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Directly Supervised Versus Indirectly Supervised Typewriting

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Loyola University Chicago

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DIRECTLY SUPERVISED VERSUS INDIRECTLY SUPERVISED TYPEWRITING

BY

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A Thesis Submitted in Partial Fulfilment of the Requirements for the Degree of Master of Arts in Loyola University

June, 1933
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CHAPTER I

STATEMENT OF THE PROBLEM

To thousands of young men and women in this country typing serves as a gateway to a career. John Hay's skill secured for him the position as private secretary to Abraham Lincoln. From there it was a straight and steady climb to Ambassador of the United States to the Court of St. James. One of the brightest members of the department of special education in Washington during the late World War was the secretary to the director and attained her responsible position of leadership because of her ability as a shorthand reporter and typist.

Typewriting skill is also a distinct personal asset to anyone planning to take up a professional or business career. It is not too much to urge, taking into consideration the very reasonable price of the typewriter, that every boy and girl who continues his education beyond the elementary grades should study these arts not merely for their practical value to him, but for the educational values that may be obtained. From the practical or personal point of view, everyone should learn to be his own typist. A very small fraction of the time at the proper point in one's educational career would make one reasonably skilled in this art. The time spent in learning typing would be returned in after life a hundredfold in the saving of time.
and labor. Furthermore, typewriting requires accurate observation, careful analysis, constant concentration, and persistent effort appropriately applied to a specific task, and thereby assures the development of habits of mind and hand which are probably desirable in every sphere of human activity.

It might also be urged with considerable force that learning to typewrite is probably also a valuable aid in learning to spell, for:

(1) Spelling words on a typewriter makes the learner observe and fix the exact sequence of the letters which he makes on the machine.

(2) The fact that the process is motor and that the movements are always arranged in a serial order should help to fix correct spelling habits.

(3) The process of learning is very definite and concrete, enabling the learner to check up definitely not only on the correctness of the printed work, but calling into use a splendid aid for learning to spell; namely, learning to identify correctly spelled words when seen in print.

(4) Typing also adds zest and interest to the exercise of the particular habits that must be formed in spelling these words, because all children get pleasure from making such definite movements as are made in typing and will practice these movements with greater interest and enthusiasm than could possibly be secured either by writing the words with a pencil or
by pronouncing the letters orally. Therefore, when a student learns to typewrite, these particular habits would not only be formed and fixed, but developed in a way that would insure the establishment of the particular habits that are used in recognizing and writing words. The present study, to determine the relative efficiency of typewriting classes in high school which are taught entirely under the direct supervision of a teacher as compared with classes in which the students practice typing without direct supervision, is justified by the importance of typing as a practical skill and the desirability of using only the most efficient methods in teaching typing.

DEFINITION OF TERMS USED IN THE PRESENT STUDY:
Relative ... having connection, pertinent.
Efficient ... acting or having power to act effectually, competent.
Efficiency in typewriting ... manipulative skill, a steady sure control of all elements of the keyboard at a stroking rate of not less than 250 strokes per minute, preferably 300 strokes per minute.

A second phase of manipulative skill is the specific skill required in the proper arrangement of letters and tabulated material, the preparation of legal documents and manuscripts, and the handling of various business forms. Such skills are acquired, as are all skills of lower order, by exactly the same
steps: (1) familiarity with the process involved - the know-how step; and (2) repetitive practice of this know-how step until manipulation is smooth and effective on a time basis.

Direct Supervision in this study means correcting the defects of mass teaching; individualizing instructions; recognizing the psychology of individual differences; supervising study in the teacher's classroom; directing the pupil's efforts; anticipating the pupil's difficulties; working with the pupil, not for him, helping the pupil judiciously; training the pupil how to study; devoting most time to the lower half of the class; increasing the amount of school study (15:186-204).

From the point of view of progressive writers and teachers, supervised study may be defined as the effective direction of all the pupil's learning activities. Such supervision consists of the following factors:

1. The making of a definite plan for directing the learning of a subject, basing this plan on the best available material, such as experimental investigations and the best books on the teaching of the subject under consideration.

2. The observation of the pupils engaged in study to discover their present methods of studying, thus determining their needs.

3. The instruction of the pupils, according to their needs, in the most effective methods of studying and closely supervising them until proper habits of study are firmly estab-
lished (43:64-70).

Indirect Supervision in this study means: observing the typing class through a glass partition while conducting another class in an adjoining room.

There has been a marked improvement in the typewriter and a transformation in the methods of teaching during the past quarter of a century. The machine itself has been refined, made more compact, visible, and noiseless. In contrast to the schools and a few high schools that were teaching typewriting twenty-five years ago, there are now a great many private and public institutions with well-conducted departments of typing.

The typewriter teacher should be a thorough-going instructor of the subject with methods that are psychologically and pedagogically correct. May we never rest until our good is better and our better best.
CHAPTER II

THE PSYCHOLOGY OF MOTOR LEARNING

A. Imitation and Motor Learning

Among the psychologists it has been commonly assumed that there is an instinct to imitate, in man as well as in animals. Bain, however, gives five reasons why human imitation is not instinctive and innate. First, there is no imitation in the first five months of the child's life. Second, imitation is slow and gradual, hence it appears to be acquisition. Third, adults gain more by imitating children than children gain by imitating adults. Fourth, imitation tends to vary with the natural abundance of spontaneous activity. Fifth, imitation varies with acquired habits. Many modern psychologists have abandoned the theory of instinct in general. An instinct of imitating might naturally be abandoned along with the rest (4:147-190).

Many experiments have been carried on to determine to what extent, and under what conditions, animals imitate. Berry, (6:23-39), found that a certain type of voluntary imitation exists in cats. He found that cats to some extent imitate human beings. Cats do not instinctively kill and eat mice, but learn to do so by imitation. Thorndike (52:35-36) found no
evidence of imitation in any animals. Lashley (37:353-67) obtained an Amazon parrot which could not talk. He taught this parrot to talk by placing it in a position to imitate one which did. Haggerty, (29:544-546) after experimenting with monkeys, found five levels of imitation behavior: (1) Simple arrest of attention, that is, one monkey merely watches the other; (2) Following, that is, one monkey follows the other from place to place; (3) Reaction to locality; In getting out of a cage, for example, the monkey profits by observing the other to the extent that it goes to the proper side of the cage, or it begins to play about with the proper part of the door, etc., instead of merely adopting a trial and error behavior; (4) Reaction to an object; that is, the monkey picks out the correct detail, such as the lock, for special investigation; (5) Exact repetition in detail of the act witnessed.

Bryan reported some experiments on the learning of motor activities, to show the value of demonstrations which give the learner an opportunity to imitate. These experiments were concerned with learning to swing Indian clubs and learning to juggle two balls with one hand. It was found that the value was chiefly in the first few trials. After a small amount of improvement had taken place, the demonstrations ceased to have any value. Their value at any time was small. The learners did not imitate the act in detail, but merely gained suggestions which enabled them more quickly to adopt a good method of pro-
Human beings, quite early in their lives, apparently form habits of imitation which continue to be of some value in learning new motor activities. It is worth while, apparently, to give demonstrations in connection with the teaching of many athletic and manual skills. However, it cannot be expected that the learner performs the act perfectly at once. The habits of imitation which are formed by children seem to be of two general classes. There are specific conditioned responses of such a nature that a movement, or the result of a movement, is a sufficient stimulus to lead the child to reproduce the same movement. There is another class of habit which is concerned merely with the desirability of closely observing another person's action. Children do learn rather quickly that it is worth while to watch the behavior of other people on the chance that they may profit by it. The watching of other people by children seems to be the only act in the nature of a general tendency to imitate (17:27-53).

B. The Learning Curve For Motor Learning

One of the earliest experiments dealing with the rate of learning a motor function was that of Bryan and Harter, in which they studied the learning of the telegraphic language. The learning curve for this activity was found to have the following characteristics: (1) Negative acceleration; skill learned rapidly at the beginning of the practice, but slowing
down of progress as a higher degree of skill was reached.

(2) Daily fluctuations; inconstant increase of skill, on some days the learner falling below the level of performance reached on the preceding day. (3) Plateaus; no apparent increase in skill over a relatively long period of time (several days or weeks). Bryan and Harter found such a plateau in the receiving curve just before the slowest main line rate, that was acceptable, had been reached, and another such plateau just after the ordinary main line rate had been passed (18:345-375).

