbing the tapes from different sources into one composite reel was informally termed "scrambling": a time-consuming but necessary preliminary to objective rating of speech.

Listening comprehension was measured by a test devised for this experiment which requires no expression in the language at all. Each student received a copy of a picture. A tape was played, directing students to write a number on a specific part of the picture. Directions were graded from simple to more difficult. For example: "There is a television set in the room. Write the number one on the television set." A more difficult direction was: "There is an object in the room which one uses if one wants to talk to someone who is in another part of the city.

Write the number fourteen on the object." Unlike the question-answer test, where expression as well as comprehension were involved, the quality of the response in the listening test was not affected by the student's ability to structure a sentence, or to pronounce well. Only his understanding was tested. The score was the number of correct responses.

A student's ability to comprehend may be quite different for fast and slow speech. Immediate comprehension of fluently-presented material is a usable skill in a life situation. A less than expert learner, with more time and a second exposure, may manage to figure out the meaning. The test was given, first rapidly, on a level of realistic utilization, and then more slowly, to give the pupil a chance to show what he could do under less taxing conditions.

Conventional paper-and-pencil skills were tested by the Cooperative French Test of the Educational Testing Service. This well-known standardized test, administered and rated according to precise instructions, needs no detailed description here.

Discussion of the Findings in the First Experiment

The findings are summarized in Chart III, which lists the areas in which laboratory groups developed superiority over comparison groups, and the grade level at which each difference occurred. Results in the standardized tests are also shown. Results show effects of a one-year span of activity, with no laboratory experience by any group prior to the year under study.

We used the statistical technique of computing the means of the scores of laboratory and non-laboratory groups, comparing the means and applying the t-test of significance, which assures us that the differences between groups are statistically sound, and were not obtained by chance.

Grade levels at which the various differences developed should be noted. In the first year, the experimental group was judged superior in fluency of speech; in the second year, in fluency and intonation. In the third year no superiority was evidenced by the laboratory group in any speech factor measured. This may indicate that the muscular skill involved in speech develops through practice more easily in younger pupils, whether because muscular flexibility is greater at the earlier age, or because the younger student is less self-conscious about imitating sounds, or because imitation is a simpler type of activity than comprehension. The third year students may have formed their speech patterns in their first two years of pre-laboratory

Chart III

Superior Skills Developed by Groups Using Laboratory Sixty Minutes a Week for a Year (No Previous Laboratory Work)

Grade Level	Laboratory Group Showed Superiority in:	Process Involved	Indicates
First Year French	Speech: Fluency	Repetition; imitation Physical Skill Muscular Control	Speech habits develop earlier
Second Year French	Speech: Fluency, Intonation	Repetition; imitation Physical Skill Muscular Control	Speech habits develop earlier
Third Year French	Listening Comprehension	Cerebration Judgment Interpretation	More complicated process to understand and follow directions. More maturity needed? Speech habits fixed previously.
	Conventional Skills		
First Year French Second Year French Third Year French	No difference in conventional skills between laboratory and non-laboratory groups at any grade level.		

CHART IV

EQUIPMENT UTILIZATION AND TIME FACTOR STUDY

Type of Equipment Tested	Time Patterns	Activities
Record-Playback	Twenty Minutes Daily	Listen and record Respond and record Playback Compare Re-record
	One Period Weekly	
Audio-Active	Twenty Minutes Daily	Listen Respond
	One Period Weekly	
Control Group	No Electronic Experience	

language study. The type or the amount of laboratory practice provided in this experiment did not change them.

The third year laboratory group developed superiority in comprehension of speech at both rapid and slower rates. Laboratory groups at earlier grade levels developed no such superiority. Perhaps comprehension is a more complicated process, involving prompt response to an unexpected stimulus and requiring more maturity and interpretative judgment than is involved in direct imitation of speech.

The Cooperative French Test, which gives scores in vocabulary, reading comprehension, grammar, and total score, showed no statistical differences between laboratory and non-laboratory groups at any administration, in any grade level. This appears to provide a reassuring answer to the question as to whether audial skills were developed at the expense of conventional skills. The laboratory group, with sixty minutes less of conventional teaching, performed as well in tests of conventional skills. Laboratory practice appears to have influenced not only listening and speaking, but other aspects as well. It may seem logical to infer that conventional skills result from conventional teaching, speech and listening skills from laboratory experience. This is an oversimplification. While the student is practicing structure drills, he is acquiring conventional grammatical language forms. While he performs the activities of listening and speaking, he learns vocabulary and sentence meaning. The interrelationships among language skills are sufficient to account for an overlap of learnings, particularly where linguistically identical elements exist, as they must in the same language.

The experiment just described studied the effects of the use of the laboratory in first, second, and third year classes for sixty minutes a week for a year.

THE TIME AND EQUIPMENT STUDY

A follow-up experiment tested two different types of laboratory equipment, recording-playback and audio-active, each used in two time patterns: one period a week, or 20% of total class time, and twenty minutes daily, or 50% of total class time. None of the classes had had previous laboratory experience.

The two types of equipment tested were: 1) audio-active, consisting of a microphone and headphones, and 2) recording-playback, consisting of a microphone and headphones, plus an individual tape recorder at the student station. The question was whether the simpler installation was sufficient for laboratory learning, or whether greater improvement is achieved through the activities made possible by the tape recorder (as shown in Chart IV) at the student's station.

Four experimental groups and a comparison group using no electronic equipment, all in second year French, constituted the experimental population.

For this experiment, tapes with the same content were prepared in two different ways, since recording-playback utilization requires a different tape-structure from audio-active.

The testing program was like the one described for the first experiment (Chart II) with the addition of a mimicry test requiring students to imitate model speech immediately after hearing the test materials played.

The statistical calculations for this experiment were based on the gains made by each group, from start to termination of the experimental year. Group gains were then compared for each variable, and statistical significance determined. Among the five groups, the group making the greatest gain from beginning to end of year was rated 1. The group making the second greatest gains was rated 2, and so on. The rating of 5 means that the group gained least. N. S. means the differences were too small to be significant. However, several variables with a non-significant difference always in the same direction may indicate a trend. A level of significance computed to be .05 is accepted as statistically significant; this means that the result did not occur by chance. A level of significance of .01 indicates that the differences among groups are sharper, and the results are more highly significant than .05.

In Chart V we underline the groups having no significant difference among themselves, but different from those not underlined. Where only one number is underlined, the significant difference occurs between that group and the other four.

The Findings in the Time and Equipment Study

Results (Charts V and V-A) reveal two kinds of information: gains made by laboratory groups as compared with the non-laboratory group, and the relative standing of the four laboratory groups among themselves.

In *speech* (sight-reading): in pronunciation and intonation all laboratory groups, and in fluency all but one, made greater gains than the non-laboratory group. In overall quality of speech, the recording-playback-daily group made significantly greater gains at the .01 level than any of the other laboratory groups, or than

Chart V

Comparative Achievement Gains of Five Groups in Fourteen Measures
Equipment Utilization and Time Factor Study

Variable	Laboratory Daily		Laboratory Weekly		Control (no laboratory)	Significance
	Record-Playback	Audio-Active	Record-Playback	Audio-Active		
Speech: Sightreading						
Pronunciation	1	2	3	4	5	N.S.
Intonation	1	2	3	4	5	N.S.
Fluency	1	2	3	5	4	N.S.
Mimicry	2	5	1	4	3	N.S.
Overall Rating	1	2	3	4	5	.01
Speech: Oral Answers to Oral Questions						
Appropriateness	2	3	5	4	1	.01
Correctness	2	3	5	4	1	.01
Fluency	2	3	5	4	1	.05
Comprehension						
Fast	1	2	3	5	4	.01
Slow	5	1	3	4	2	.01
Conventional Skills						
Silent Reading	2	3	5	4	1	.01
Vocabulary	2	5	1	4	3	N.S.
Grammar	1	3	5	4	2	.05
Total Score	1*	3	5	4	2**	.01* .05**

* The group ranking 1 is superior to Groups 3, 4, 5 at the .01 level.

**The group ranking 2 is superior to Groups 3, 4, 5 at the .05 level. There is however no statistically significant difference between groups ranking 1 and 2.

the non-laboratory group. Overall quality is a rating not dependent upon the ratings of specific speech factors. It was judged in a separate hearing of the tapes, under the conditions of anonymity described earlier: coded taped responses, "scrambled" so the judges could not know whether a response had been made by a laboratory student or a non-laboratory student, at the beginning or end of the year. It is worth noting that while the degree of difference among groups is statistically significant only in the rating of overall quality, the order of gains is generally parallel for the various speech factors and the overall rating.

In *oral answers* to oral questions the non-laboratory group ranks first, followed by the two daily laboratory groups. All three make significantly greater gains than the two once-a-week groups. The measures are fluency, appropriateness, and expressional correctness of answers. The order of gains is the same in all three measures.

In *listening comprehension* at both speeds a laboratory group made significantly greater gains (.01) than the non-laboratory group. At the more taxing fast rate, the daily recording-playback was superior to all other groups, laboratory and control, at the .01 level. In comprehension of slowly-spoken French, the daily audio-active group gains were significantly greater (.01) than all other groups, laboratory and control.