Book,(9:278-287) in his studies of the learning curve of typewriting, found these same three characteristics. The numerous studies of "Animal Intelligence" have usually shown the first two characteristics, but no plateaus. The error curves followed in general the same course as the time curves and the curves for the amount of work done. The explanation given by Book was typical of that ordinarily given for these three characteristics. (1) The first rapid and continuous rise was due to the fact that the learners were making improvement along many different lines at once. Rapid progress was made in every department of the work. The learners were improving their method of locating the keys, of directing and controlling their fingers, of initiating and controlling the sequence of the letter-making movements, of getting the copy, of learning to deal with the many special difficulties which the task of learning this feat presented. They were also making progress
in developing and fixing letter, word, and phrase habits almost from the first. Moreover, the improvement in each of these lines was easy at first, and became increasingly more difficult as the skill increased. The learning curve, therefore, rose rapidly and continuously as long as many of these possibilities for improvement existed. But as the sources of improvement became less numerous and as the difficulties in each line increased, the rate of improvement gradually declined until a stage was finally reached where most of the adaptations in method was made. And since improvement in method became more and more difficult to make, because it must be made in the realm of the higher order habits where the learner had little or no experience, the rise in the learning curve became slower and slower as this physiological limit for improvement was approached. Finally, as the expert stage of skill was reached, the learning curve became almost horizontal. In these later stages of practice, the sole gain must come from occasional adaptations in method and from the fixing of present habits and methods of work which, as the analysis showed was a very slow and difficult process.

The progress which a learner of typewriting makes may come from a number of different sources. The gains may be due (1) to a strengthening by practice of the correct responses to be made on the machine; (2) to the elimination of some of the wrong responses unintentionally acquired in the course of prac-
tice; (3) to improvement of some of the specific habits—already formed; (4) to the origination of new habits or superior methods of work or control; (5) to a better identification of the true sources of improvement; (6) to improvement in the learner's ability to deal with some of the special difficulties which the task of learning presents; (7) to attaching greater satisfaction to the responses that bring success, and dissatisfaction to the things that produce failures; (8) to the development of a right attitude towards success; (9) to improvement in the learner's attitude towards the task of learning as a whole; (10) to increased interest in improvement as such; or (11) to a growth in the learner's belief in his own ability to improve and in the significance and worthwhileness of the task for him.

Swift (51:17-19), in his studies of juggling two balls with one hand, found a learning curve that had positive instead of negative acceleration. Skill was found to increase slowly at first, but more and more rapidly as time passed. He found the daily fluctuations as found in other learning experiments, but no plateaus.

The experiment of Swift introduced a new factor which had an influence upon the shape of the learning curve. Swift allowed his learners ten trials daily. By a trial he meant tossing and catching the ball until an error was made. An error consisted of failure to catch a ball or catching one ball while
the other was still in the hand. The amount of practice engaged in each day was, therefore, limited by the occurrence of ten errors. When ten errors were made, practice was discontinued. In the experiment of typing, the amount of practice was determined usually by a fixed number of units of work. In Swift's experiment the amount of time spent in the practice increased materially as skill increased. A comparable way of limiting practice for typing would be to limit the length of the practice period each day to the time required to make ten errors.

It developed, then, that three methods were used as means for limiting the amount of practice in learning experiments. (1) Time limit: work continued for ten minutes, thirty minutes, etc. (2) Work limit: a fixed number of work units completed at each practice period. (3) Error limit: practice continued until a fixed number of errors were made.

It should be noted in this connection the word "trial" as used by Swift was confusing. He used the word to mean "practice" until the occurrence of errors. In most kinds of work "trial" refers to a unit of work, which "trial" might be the writing of a word, or sentence, either with or without errors. In maze learning a "trial" means a single traversing of the maze with no reference to the occurrence of errors. In athletic activities a "trial" means a single attempt either successful or unsuccessful.
The question arose whether the positively accelerated curve, as found by Swift in ball tossing, was due to his method of limiting practice, to some peculiarity of his method of measuring progress, or to the type of activity itself. To investigate this point, experiments were set up at the University of Wisconsin. When the measure of progress was taken as the number of balls successfully thrown and caught during a thirty-minute working period, the learning curve had a negative acceleration, just as it had in typing, telegraphy, etc., where a similar measure of improvement was made. When the measure of progress was the number of errors made during a thirty-minute working period, the errors showed a rapid decrease at first, followed by a slower hundred successful catches. The curve showed an initial rapid decrease in errors followed by a slower decrease. This was the same kind of error curve which was found in maze learning with animals.

It is perfectly clear in view of these experiments that the learning of ball tossing followed the same general course as the learning of typing and telegraphy. When the plan of practice adopted by Swift was used (ten errors daily determining the length of the practice period) all the curves were positively accelerated.

Curves for total catches during the learning period always had negative acceleration, as do the error curves. Instruction caused the positively accelerated curve to approach a straight
The curves of slow learners showed a tendency to positive acceleration while the good learners were likely to have curves which occasionally showed negative acceleration.

When the plan used by Swift was adopted, (ten errors daily determining the length of the practice period) all the curves were positively accelerated.

Whenever the measure of improvement was primarily in terms of accuracy, there was apt to be an initial period of apparently little progress. In ball tossing, as an example, accuracy in throwing was essential to the making of a large number of catches in succession. Until accuracy was greatly increased a high score was impossible. The learning curve based on this measure, therefore, showed an initial period of slow progress and was positively accelerated. When skill was measured, in ball tossing in terms of the number of balls caught in a thirty-minute practice period, a measure in terms of speed, progress was rapid at first and the curve was negatively accelerated.

Bowdlear (12:100-105), in an observation of learning the upstart on the parallel bars, obtained similar results. (His factual material should be examined, not his conclusions). Out of thirty-seven boys, eighteen had no success in eighteen days of practice. Only seven showed perfect learning when judged by perfect scores on the last two days of practice. In most cases, where learning took place, initial progress was slow. The
curve of the twelve boys who showed results gave evidence that out of thirty-seven boys, seven only were ready for a period of rapid initial progress, while thirty must wait for an increase of accuracy of coordination before measurable progress took place at all.

Swift (50:131-133) found no plateaus in ball tossing. Using a fixed number of catches daily as a method of determining the length of the practice period.

The subject of plateaus has for some years claimed the attention of psychologists. Book's explanation of plateaus has been followed by numerous experimenters. Bryan and Harter said that plateaus occurred when the habit being formed was complex and consisted of a hierarchy of habits. A plateau meant that the lower order habits were approaching their maximum, but the higher order habits could not be better formed, because of the imperfections of the lower ones.

Stetson and McDill (45:18-40) approached the question of plateaus from the standpoint of the type of muscular contraction involved in the activity. They classified movements as (1) fixation, (2) slow movement, (3) fast movement. The author describes fixations as an activity in which the opposing muscle tremors exactly balance. Muscle tremors occurred at about the rate of ten per second. Fixation consisted of a number of muscle tremors, each of slight extent, added together in a given direction. In fast movement each muscle tremor became
greater; there were fewer muscle tremors per unit of length of path. The maximum speed of movement was attained when there was one muscle tremor covering the full length of the movement. Such movement could not be stopped once it had begun. When movement occurred under tension, there was excess contraction in one of the muscle groups involved in holding still. Ballistic movement was initiated by muscle contraction, but during a portion of the movement, the part of the body in motion was swinging freely from the joint with all the muscles relaxed. The ballistic movement was terminated (1) after a full swing by the pull of the ligaments; (2) by a block, as in striking; (3) by the contraction of an opposing muscle group as in the to-and-fro movement of the hand. Ballistic movement was very common in motor activities which were done at a high speed. It is a form of movement which must be adopted in many activities before the highest speed can be attained.

When students undertook the learning of a new activity, such as typing, running a piece of machinery, or learning a new swimming stroke, they began by practicing "slowly and carefully." The movement was "slow" in the meaning used by Stetson and McDill. It was "careful" in the sense that the learners tried to move their fingers, hands, and arms through the approximately correct pathway. The objective product was a correctly spelled word, a machine product which was not defective, or keeping afloat in the water. It should be pointed out that
while the learners attained a good finished product, they did not at once attain the correct path of movement or attain good form. Somewhere during the period of practice, there was a transition from slow movement (usually under tension) to the rapid ballistic movement. According to Stetson and McDill, the plateaus in learning were due to this transition from one type of movement to another. Development in skill usually meant increased speed. In all such cases plateaus were usually found.

Some activities were practiced as full speed from the beginning, in diving, for example. The occurrence of a plateau in such an activity had a different cause. Other activities were practiced either slowly or rapidly, as, for example, throwing, driving a golf ball, or serving a tennis ball. Mere repetition did not constitute fruitful practice, but resulted in a plateau. Change in type of movement was essential to increased speed. The elimination of errors was accompanied by increased speed, but had a different cause.

A radical change in style, as from juggling balls in a frontal plane to a lateral plane, was necessary to produce a further increase in accuracy. Temporarily, however, the factor of accuracy in throwing became acute, thus producing a period of slow progress, a plateau. The movement cycle was performed at a relatively slow speed at all times and there was no change in the type of movement. In such an activity as typing, on the other hand, accuracy was better controlled from the beginning;
slight inaccuracies were of little consequence at first. Improvement in typing depended primarily upon an increase in speed movement, and showed a plateau, just before and during the change from movement under tension to ballistic movement.

In conclusion, it appeared that positive or negative acceleration of the learning curve depended on: (1) the unit of measure which was used; (2) the way in which the unit was related to the total work done during the practice periods.

The nature of the activity being learned was an important factor since the unit used for measuring progress varied with the activity. In some activities where skill was almost exclusively a matter of accuracy, i.e., the correct timing and coordination of parts of a movement rather than increased speed of movement, there was a long period of little or no apparent progress followed by relatively sudden learning. The daily fluctuations in score depended upon unidentified variations in physiological or environmental conditions. Plateaus depended upon (1) a gradual change from one style of performance to another and better style, or (2) upon a change in the type of movement under tension to ballistic movement. The rise after the plateau occurred when the new style or the new type of movement was definitely accepted as a goal to be attained. Plateaus were found when progress definitely required increase in speed movement. They were also found when a change in style temporarily interfered
with increase in accuracy, in activities where accuracy rather than speed was the chief factor in progress.

All the difficulties encountered in learning to typewrite could be successfully met and prevented if the teacher knew the exact kind of direction and help which the learners need at the critical stages of advancement where the plateaus in the learning curves tend to appear.
SUMMARY

Among the psychologists it has been assumed that in man as well as in animals, there is an instinct to imitate. Bain gave five reasons to disprove this theory. Many modern psychologists had abandoned the theory of instinct in general. An instinct of imitation would naturally be abandoned along with the rest.

Berry found that a certain type of voluntary imitation existed in cats. Thorndike found no evidence of imitation in any animal. Lashley experimented with an Amazon parrot which did not talk, by placing with it a bird that did, and found there was some imitation. Haggerty, after experimenting with monkeys, found five levels of imitation behavior.

Human beings, quite early in their lives, apparently form habits of imitation, which continue to be of some value in learning new motor activities. These habits of imitation, which were formed by children, seemed to be of two general classes. They were: (1) specific conditioned responses, and (2) the desire of observing another person's actions.

Bryan and Harter studied the learning of the telegraphic language in order to determine the rate of learning a motor function. The learning curve of this activity was found to have the following characteristics: (1) Negative acceleration;
(2) Daily fluctuations. (3) Plateaus.

Book, in his studies of the learning of typewriting, found these same three characteristics among students. The explanation given by Book was typical of that ordinarily given for these three characteristics. The progress which a learner of typewriting made came from a number of different sources -- an important source of improvement was due to a growth in the learner's belief in his own ability to improve and in the significance and worthwhileness of the task for him.

Swift, in his experiment of juggling two balls with one hand, allowed his learners ten trials daily. By a trial he meant tossing and catching the ball until an error was made. The amount of practice each day was, therefore, limited by the occurrence of ten errors. A comparable way of limiting practice for typing would have been to limit the length of the practice period each day to the time required for ten errors.

To investigate this point experiments were set up at the University of Wisconsin. It was perfectly clear, in view of these experiments, that the learning of ball tossing followed the same general course as the learning of typing and telegraphy.

Swift found a number of plateaus in ball tossing. He used a fixed number of catches daily as the method of determining the length of the practice period. The subject of plateaus was found worthy of special consideration. Book's explanation was quoted at length. Bryan and Harter said that plateaus
occurred when the habit being was complex and consisted of a hierarchy of habits. Stetson and McDill approached the question of plateaus from the standpoint of the type of muscular contraction involved in the activity. They classified movements as: (1) Fixations. (2) Slow movement. (3) Fast movement.

According to Stetson and McDill the plateaus in learning were due to this transition from one type of movement to another.
CHAPTER III

A SURVEY OF THE LITERATURE IN THE FIELD
OF THE PRESENT STUDY

This chapter will present a brief resume of the principal findings of the various available studies in the field of the present experiment.

A survey of the literature in the field of typewriting discloses a considerable number of experimental studies. Most of them have been directed toward an investigation of the learning curve. A large number of the experimenters have been interested primarily in the general problem of the psychology of learning and only incidentally in the practical suggestions for the teaching of typewriting which might result from their studies.

(1) The Learning Curve in Typewriting

Swift's experiment was an investigation of the learning curve, in which he used one subject, who practised for an hour a day for forty-nine days. The number of words written in the hour was recorded and from these daily records the curve for the learning process was drawn. His conclusions were as follows:
1. The learning process is irregular. Periods of advance and retardation alternate.

2. The acquisition of skill in typewriting is an exceedingly complex process.

3. The elements involved in the process do not have separate periods for their beginning and development. Both simple and complex factors come in early but in different degrees of activity.

4. There are one or two periods of delay in which lower order habits are automatized and preparation is made for a higher order.

5. Plateaus have at least two causes. They are resting places; the learner has overshot his permanent power and must wait until automatization is perfect. They are also due to slumps in enthusiasm.

6. The daily variations are sometimes due to physical conditions, and sometimes to other causes. But often no definite cause can be assigned to them.

7. The process of developing higher-order habits is subconscious. The learner suddenly finds himself doing something that he has not done before (48:295-305).

Swift and Schuyler reported an investigation of the learning curve. There was one subject, and he used the "touch" method of typewriting. He followed the exercises in a typing manual. The subject wrote half an hour a day for
sixty-six days. The record was in the form of the gross number of strokes written for thirty minutes. From this experiment the following conclusions were reached:

(1) Repeated practice in a single sentence brought an increase in speed over a period of fourteen days. (2) There was a gradual decrease in the percentage of error. (3) Writing the same copy over and over in successive practice has no influence on the number of errors. (4) Increased speed is usually associated with an increase of errors (47:305-310).

Barton in an experiment attempted to compare the learning curve of two groups, one using a regular method of studying typewriting, and the other using the incidental method. The first group worked from a regular textbook. The second group first learned the keyboard and then wrote letters of their own composition, and later copied from textbooks in other subjects. Tests were given to the two groups at regular intervals. There were fifteen subjects in the first group and twelve in the second, and the experiment was carried on during the school year. The curves were made on the basis of net words per minute, after ten words had been deducted for each error. The conclusions reached were as follows: (1) The second group in almost every case averaged better than the first. (2) The curves of early learning of the second group followed the ordinary curve of learning except that there was an initial rapid rise (3:465-474).
The first really comprehensive study of the learning curve was reported by Book. In this experiment he used eleven subjects: three regular learners, and three professional typists, four beginners and a typewriting expert. Several of the subjects learned by the sight method, and some by the touch method. In the first case the practice and test was for half an hour, and for the latter group there was an hour of practice and a ten-minute test daily. The experiment was carried on for from 86 to 174 days for the different subjects. The curves were based on the total number of gross strokes made in the tests. On the basis of these curves and the supplementary data obtained from the subjects, the following conclusions were drawn: (1) The curves are of regular type - they rise rapidly at first and then more slowly as an expert skill is approached. (2) There are marked fluctuations in efficiency from minute to minute and from day to day. (3) All curves show a number of short irregular periods of arrest, called "breathing places." (4) Most of them also show one or more longer periods of arrest, actual plateaus. (5) Variations in the curves are accompanied by fluctuations in attention and effort, and by definite changes in the learner's feelings and attitudes. (6) The special associations or habits or manipulations are developed in a definite order; first, the use of old associations then the reorganization as parts of higher and more economical groupings. (7) The separate factors develop simultaneously, but not all make
steady gains at the same instant. (8) The final perfection of the special associations is a slow and gradual process (10:167-174).

Later Book (11:183-199) published another article on the subject, with special reference to the direction of the work by the teacher. This article consisted simply of a reorganization of the earlier studies.

Hill, Rejall, and Thorndike reported a study of the learning curves in the case of two subjects who worked for five months. In this experiment the subjects wrote the same number of words each day and kept a record of the time required. Their conclusions were: (1) After the first few days the curves are almost straight lines, and do not show the parabolic form. (2) There is a rapid initial rise. (3) A memory test after four and a half years showed very great permanence of the old learning (30:516-529).

Bradford carried on an experiment with four subjects. These subjects wrote their copy each day first from visual stimuli, and then from auditory, and finally from a combination of these. Three-letter syllables were used, as well as words, sentences, and finally some continuous matter. The curves were based on the number of strokes per minute. Conclusions were as follows: (1) The zig-zag order is a very natural one in the learning process. (2) Learning to typewrite consists of very complex mental processes which necessitate absolute concentra-
tion of the attention. (3) Work done late in the evening is not so efficient as that done earlier in the day. (4) The guide to success is good mental and physical condition and an agreeable attitude toward the work (14:445-460).

An experiment reported by Kjersted had a twofold purpose, first, to study the learning curve, and second, to study the kinds of errors and their causes. He used four subjects, who practised half an hour per day, ten minutes on a practice sentence and twenty minutes on copy material. The entire practice material was considered in the records, both in the study of the learning curve, and in the study of errors. The curve was based on the gross number of strokes per minute. From this experiment the following conclusions were drawn: (1) There is somewhat regular, rapid, and continuous advance in the early stages of the learning. (2) Following this there is a period of less rapid advance within which are shorter periods of very rapid and very slow or no advance. (3) Those who go beyond 108 strokes per minute experience another rapid and continuous advance. (4) There was no correlation between the curves for the two different kinds of practice. (5) The curves on the same type of material were very similar for the different subjects. (6) Most of the time and energy of the subjects was spent on the periods of little or no advance. (7) The daily or individual variations in speed were very marked during the periods of little or no advance. (8) The periods of little or
no advance were short in the early part of the learning and seemed to grow longer as the learning advanced. (9) There is no correlation between increase or decrease in speed and in per cent of errors. (34:5-49).