In the total score of the *standardized pencil-paper test*, the daily recording-playback group made the greatest gains, followed by the control group; both gained significantly more than the other groups: the recording-playback group at the more sensitive .01 level, the control at the .05 level.

Inspection of the columns vertically shows the trend of performance of each group. The daily recording-playback group shows remarkable results. It ranks first or second in thirteen of the fourteen measures, while the control group ranks first or second in seven measures and fourth or fifth in five. The other columns should be similarly inspected for relative achievement in each type of laboratory utilization.

Both groups which spent more time in the laboratory made the greater gains. As between the two groups using different equipment in the same time pattern, the recording-playback groups made greater gains than the audio-active, within each time allotment period. This was the case for almost all variables in the daily pattern, but for only slightly more than half the variables in the weekly pattern. In several measures the control group made greater gains than one or both once-a-week groups. Where the control group made its greatest gains, it was still never significantly superior to *all* the laboratory groups. On the other hand, in several measures, one or more laboratory groups are superior to the control.

To call attention to three especially interesting measures, we extract them from Chart V and reproduce them as Chart V-A.

CHART V-A

RELATIVE ACHIEVEMENT GAINS IN THREE VARIABLES: OVERALL QUALITY OF SPEECH, COMPREHENSION, FAST, TOTAL SCORE OF WRITTEN TEST

Variable	Laboratory Daily		Laboratory Weekly		Control	Significance
	Record-Playback	Audio-Active	Record-Playback	Audio-Active		
Overall Quality of Speech	1	2	3	4	5	.01
Listening Comprehension, Fast	1	2	3	5	4	.01
Total Score, Written Test	1*	3	5	4	2**	.01* .05**

* The group ranking 1 is superior to Groups 3, 4, 5 at the .01 level.

** The group ranking 2 is superior to Groups 3, 4, 5 at the .05 level. There is however no statistically significant difference between groups ranking 1 and 2.

Discussion

Speech (Sight-Reading)

The superiority of all laboratory groups over the non-laboratory group in quality of speech suggests that laboratory work of any kind gives an experience in speaking different from the usual "live" class and that it shows results proportionate to time spent in the laboratory. As shown in Chart V the more time spent in the laboratory, the greater the gains in speech; the more complete the equipment, the better the results, comparatively, but even the group assigned to minimal time and simpler installation showed gain superior to the non-laboratory group.

Let us compare a laboratory class with a "live" class, well-taught, interested, taught by a competent, interested teacher. Teachers have always wanted their students to learn to speak but have frequently deplored the lack of sufficient time to develop speaking ability in a class situation. In the usual class, only one student at a time can speak. While other members of the class recite, in turn, any one student can only sit and listen. Most of the time, then, he is a member of an audience, not a performer. In the laboratory he multiplies his direct contact with the language, for as much time as he spends in laboratory work. He does not have to sit and wait for other students to finish reciting in order to get his brief time for linguistic practice. He is a performer during the entire practice period.

Speaking a language is a muscular as well as an intellectual skill. Even when one knows what one wants to say, coordination of the thought with its appropriate formulation, and prompt physical expression of the thought are related but separate activities. The physical expression corresponds to a musician's ability to execute a selection on a musical instrument. Let us say he plays a difficult cadenza once through. He now knows the structure and perhaps the composer's intention; but he is still far from being able to play it correctly and smoothly. For this he must practice it himself.

Similarly, the language student must still develop muscular control over his speech, after he knows what he wants to say, and before he is able to put it into satisfactory spoken form. For this he needs to practice speaking, not listening to others.

Oral Answers to Oral Questions

In the set of measures relating to oral answers to oral questions, the results are quite different from those obtained in sight-reading. It appears therefore that response to an oral stimulus requires a different study technique, which may have been less satisfactorily handled in the laboratory than in the "live" class. Investigation is still being conducted to improve the kind of lesson-tape needed for developing skill in answering questions. It is possible that this specific exercise may remain more satisfactorily handled in the "live" class situation than in laboratory sessions.

Pre-recorded lesson-tapes require that the scriptwriter foresee the student's response. In a question-answer exercise, this has been anticipated in the structuring of the question. It works for questions whose replies are set formulas, but when a certain amount of freedom enters in the answer, this format does not serve.