Chapman and Hill conducted an experiment which attempted to portray conditions more nearly as they existed in the actual classroom rather than under unnatural laboratory conditions. They studied the learning curves of a class of pupils working in school. Five-minute tests were given once a week. One group was studied from the point where they had 20 hours of practice to the point where they had had 100 hours of practice; and another group from the point where they had had 75 hours of practice to the point where they had had 165 hours of practice. One word was deducted for each error, and the curves were constructed from these "net" scores on one axis, with hours of practice on the other. Their conclusions were: (1) In the period from twenty to one hundred hours of practice all but three subjects showed positive correlation (2) In the period beyond 75 hours, all showed negative correlation (22:494-507).

Chapman published a continuation of the experiment given above, covering in all a period of two school years. He concluded: (1) The individuals reaching (after the same period of practice) the same degree of skill do not by any means learn in the same manner. (2) There is no fundamental or
typical curve to which all individual curves approximate.

(3) Short plateaus occur in the curves of many individuals; they do not occur at fixed places which are the same for all.

(4) Some show distinct positive acceleration in improvement in the period from twenty to sixty hours. (5) Some are comparatively erratic in their variations from week to week, while others seem to vary little. (6) The average for the whole class showed a straight-line curve for the period of ninety hours of practice. At that point there was an abrupt turn and the learning curve from there on was nearly horizontal.

(7) Correlations of initial speed and final speed with each other were practically .66 in each case (21:252-288).

An experiment somewhat out of the ordinary was made by Freeland. This was a study of the learning curves in typing of six children, one from each of the grades from 1 to 6. Each child practised ten minutes a day, five days a week, for a school year. All the work done was considered in the curves, which were drawn on the basis of the gross strokes written in ten minutes. His conclusions were: (1) Children in all different grades could learn the touch system; the older children learned it most rapidly and retained it best. (2) Long vacations caused a decrease in skill. (3) Considerable testing was necessary to keep the teacher informed -- occasional testing will often give the wrong impression of the work accomplished. (4) Initial performance gave no indication of power or
capacity. (5) There was a very rapid gain for about three weeks, followed by much slower gains. Accuracy improved rapidly at first, later hardly at all. (6) The younger the child, the greater and more frequent the fluctuations. (7) Each child reached a plateau and remained there until special effort was made to break it, indicating that this phenomenon is probably due to the ordinary causes and is not an essential feature of the learning curve (27:97-115).

Butsch made a study of the learning curve in typewriting in an experiment at the University of Chicago. The data consisted simply of records or tests taken about twice a week by nine typewriting students during their second year of instruction. In order that the curve should be more nearly representative of the ordinary work done in the classroom, the records were not all obtained under the same conditions, but were samples of the results obtained under different classroom conditions. The records were not all made the same year. They do not include simply the records of the best students of their classes, although they are the records of students better than the average. The subjects were not all taught by the same teacher. The tests upon which the records were based were not in all cases upon the same material. However, the material used was quite similar in all the tests, and in practically all cases five strokes were counted as one word. In addition, all
tests were graded on the basis of a deduction of ten words, or fifty strokes for each error, deductions being made for the errors as they are defined in the rules of the International Typewriting Contests. The following conclusions were drawn: (1) For most subjects the general shape of the advanced curve was practically a straight line, by no means horizontal, or even approaching the horizontal, up to the end of the second year. (2) The improvement during the second year is about 40% of that made during the first year. (3) The most prominent characteristic of the advanced curve, for all subjects, is the extreme variation between successive test scores, or between test scores which follow each other by only a short interval of time. (4) The extreme irregularity did not seem to be due to any great extent to extreme variation in the number of errors, but was apparently based upon great fluctuation in the gross scores. (5) A number of subjects showed plateaus at this higher level, although in most cases, it was rather difficult to determine whether the period of little or no advance was a real plateau, or was only apparent and was due to upper limit and was approximating a straight line. (6) Final ability was related quite closely with ability at the beginning of the second year of work; however, this beginning score was not very closely related with the amount of improvement which might be made (20:39-74).
SUMMARY

On the important matter of the shape of the learning curve in typewriting there is quite a general agreement. Book (10:1-14) says that there is a rapid rise at first, followed by less rapid rise later. Kjersted (34:50-59) used almost the same words, and then adds that there is a further rapid rise after the point of 108 words per minute. Freeland (27:115) speaks of a rapid gain for three weeks, followed by a slower rise later. Thurstone (53:31-45) finds that for the majority of his subjects the curve is a parabola. Chapman (21:261-268) differs from these investigators. He reports that there is no fundamental typical curve, although the study when reported at an earlier stage by Chapman and Hill describes the curve as having positive accelerations at about one hundred hours of practice, and negative acceleration beyond that. Thurstone (53:31-49) reported exactly this type of curve for his data when they are plotted against weeks of practice. In contradiction to Thurstone's curve for the average scores of his group, Chapman (21:252-264) reported that the average for his class showed a straight line to ninety hours of practice, then an abrupt turn and an almost horizontal line from that point on. Hill, Rejall, and Thorndike (30:522-524) spoke of a rapid initial rise, followed by an almost straight line for the re-
mainder of the curve. The curves in the case of the other
investigators who did not make special mention of this point are
in most cases of the usual parabolic form.

Most of the investigators spoke of various irregularities
in the curves. The daily fluctuations, zig-zag lines, etc., are
mentioned by many of them. Chapman found that some subjects
had much of this irregularity, while others had little. His
curve probably showed fewer fluctuations than did those of most
of the other investigators, as he gave the tests only once a
week. Freeland found that the fluctuations are greater with
the younger children.

As to the causes of these daily fluctuations, most of the
authors do not venture an explanation. Book explained them as
due to variations in attention and effort, and to change in the
feelings and attitudes of the learners. Both Swift and Brad-
ford spoke of the importance of physical and mental conditions
and proper attitudes as factors. Swift also said that some-
times the retardation or loss may be accounted for by physical
conditions or in some other way, but again no cause can be
assigned for it.

In addition to the daily variations, Book also called
attention to short "breathing places" of no improvement, and
longer periods of arrest, or plateaus. These plateaus were
also mentioned by many other investigators besides Book, some
of whom attempted to explain their cause. Swift explained that there were times when lower-order habits were automatized and preparation was made for higher order habits; he also accounted for them as due in part to a slump in enthusiasm. Chapman reported that plateaus did not occur at fixed places. In the experiment reported by Hill, Rejall, and Thorndike the subjects did not show any plateaus at all. Kjersted found that most periods of little or no advance came at definite levels of accomplishment, and that they were short at the beginning of the work, but were longer after the subject was more advanced.
(2) Experiments Based Upon Prognostic Tests

A number of experiments have been made to determine the
native characteristics that are apparently necessary for learn­ing to typewrite or to achieve distinction in the practice of
this art.

Tuttle selected six psychological tests which he believed
would measure the psycho-physical processes involved in learn­
ing to typewrite: (1) a motor reaction test, (2) a test for
rhythm, (3) a test for attention and accuracy, (4) a test for
memory span, (5) a direction test, (6) a substitution test.
Three of these tests gave no help whatever for determining in
advance the student's ability to learn to typewrite. The test
for rhythm and directions test showed little positive correla­
tion with the progress made in learning to typewrite. The test
for memory span test gave a negative correlation, while the motor
action, the attention, and the substitution tests gave a pos­
itive correlation ranging from 0.52 to 0.68 (55:171-182).
Tuttle concluded that the particular abilities measured by the
last three tests are required in learning to typewrite, because
the students who did well in these mental tests also received
the highest grades in typing.

The results of the investigation seemed to show that those
who made a mark of eighty or above on these particular tests my
become expert typists.

Bills in two investigations tried (1) to get a reliable basis for selecting applicants for courses in stenography and typewriting who would be successful in learning these arts, and (2) to determine whether it was possible to select, without tryouts, from a group of applicants for stenographic positions those who would be eminently successful. Three types of tests were given to the learners: (a) a general intelligence test, the Carnegie Employment Vl, (b) a series of five tests designed to show special aptitude in stenography and typewriting, the Carnegie Employment Vill, (c) a will profile test designed to measure motor inhibition, speed of decision and perseverance. The rating made on these tests was compared with the progress these same subjects made in learning to typewrite. It was concluded from this investigation that eighty-six per cent of the failures could by this means be selected in advance and eliminated on the basis of the ratings made on this test. Parts I and V of the special ability tests proved most helpful for selecting for positions candidates who could be certain of success, the reliability of the prediction being sixty-seven per cent for Part V and sixty-nine per cent for Part I (7:275-283).

Bradford made an investigation, the purpose of which was to study the influence of (1) practice; (2) different stimuli
visual, auditory and audio-visual; (3) distribution of practice; and (4) secondary factors, such as momentary disposition, time of day, fatigue, concentration of attention, etcetera (14:445-460).

These experimental tests were taken by four subjects. The Hammond Number 12 typewriter was used. The following conclusions were reached: (1) Much care was necessary for a beginner to keep from getting lost in the copy; especially was this true when copying single letters. For one to rush meant an increase in errors and at times a confusion which impaired the knowledge of the keyboard. Copying single letters was much slower than copying larger units, and the sentence copy gave the best record of any units practiced in those tests. (2) Writing by touch was very slow and discouraging at first; but the learner soon became familiar with certain keys and with certain associations, and the practice became interesting. (3) There were many minor details as well as the more important mental processes to be attended to continuously and simultaneously which made the learning process highly complex. (4) Habits of all orders made progress simultaneously, some in less, some in greater degree, and occasionally there seemed to be an interchange of rates among the different orders in regard to development. Sometimes the lower orders usurped the place of a higher order and thus reduced the writing to a slower and
eruder type. But this falling back in progress of the higher-order habits was not for a long period; it soon gained the ascendency again. (5) Progress was not characterized by a smooth curve, but rather by a very irregular one; at times the subject leaped forward beyond the point which his efficiency could maintain, then a drop occurred, followed by constant gain till the maximum was reached again, and then another leap was taken. This zig-zag process seemed to be the natural order of the learning process. (6) The curve showed conclusively that the subject made the least gain in writing from letter copy, and the greatest gain in writing from connected discourses. (7) Probably the best time of day for such work as typewriting was not the same for all individuals; but these experiments showed that work done late in the evening was not as efficient as work done earlier in the day. (8) Long practice periods were not as successful as short ones, repeated oftener. (9) Learning to typewrite consisted of very complex mental processes which necessitated absolute concentration of the attention. (10) The key to success in this activity was good mental and physical condition and an favorable attitude towards the work (14:445-460).

An experiment made by Brewington on prognostic tests in typewriting was carried on with forty-two students as subjects. They were given tests at the beginning of the typewriting
course and the scores made on these tests were studied in comparison with the work done during about six months of practice. The conclusions were: (1) It is possible and practicable to construct tests which reveal, with a fairly high degree of accuracy, the degree of skill which can ultimately be acquired. (2) Some of the tests used in the experiment were of value and some proved not to have a very high correlation with the degree of skill ultimately acquired (16:10-14; 29-35).

Stiles conducted an experiment the purpose of which was to evaluate a group test for predicting skill in typewriting. The test used in this experiment was given to two classes of girls in beginning typewriting at the branch of the Lake View High School, Chicago. Though the classes were planned for beginners only, there were a few repeaters found in each class. No record of their work was kept. There were twenty-seven subjects in the first-period class who were taking typewriting for the first time, and twenty-eight subjects in the second-period class who were taking typewriting for the first time. Two subjects withdrew from the first-period class. There was no practice outside of the class period. The instructor was always with the class, giving directions and watching the subjects during the entire time. The prognostic test was given to the group after the subjects had had one lesson on the typewriter. The test used was a serial-reaction test similar to
Miss Brewington's, but adapted to group testing. The conclusions were: (1) Three sets of scores were obtained from the prognostic test: (a) The correct strokes written on each exercise, (b) the time that it took to write each exercise, (c) the correct strokes per second written for each exercise. (2) Scores on a serial-reaction test used for predicting ability to learn typewriting were found to be satisfactorially reliable. The most reliable scores were obtained from the third day of testing. (3) While the criteria employed -- Blackstone's Stenographic Test, perfect-paper counts, and teacher's grades -- were not as high in reliability as would be desired, they agree moderately well with one another and serve to indicate, roughly at least, the typewriting achievement of the subjects. (4) The results of the correlation between the scores of the prognostic tests and the criteria were sufficiently high to indicate that the prognostic test was of some value in predicting typewriting skill (46:1-4; 15-25).

Ackerson reported a study of predictive experimentation in typing, i.e., the type of experiment in which one correlates the results of a series of psychological tests or similar test variables with a series of criterion measures of proficiency in typing. Its aims were to determine the interrelations of the objective and measurable elements of a group of typed papers with reference to their value as criterion measures of proficiency, and to ascertain the extent to which psychological test
scores and similar variables were correlated with these purely objective measures.

The outstanding conclusion from this study was that in predictive experimentation of this sort, the criterion measures of proficiency should receive closer study and closer analysis into their factors. The speed factor is not difficult to predict by psychological tests, but in the case of the accuracy factor, a representative sampling composed of twenty-seven variables showed a series of correlations which were little better than such as would occur in purely uncorrelated material, such as might be obtained from dice throws or card draws. Since the speed factor and the accuracy factor are themselves intercorrelated only to the extent of .2 or .3, it is unlikely that a test which correlates highly with one factor would also correlate highly with the other except as a matter of chance. Therefore, each factor should be treated separately and the experiment should aim to select tests which will predict each factor by itself. When such an analysis has been made, the combining of such criterion elements into a composite is a relatively simple process by means of the useful Spearman sums-and-differences formula.

The second outstanding conclusion concerned the inadequacy of the criterion measures themselves. In this study two types of criterion measures were employed, one an objective score
based upon a total of forty-eight minutes of speed testing, and
the other based upon the teacher's marks covering the entire
six semesters of training. Although each score would appear to
afford a plausible criterion, the two intercorrelated only to
the extent of .50±.30. Now this means that the two scores
would accurately be considered as measures of the same thing.
Among the several criterion measures employed by the other
fourteen contributors to predictive testing, it is unlikely
that these intercorrelations between the proficiency measures
themselves would be any higher. Apparently the most immediate
necessity is to attack the question of the criterion itself,
because until one can establish a proficiency measure which
will manifest a degree of validity, or at least a degree of
plausibility, it is idle to search for tests which purport to
prognosticate a capacity which is itself not yet identified and
measured (1:88-95).

Korngold in an experiment aimed to select a set of tests
which if given to pupils before they begin the study of type-
writing, would predict their chances for success in typewriting.
At the outset of the experiment a study was made of previous
investigations and by theoretical analysis and practical obser-
vation a tentative conclusion was reached as to what abilities
were needed to become a successful typist. The actual experi-
ment consisted of administering the typing tests and the test
of ability to seventy-three high school students in the beginning class in typewriting. The scores which they made on these tests were correlated with the scores made on the test of typing. The tests which yielded the most promising results were then combined in such a way as the statistical treatment of them suggested, and they constituted the test battery. This study assumed the necessity of a thorough analysis of the capacities needed by the successful typist. The reality of the criterion measured and of the tests must be satisfactory before one can ascertain the true reason for the presence or absence of correlation between the two. Of the two types of capacities treated in this study mental capacity seemed of greater significance than did motor capacities in the development of success in typing (36:15-36).

There have been a number of attempts to devise prognostic tests in typewriting. The most important are those of Lough, Rogers, Gronert, Tuttle (55:177-81), Brewington (16:29-35), Book (10:147), and Korngold (36:15-36). Lough’s (39:159-180) Experimental Psychology in Vocational Guidance describes a test in which one letter was substituted for another according to a key or code. The results of the tests were determined by the subjects’ ability to improve in a number of performances of the test. Test records were compared with teachers’ ratings in courses in typewriting. The subjects who made high scores in
the substitution test were those who were given the highest rating by the typewriting teacher. No statistical evidence is given to support the author's conclusions (39:159-180).

Among the conclusions reached by the investigators in prognostic testing, there are many agreements and many contradictions. Some questions have been considered by practically all those working in the field, while others have been mentioned by only one or two. An attempt is made in the following paragraphs to bring into relief the findings of the different investigators on some of the most important questions considered.

The possibility of prognosis is one of the most interesting questions in connection with any activity. A few of the investigators were chiefly concerned with this question, and others touched upon it incidentally. Chapman found that the correlation of beginning, intermediate, and final scores was practically .66 in each case, which is a significant correlation. Freeland, on the other hand, reported that initial performance gave no indication of power or capacity. Thurstone reduced the curve to a parabola. Korngold found that mental capacity seemed of greater significance that did motor capacities in the development of success in typewriting.

If the experimenters had directed their chief efforts to such a study of criteria in typing, the accumulated body of experimental knowledge in this field would now be of such dependability that succeeding experimenters would be able to
work directly toward the devising of a practicable predictive test series.

(3) Various Methods of Instruction Compared

In 1923, Charles Miller, former instructor in stenography and typewriting in the Secretarial School of Columbia University, at present principal of the Miller Institute of Shorthand and Typewriting in the City of New York, obtained a copyright on a system of typewriting instruction which shows many points of variance with commonly accepted theories and introduced several distinct new features in this field (40:77-89).

The essential parts of the typewriter mechanism, muscular development, and development of proper finger action and touch are taught in more or less orthodox fashion. But in the matter of developing coordination between mind and muscle, this system has taken a radical step -- no keyboard charts are used; the student is not to keep his eyes away from his fingers and the typewriter keys; he is told to study the location of the keys upon the machine and to watch his fingers as he strikes each new key for the first few times. The claim is made that the student thus gives his mind, through the eye, an opportunity to discover just what order it will send out when it wants a key struck. This is supposed to add a visual to the usual auditory and motor images given by other methods of teaching the location of the keys. The student not only hears the instruction
of the teacher and feels the key on the machine, but looks at the key itself, and watches the movement required to strike it effectually. When he is rather sure of the location of the key he is challenged to write it without looking.