Listening Comprehension

How does a student learn to understand what he hears? The impact made by a single hearing of a new utterance is insufficient to register a permanent impression. A little child insists on hearing a story retold in exactly the same words each time, sometimes to the exasperation of the parent. This generally takes place while the child is very young, when he is learning to control language. He feels the need for repetition; he feels comfortable with it. If he finds the material interesting, the repetition is agreeable to him, not dull.

Auditory memory is weak. That is why one takes notes at a lecture. If one forgets a fact he has read, he has only to reread his book in order to recall it. If one forgets a sound, it is impossible subsequently to recapture it.

The same idea can be couched in so many different ways. A restatement of the same meaning in other words may present a new listening-understanding problem. "Il s'en alla" and "il partit" may have approximately the same meaning, but the ear is compelled to register an entirely different impression with different auditory problems in the interpretation of sounds.

For listening practice, the non-laboratory group depends upon the teacher's voice for model speech and for all auditory practice. In a usual class situation, this cannot be accurately defined either in amount or in speed. The teacher's voice may be tired, toward the end of the normal high school teaching day of five classes taught by the audio-lingual method. He may reduce the amount of listening experience he furnishes to the class. Then, if some of the students appear doubtful about the meaning the teacher is apt to slow down his speech to accommodate them. This changes the speech pattern and may fail to give the student the experience of hearing smoothly spoken consecutive speech, which, of course, the tape furnishes in the laboratory.

To use a foreign language in a real-life situation outside the classroom, it is necessary to understand fluent speech the first time it is spoken. Repetition makes it a classroom exercise. The first administration of the listening-comprehension test was therefore considered the better indication of competence. It was in this measure that three laboratory groups showed superiority over the non-laboratory group.

Written Test of Conventional Skills

When laboratory and non-laboratory groups were compared in the standardized pencil-paper test, in the earlier experiment, no significant differences appeared among the groups at any administration. In the second experiment, where the laboratory group is subdivided according to kinds of utilization, certain differences emerge. In silent reading, the control and one laboratory group gained significantly more than the others. In grammar, the control group and two laboratory groups gained significantly more than the others. In vocabulary no significant difference appears among the groups. In the total score the control and one laboratory group gained significantly more than the others.

Since the daily laboratory groups perform as well as or better than the non-laboratory group, we may assume that there is no detrimental effect on conventional learnings because of the diversion of time from conventional learnings. Since pupils spending 50% of class time on laboratory work equal or exceed the non-laboratory group in conventional learning, gains as measured in this standardized test, the work done in the laboratory may be assumed to have contributed to total language achievement.

Motivation to Continue Language Study

An interesting development appeared when the first language laboratory group reached the terminal grade of the three-year French course. This span of study satisfies high school graduation and college entrance requirements. While a longer course is recommended, it cannot be imposed, and in many schools the proportion of third-year students continuing into the fourth year of French is quite small. It was therefore striking to find in the fourth year class in September 1961 a great proportion of students who had used the laboratory in their previous study. In a school where 39% of the third-year class continued, the fourth year group included 50% of laboratory students and only 21% of students who had not had laboratory work. The following year in the same school 30% of the department's third-year register continued into fourth year French; this number included 49% of the department's laboratory students and only 20% of the non-laboratory students. In the second school (whose first group of laboratory students reached the termination of third-year French a year later) 58% of the department's total third-year register continued. In this group were 74% of the students who had used the laboratory and only 45% of those who had not. The students' behavior was not induced by any persuasive power, but by their own desire to continue studying French. If the laboratory was the influence that motivated them, one might infer that laboratory work acts favorably on interest in language study, perhaps even where persuasion fails.

The results are shown for 1961 and 1962, in the first two schools in which the research study was conducted (Chart VI).

Factors Related to Successful Use of the Laboratory

Certain conditions have been found to be closely related to the successful use of the language laboratory.

The amount of *time* spent in the laboratory influenced results. During the total period of

experimentation, time patterns of utilization included once a week, twice a week, and daily (part of each period). Five laboratory lessons a week had a great impact on learning gains in all areas. One laboratory lesson a week showed less impressive gains. In fact, in some measures the non-laboratory group was superior to the once-a-week laboratory groups. Two weekly laboratory sessions produced superior results in several areas (see Chart III). It is possible that one weekly laboratory session may not allow the student enough time to develop the habit of learning through hearing. These experiments may have defined the minimum amount of laboratory practice time that will produce significantly greater learning gains.

Types of *equipment* influenced results. The recording-playback group generally achieved better results than the audio-active group in the same time pattern, more consistently in the daily time pattern. Recording-playback may have greater effect because a variety of activities is more interesting than a single activity and brings various kinds of involvement with the language, or because greater concentration is needed to compare the model speech with the imitation, or because the student finds it particularly interesting to hear his own voice and listens more attentively.