The author declares that as students of their own initiative seldom write at the peak of their ability, it is necessary to provide an urge that will cause them to write rapidly. If students were satisfied with their own level of speed and accuracy they would make no effort to improve. Mr. Miller cites the experience of many educators to prove that direct dictation provides the incentive needed for the development of rapid, accurate thinking. Vocal class dictation by the instructor he thinks well worth while, but he believes that the vocal strain involved, and the necessity of keeping the entire class writing at a speed consistent with that of the slowest student, militated against the complete success of the method. The rapid typist gets little or no benefit from such slow practice.

To meet the important need of direct dictation as an incentive to write rapidly, the dictaphone is introduced into the classroom. By using records which parallel the exercises in the textbook, at graduated rates of speed of from ten words a minute upward to sixty words a minute, the student is given the urge best adapted to his needs. Individual needs are provided for by giving slower records to the backward students and fast-
er records to the swift typists. Transcription of these re- cords, it is asserted, develops a high degree of automaticity and enables the student to move quickly and easily from a lower speed record, the bad habit of forming a "set" speed is elim- inated, and he is made to progress at the highest consistent rate of speed.

Mr. Miller has devised an interesting method of overcom- ing the troublesome speed "plateaus" in typewriting. When a student reaches a plateau and cannot write a record at a given speed, say twenty words a minute, he is advanced to a record dictated at a higher speed -- twenty-five or thirty words per minute. After he has worked with this for awhile he is put back on the one that proved troublesome. According to the author, this transfer to touch is easily made and the student is soon ready to type from copy and direct dictation. Having brought the senses of sight, hearing, and touch to bear upon the location of the keys, he has a triple image in his mind, which is believed to be more vivid and permanent than the dual image of touch and hearing given by ordinary methods of instruction.

Advanced dictaphone transcription is given late in the course for the purpose of impressing essential facts in con- nection with business procedure and to give the student prac- tice on the dictaphone as it is used in a business office. According to the author, the student upon finishing the course is both an efficient typist and a finished dictaphone operator.
Another unusual feature in this system is that perfect accuracy is not demanded at the beginning of the course. To do this, the author believes, materially retards progress. However, each new word introduced is made up principally of letters formerly used by the pupil and definite instructions for elimination of faulty technique are given. The student is always asked to write just as well as he can, but the customary requirement of "perfect copies" has been abandoned.

An interesting device is the use of an accuracy record sheet similar to the Error Diagnostic Chart designed by Dr. Blackstone of the University of Iowa. On this Accuracy Record Sheet are listed all the letters, figures, and numerals on the typewriter keyboard, together with number of the mechanical operations used in running a typewriter. A line appears at the side of each item listed on the sheet. When the student checks over his errors, he records each mistake on the line following the item on which the error was made. For example, if he has struck "t" in place of "r", and so on. Thus, the student not only discovers the error he has made, but he also notices what key he struck in place of the right one. The teacher by referring to the chart can detect the most frequent errors made by the student, and give special exercise designed to overcome each one.

Rhythm is fixed by means of a dictaphone metronome, the speed of which may be gradually increased in accordance with
the progress of the student. However, no great stress is laid on rhythm and musical records to teach rhythm are not used with this text. Perfect rhythm, of course, is never possible. Probably the only value of rhythm drills, after all, lies merely in bringing the student up to a necessary minimum on slow strokes. Finally, the claim is made that students under the dictaphone system of learning typewriting will be able to typewrite at a rate of about one-third faster at the end of the semester of work than students taught by orthodox methods. At the same time they will have completed a greater number of exercises, thereby learning more of the subject matter.

To test the claims of this system the following experiment was conducted in the commercial department of the University High School at the State University of Iowa during the semester beginning September 17, 1925, and ending January 30, 1926. Two classes in typewriting were enrolled. Both classes were taught by the same instructor; one class, which might be called the traditional class, contained seventeen students; the dictaphone class, nineteen. Blackstone speed tests were given both classes at intervals of about a week. The results of these tests were carefully checked.

Unfortunately a number of difficulties were met which detracted seriously from the validity of the results. The two groups were not so evenly matched as they should have been. There were more advanced students in the dictaphone class than
in the traditional class; they were older and slightly more intelligent as a group. The number of cases was too small. A new and complete set of dictaphone records arrived too late for use during the time for the experiment; the set used was incomplete and variations from the text were frequently necessary.

Most of the parts of the study can, therefore, be rejected as unreliable. The superior results achieved by the dictaphone class may have been due to other factors than the method. It is possible that the same results would have been secured by using the traditional method for both classes. In fact, the dictaphone class might have worked better under the old system. Whatever the results may have been had the traditional method been used for both classes, the results obtained are, at least, interesting. Both classes were successful, as is shown by the fact that the traditional class achieved the Blackstone test norm of sixty-eight for the end of the semester during the thirteenth week, and the dictaphone class during the ninth.

The highest score of the traditional class represents about fifty-three per cent greater achievement than is ordinarily made in one semester. The dictaphone class was typing at a rate about sixty-eight and one-half points faster than the traditional class. The individual pairs shown on the charts were the best obtainable comparisons, and each case shows a marked superiority in typing ability on the part of the students using the dictaphone. The commercial department at the
University High School regards the results as significant, and has decided to continue the use of the Miller dictaphone method in all typewriting classes. Probably the greatest value in this experiment lies in the fact that other schools may be encouraged to undertake similar studies under better controlled conditions and with a larger number of cases. Should their experience with the dictaphone be uniformly as successful as that described, its use could safely be said to result in greater efficiency in teaching typewriting.

Entwistle carried on an experiment with six beginning classes of typing in the high school at Lead, South Dakota. Three classes were taught without any mention of rhythm and the other three were encouraged to use rhythm all the time. The same textbook was used with both groups, the same method of grading was followed, and everything possible was done to keep all factors constant save that of rhythm. For the purpose of this study rhythm was defined as "giving to each letter stroke an even flowing touch, so that each key required approximately the same amount of time as is given to the other strokes." The students were tested monthly by means of the Blackstone Typewriting Tests, and careful records were kept as a basis of determining the achievement of each group. The following conclusions were reached: (1) the number of cases included in this study was too small to yield conclusive results. (2) In so far as the results were reliable, it seemed that students
who had been taught rhythm. (3) If rhythm is as valuable as had been maintained, the rhythm group should have scored the higher. (4) In this study, rhythm failed to prove its value.

This experiment was carried on primarily to aid in getting practical suggestions for the teaching of typewriting, and to increase the efficiency of the learner (25:75-76; 80-83).

Pearson made an interesting experiment in the teaching of typewriting in the commercial department of the Experimental High School at the University of Iowa. Two classes in typewriting were enrolled. Both classes were taught by the same instructor, one class being taught according to traditional methods, the other class using the Miller dictaphone system. The results have been published by the University in a monograph entitled Research Studies in Commercial Education (42:77-95).

They were as follows: (1) The dictaphone class averaged forty-two points higher than the traditional class in scores made on the Blackstone tests during one semester, the time allotted to the experiment. (2) In percentage of gain the dictaphone class averaged sixty-three per cent higher than the traditional class. From these results the University High School concluded that the Miller dictaphone method was the more efficient method of teaching typewriting and it has since continued the use of dictaphone records in the classroom as an urge to faster and more accurate typing.

The plan used in the automatization class varied from the
dictaphone method in many particulars. During the first four periods the automatization students were given three sentences to typewrite. These sentences had a thorough connection, were composed of words in the Ayres list, and contained all of the letters of the alphabet. No keyboard drills of any kind were used. The students were told what "home position" was and which finger should strike each key. Then they were asked to typewrite the sentence as well as they could. The conclusions were: (1) Both classes were quite successful, the automatization class passing the Blackstone test norm of eighty-eight for the semester during the ninth week, and the dictaphone class likewise. (2) Neither method used proved markedly superior to the other. (3) Since the automatization class made approximately the same gain as the dictaphone class, it might be fair to assume that it is not necessary to use nonsense letter groups as practice material in teaching typewriting. An interesting point was raised here as to whether or not the automatization class would have proved noticeably superior had dictaphone records been made from the complete composition material based on the words from the Ayres list and used as extensively in this class as the Miller dictaphone records were used in the other. Had this been done, it might have been possible to "automatize" the entire list of one thousand commonest words, and this, too, might have had some influence on the results. (4) In view of the fact that the automatization plan was in a very nebulous
state from the beginning and was "made up" and changed from time to time as the class progressed, the results obtained can be regarded as somewhat astonishing, since both classes reached a score about sixty-three per cent higher than that ordinarily made by a class taught according to traditional methods (43: 77-87; 94-95).

During the summer of 1926, Crews, after investigating some of the research studies that had been made and realizing the need for further research, determined to make a study of the subject of "Finger Gymnastics in Typewriting." This work was carried on in the Palmyra High School, Palmyra, Missouri, during the school year, 1926-1927. Many textbooks with regard to finger movement in typewriting were examined and many teachers interviewed. It was found that very few of the authors of typewriting manuals even suggested that the teachers should give the students finger gymnastic exercises. When approaching teachers with regard to the subject of finger gymnastics it was learned that some of them had never heard of such a procedure, a few had tried some exercises and later abandoned them, while others were firm believers in finger gymnastics without having any proof that these exercises had been of real value. What seemed to be necessary was to conduct a study which at its conclusion would demonstrate clearly the real value or lack of value of the use of finger gymnastic exercises in the teaching of typewriting. If these exercises were worth while they
should be incorporated in the typewriting manuals and every teacher should be familiar with them; if they were useless then their use should be entirely abandoned (24:126-127; 144).

In order to carry on this study it was found necessary to conduct a class of two sections of students throughout the year. The section which will hereafter be mentioned as the non-gymnastic section met during the second period in the morning; the other section (gymnastic section) received instruction during the fourth period in the afternoon. The same textbooks, drills, exercises, and tests were used in both sections; in the non-gymnastic section, however, the subject of finger gymnastics was not even explained to the students, while in the gymnastic section about five minutes each day were devoted to their use and explanation. Since very little material was available on the subject of finger gymnastics, it was somewhat difficult to secure exercises which would serve the purpose in a satisfactory manner. The exercises used were taken from Twentieth Century Typewriting, by Grisso, and from Seven Speed Secrets by Wiese and Smith. In addition to these, some exercises were given which were secured from the Gem City Business College, Quincy, Illinois, together with many others that were original with the writer.

The number of cases studied was too small to render the results of this experiment of any great scientific value. Just what results would have been obtained had the gymnastic section
been taught without the use of finger gymnastics, it is impossible to state. The sections were not so evenly matched in every respect as they should have been; and other uncontrolled factors detracted from the value of the investigation. However, the results obtained were interesting and should receive some consideration.

That both sections were successful in their work was shown by the fact that the non-gymnastic section reached the Blackstone test norm of 148 for a school year by the end of the sixth month and the gymnastic section by the end of the fourth month. The highest score attained by the non-gymnastic section is about 28 per cent greater than that obtained by the average class in that time. The gymnastic section reached a score of 53 per cent greater than was ordinarily achieved by the average class in that time. According to the Blackstone Stenographic Proficiency tests the section using finger gymnastics wrote about 19 or 20 per cent faster than the section not using the exercises. At the end of the school year, as measured by the typewriter company awards tests, the gymnastic group was writing about 25.3 per cent faster than the non-gymnastic group. The experimenter also stated that a class using gymnastic exercises in the proper manner -- other conditions being the same -- will write faster and more accurately than a class not using the exercises. This belief is strengthened further by the fact that students who have used the exercise called for
it before taking a test.

Gatewood made a study of individual differences in finger reactions. This experiment attempted to determine the time of reactions of the several fingers. The results were summarized as follows: (1) The fingers of the right hand were faster than the fingers of the left hand, and they were also slightly better in accuracy. (2) When two fingers react in immediate succession, as in typewriting, the speed at which a given finger reacts will vary, depending upon the finger which reacts before or after it. (3) Two-finger reactions -- the reactions of two fingers in immediate succession -- were faster than single-finger reactions and were more accurate. (4) Two-hand combinations were faster than one-hand combinations. (5) Individuals differed in speed and accuracy of finger reactions (28:51-82).

Coutts gave a battery of typing tests to 350 students who were under the care of teachers of typing during the entire class period, in forty-nine small high schools in the Middle West. The same tests were given in other high schools to 350 students who had only indirect supervision, that is, the teacher in charge was teaching another class at the same time. The supervised group was superior to the unsupervised group in every part of the test, and its composite score was 41.7 points higher than that of the unsupervised group. It may seem that this is a study of a self-evident truth, but the mere fact that the investigator was able to find so many schools using the
unsupervised system indicated that, while opinions as to its worthwhileness may be pretty well crystallized, the proof has been lacking until this study provided it (23:17-26; 38-40).

Fleming reported a comparative study of the whole and the part method of teaching typewriting keyboard. The fifty subjects of the experiment were members of two regularly scheduled beginning classes in typewriting. The experiment covered the entire semester with both groups using the same practice material, except for the first six weeks of the study. Great care was exercised to hold constant every factor likely to effect the progress of the two sections except the experimental factor, that is, the number of characters or letters which were presented at a given time. In the experimental factor, the only variable was the manner in which the letters and characters of the keyboard were presented. To the control group the various characters and letters were presented in groups or sections. To the experimental group, the entire keyboard was presented as a unit. (1) The test results that have been obtained from this experiment provided a basis for judging the relative effectiveness of two methods of instruction. (2) The first seven tests given showed an advantage in favor of the experimental group. (3) The next five tests given showed an advantage in favor of the control group. The outstanding conclusion was: that the part-method of teaching the keyboard of the typewriter had an advantage over the whole-method of teach-
ing the keyboard (26:5-9-95).

Young administered a battery of tests to 3300 students in seventy-five of the schools where only a single period was devoted to typewriting. When the scores were assembled on the basis of the period devoted to the instruction, it was found that the single period group median was twelve points ahead of the double period group median. If double periods were as valuable as have been maintained in former years, the double period should have scored many points higher. Many of the teachers who participated in the experiment believed that the double periods belong to the antiques of high school commercial teaching. The study seemed to be extensive and to have been accurately and adequately handled. It appears to provide significant data on this question of double and single periods, and should, perhaps, be brought to the attention of the accrediting agencies, which have in the past required double periods for typewriting credit. Apparently double periods are economically unjustifiable (59:4-12; 15-68).
SUMMARY
Part C

Charles Miller, at one time instructor in stenography and typewriting in the Secretarial School of Columbia University, and later Principal of the Miller Institute of Shorthand and Typewriting in the city of New York, obtained a copyright on a system of typewriting instruction which showed many points at variance with the commonly accepted theories and introduced several distinctly new features in this field.

The essential parts of the typewriter mechanism were taught in a more or less orthodox fashion, but in the matter of developing coordination between mind and muscle, this system took a radical step -- no keyboard charts were used; the student need not keep his eyes away from his fingers and the typewriter keys; he was told to study the location of the keys upon the machine and to watch his fingers as he struck each new key for the first few times. When he was rather sure of the location of the key, he was challenged to write without looking.

Mr. Miller cited the experiences of many educators to prove that direct dictation provided the incentive needed for the development of rapid, accurate typists.

To meet the important need of direct dictation as an incentive to write rapidly, the dictaphone was introduced into
the classroom. Advanced dictaphone transcription was given late in the course for the purpose of impressing essential facts in connection with business procedure and to give the student practice on the dictaphone as it was used in a business office. The student was always asked to write just as well as he could, but the customary requirement of "perfect copies" was abandoned.

An interesting device was the use of the accuracy record sheet, similar to the error Diagnostic Chart designed by Dr. Blackstone of the University of Iowa. The teacher referring to the chart could detect the most frequent errors made by the student, and give special exercise designed to overcome each error. Rhythm was fixed by means of a dictaphone metronome, the speed of which could be gradually increased in accordance with the progress of the student. Finally the claim was made that students under the dictaphone system of learning typewriting would be able at the end to typewrite at a rate of about one-third faster than students taught by orthodox methods.

To test the claims of this system, an experiment was conducted in the Commercial department of the University High School at the State University of Iowa. Two classes in typing were enrolled. Both classes were taught by the same instructor; one class -- the traditional -- contained seventeen students, the other, the dictaphone class, nineteen students. The traditional class achieved the Blackstone test norm of sixty-eight during the thirteenth week, and the dictaphone
class during the ninth week.

The Commercial department at the University High School regarded the results as significant, and decided to continue the use of the Miller Dictaphone method in all typewriting classes.

Entwistle carried on an experiment with six beginning classes of typewriting in the high school at Lead, South Dakota. Three classes were taught without any mention of rhythm, and the other three were encouraged to use rhythm all the time. The students were tested monthly by means of the Blackstone Typewriting Tests, and careful records were kept as a basis of determining the achievements of each group. So far as the results were reliable, it seemed that the students who had not been taught to write rhythmically made a somewhat higher score than the students who had been taught rhythm. This experiment was carried on primarily to aid in getting practical suggestions for the teaching of typewriting and to increase the efficiency of the learner.

Crews, after investigating some of the research studies in typewriting, determined to make a study of the subject of "Finger Gymnastics in Typewriting." This experiment was made in the Palmyra High School, Palmyra, Missouri. The exercises used were taken from Twentieth Century Touch Typewriting, by Grisso, and from Seven Speed Secrets, by Weise and Smith.

The number of cases studied was too small to consider the
results of this experiment of any great scientific value. The non-gymnastic section reached the Blackstone test norm by the end of the sixth month, and the gymnastic section by the end of the fourth month.