Kinds of taped materials influenced the results. Among the variety of language tapes made available to laboratory classes, some proved more effective than others. "Conversation" tapes, requiring the students to answer questions, were the least satisfactory materials. They produced the least satisfactory results. Pronunciation tapes were effective in training pupils to distinguish between approximately similar sounds. Production of sounds requiring a new kind of muscular control appeared to need "live" teaching first, followed by reenforcement through laboratory practice. Pronunciation of specific sounds improved less than fluency and intonation, which showed greater gains as a result of work with tapes requiring students to imitate fluent, consecutive speech. Errors in liaison and in pronunciation of final consonants were reduced; verb endings, as *-ons* and *-ez*, were rarely mispronounced.

The teacher's *ease in handling the equipment* influenced his own attitude which was reflected in the students' attitude toward using the laboratory. When the teacher spent the time monitoring the students and addressing them individually through the intercom, the pupils worked with greater zeal and not at all perfunctorily. The motivation appeared to be not the fear of being found inattentive, but rather the contagion of the teacher's attitude, since he showed by his behavior that he considered the

CHART VI

LABORATORY AND NON-LABORATORY STUDENTS ELECTING OPTIONAL FOURTH-YEAR FRENCH

Total Registers of Department

	Third Year June	Fourth Year Sept.	Percent Continuing
School I			
1961	96	38	39.7%
1962	235	72	30 %
School II			
1962	304	178	58.5%

	Laboratory Students			*Non-Laboratory Students*		
	Third Year June	Fourth Year Sept.	Percent Continuing	Third Year June	Fourth Year Sept.	Percent Continuing
School I						
1961	59	30	50%	37	8	21.6%
1962	51	25	49%	184	47	20.1%
School II						
1962	141	104	74%	163	74	45 %

laboratory a useful activity related to other aspects of his teaching, and deserving his full attention.

Conclusion

Experiments in which the language laboratory was used in the teaching and learning of the prescribed high school course in French indicate that laboratory practice has had favorable effects on a number of aspects of students' learning. Groups of students assigned to regular periods of laboratory practice as part of their required French course made greater gains than comparison groups in several areas. In the first study, comparing the total laboratory group and the non-laboratory group, certain differences developed at different levels of study. When the laboratory group was subdivided, in the second study, the amount of gains varied according to the time spent in the laboratory and the type of equipment used. Greatest gains were made by the daily laboratory group using recording-playback equipment. This group made significantly greater gains than all other groups in speech and in listening comprehension at the fast rate. In no measure did the control group make statistically greater gains than *all* the laboratory groups. In the standardized written test, a comparison of the undifferentiated laboratory group with the non-laboratory group showed no significant differences. In the comparison with the four subdivided laboratory groups, any measure showing statistically significant differences showed at least one laboratory group that equalled or exceeded the gains made by the control group. This appears to indicate that time spent in the laboratory contributes to conventional learnings as well as to listening and speaking skills. There is also some indication of the possible effect of language laboratory work on motivation to continue language study.

Some features contributing to successful operation of the laboratory include the amount of class time regularly devoted to laboratory practice; the type of equipment used and the types of learning exercises performed; the kinds of lesson-tapes used; and, most important, the attitude and skill of the teacher, trained or retrained to use the laboratory as auxiliary to his other teaching skills.

The essentially novel characteristic of the language laboratory lesson is the method of transmission of learning materials. This is principally the concern of the technical specialist. It is for the subject matter specialist to develop new teaching techniques which make use of the new potential. As materials can only be used according to what the equipment permits, subject matter specialists must learn what is possible technically and the technical specialist must learn what is desirable pedagogically.

A new concept of a language lesson is developing. The concept of the teacher as giver and the pupil as receiver of information is changing. Less time is spent in direct instruction or explanation, more in the pupil's self-impelled practice under the direction and guidance of the teacher. The object of the foreign language course is not theoretical knowledge; it is usable performance, for which the best preparation is practice in the skills to be performed. Speaking and listening skills are the new objectives of foreign language study; our investigations have shown that these can be effectively practiced in the laboratory.

Certain uses of the language laboratory remained to be explored. Among them are the extension of laboratory utilization into advanced levels of study; the association of visual materials with the auditory in the laboratory; the simultaneous use of multi-level materials with one class; and development of new kinds of learning tapes. Use of the laboratory should not be limited to one type of exercise, nor one type of course, nor one grade level. Its applications will differ in different learning situations.

Further investigations of laboratory techniques are indicated. We have not yet discovered all its potential applications.

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