Coutts gave a battery of typing tests to 350 students, who were under the care of teachers of typing for all the class periods. The same tests were given in other high schools to 350 students who had only indirect supervision, that is, the teacher in charge was teaching another class at the same time. The supervised group was superior to the unsupervised group in every part of the test.
CHAPTER IV

THE PRESENT STUDY

The Problem: It was the purpose of the writer to determine the relative efficiency of typewriting classes which were taught under the direct supervision of a teacher as compared with classes in which the students practiced typing without direct supervision. Direct supervision in this study means the correction of the defects of mass teaching; supervising the work done in the typing classroom; directing the pupils' effort; working with the pupils, seeing that the pupils did not acquire habits which would be detrimental to their success.

Indirect supervision in this study means the teacher, after making the study assignment, goes to an adjoining classroom to teach another subject. She can, however, observe the typing class at work through a glass partition, or some other device, between the classrooms.

The Procedure: The students in the present experiment attended parochial high schools and were taught by the Sisters.

There were six schools. In each of these schools a random sample group of twelve pupils was directly supervised, and another group of the same number was indirectly supervised. These groups were all girls in the first year of high school.
The experiment was begun March first and continued through April and May. The first tests were given at the end of March; the second tests the end of April; and the third tests the twenty-ninth of May. The same test was given to both groups in each school. The tests were those supplied monthly by the typewriting companies.

Six parochial girls' high schools took part in the experiment. They were:

<table>
<thead>
<tr>
<th>Schools</th>
<th>Directed</th>
<th>Undirected</th>
<th>Address</th>
</tr>
</thead>
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<td>5100 Laflin</td>
</tr>
<tr>
<td>St. Gabriel</td>
<td>2</td>
<td>2a</td>
<td>4500 Wallace</td>
</tr>
<tr>
<td>Mercy High</td>
<td>3</td>
<td>3a</td>
<td>8100 Prairie</td>
</tr>
<tr>
<td>Nativity</td>
<td>4</td>
<td>4a</td>
<td>37th and Union</td>
</tr>
<tr>
<td>St. Martin</td>
<td>5</td>
<td>5a</td>
<td>5900 Wentworth</td>
</tr>
<tr>
<td>Sacred Heart</td>
<td>6</td>
<td>6a</td>
<td>70th and May</td>
</tr>
</tbody>
</table>

The schools are alphabetically arranged and keyed from one to six. The directly supervised group is number from one to six consecutively, and the control or indirectly supervised group from 1a to 6a. The groups will be referred to throughout the experiment by these numbers.

COPY OF ONE TEST
These tests were given to the various groups for fifteen minutes. The papers were then graded by the respective teachers and the results sent to the writer.

The rules for correcting and grading papers, on a basis of speed and accuracy, were those adopted and used in the International Typewriting Contests. They are as follows:

1. "Computing results.": Count the gross number of strokes from the printed test material and divide by five (5) for gross number of words. Deduct from the gross number of words ten (10) for each error made. This result is the net number of words. Dividing the net number of words by fifteen (15) will give the net rate per minute.

2. "General Rule.": Every word omitted, inserted, misspelled, or in any manner changed from the printed copy, must be penalized.

3. "One Error Per Word.": But one error shall be penalized in any one word save in the case of Rewritten Matter and Transposition." (See Underwood - 1925, pp. 12-16).

Speed and accuracy were combined according to the International Contest Rules.

All makes of standard keyboard typewriters were used, i.e., Remington, Royal, L.C. Smith, Underwood, and Woodstock.
THE DATA OF THE PRESENT STUDY

An analysis of the graphs and tables reveals the standing of the various schools after each test as to:

1. The gross number of words
2. The errors made
3. The number of words per minute.

(The black bar, in Graphs, represents the Supervised group. The red bar, in Graphs, represents the unsupervised or experimental group.)

Graph 1 presents the two groups of students, i.e., directly supervised and indirectly supervised. It shows the comparative gains made by each group, in school number one, for the three months of the experiment. The graph also shows the gross number of words written by each pupil, the number of words per minute, and the number of errors made.

Table 1 presents the averages of the two groups, in school number 1, for the three months of the experiment. It also shows the increase in speed and the decrease in errors.

Graph 2 presents the two groups of students, i.e., directly and indirectly supervised. It shows the rating made by each of the groups in school number two, for the three months of the experiment.

The graph also shows the gross number of words written by each student, the number of words written per minute, and the
<table>
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<th>GROSS NUMBER OF WORDS</th>
<th>ERRORS</th>
<th>WORDS PER MINUTE</th>
</tr>
</thead>
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<td>Indirectly Supervised</td>
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<tr>
<td>Mar  Apr  May</td>
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<td>March Errors</td>
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<td>-------------</td>
<td>--------------</td>
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<td>12</td>
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</table>

All Pupils: 4183 Gross, 127 Errors, 16.2 Words per Minute, 6665 Gross, 116 Errors, 30.6 Words per Minute, 7379 Gross, 110 Errors, 34.9 Words per Minute

Average per Pupil: 349 Gross, 9.7 Errors, 10.6 Words per Minute, 555 Gross, 9.2 Errors, 9.7 Words per Minute

Average per pupil -
76% increase in gross number of words
13% decrease in number of errors
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<th>Errors</th>
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</tbody>
</table>

| All Pupils | 4454 | 127 | 17.7 | 6500 | 119 | 29.5 | 6999 | 88 | 34.0 | 16.3 |

| Average per Pupil | 371 | 10.6 | - | 541 | 9.9 | - | 583 | 7.3 | - |

Average per pupil -
57% increase in gross number of words
31% decrease in number of errors
number of errors made.

Table 2 presents the averages of the two groups, in school number two, for the three months of the experiment. It also shows the increase in speed and the decrease in errors.

Graph 3 presents two groups of students, i.e., the directly supervised and the indirectly supervised. It shows the comparative gains made by each group in school number three, for the three months of the experiment. The graph also shows the gross number of words written by each pupil, the number of words per minute, and the number of errors made.

Table three presents the averages of the two groups, in school number three, for the three months of the experiment. It also shows the increase in speed and the decrease in errors.

Graph 4 presents the two groups of students, i.e., directly supervised and indirectly supervised. It shows the comparative gains made by each group, in school number four, for the three months of the experiment. The graph also shows the gross number of words written by each pupil, the number of words per minute, and the number of errors made.

Table 4 presents the averages of the two groups, in school number four, for the three months of the experiment. It also shows the increase in speed and the decrease in errors.

Graph 5 presents the two groups of students, i.e., the directly supervised and the indirectly supervised. It shows the comparative gains made by each group, in school number five,
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**Average per pupil:**
- 35% increase in gross number of words
- 26% decrease in number of errors
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All Pupils: 3403, 82, 15.6, 4275, 75, 19.6, 3805, 84, 19.8, 4.2, -

Average per Pupil: 309, 7.5, -, 356, 6.2, -, 380, 8.4, -

Average per pupil:
- 23% increase in gross number of words
- 12% increase in number of errors
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**Average per Pupil**

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**Average per pupil**

- 103% increase in gross number of words
- 52% increase in number of errors
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All Pupils: 2558 60 10.9 2767 50 12.6 4275 85 19.0 8.1

Average per Pupil: 213 5 - 231 4.2 - 356 7.1 -

Average per pupil -
67% increase in gross number of words
42% increase in number of errors.
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Average per Pupil
- 500: 18.6 - 605: 15.6

Average per pupil -
- 21% increase in gross number of words
- 19% decrease in number of errors
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Average per pupil -

- 52% increase in gross number of words
- 45% decrease in number of errors
for the three months of the experiment. The graph also shows the gross number of words written by each pupil, the number of words per minute, and the number of errors made.

Table 5 presents the averages of the two groups, in school number five for the three months of the experiment. It also shows the increase in speed and the decrease in errors.

Graph 6 presents the two groups of students, i.e., directly supervised and indirectly supervised. It shows the comparative gains made by each group, in school number six, for the three months of the experiment. The graph also shows the gross number of words written by each pupil, the number of words per minute, and the number of errors made.

Table 6 presents the averages of the two groups, in school number six, for the three months of the experiment. It also shows the increase in speed and the decrease in errors.

Graph 7 presents the averages of all the schools taking part in the experiment, for the three months of the experiment. This graph shows a slightly higher rating in the last test (May) for the supervised groups.

Table 7 presents the gross number of words written. The number of errors made and the number of words per minute. It also shows the net gains made by the schools, together with the per cent of increase in the gross number of words written, as well as the decrease in the number of errors.
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**AVERAGE OF ALL PUPILS**

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**All Pupils**

|          | 5722 | 103 | 26.1 | 7214 | 101 | 34.5 | 7989 | 101 | 38.8 | 12.7 |

**Average per Pupil**

|          | 477  | 8.6 | -    | 601  | 8.4 | -    | 666  | 8.4 | -    | -    |

**Average per pupil**

- 42% increase in gross number of words
- 2% decrease in number of errors
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All Pupils 5910 | 120 | 26.2 | 6670 | 88 | 32.2 | 7132 | 103 | 33.9 | 7.7 | - |

Average per Pupil 493 | 10.0 | - | 556 | 7.3 | - | 594 | 8.6 | - |

Average per pupil -
17% increase in gross number of words
14% decrease in number of errors
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All Pupils 5553 124 24.0 6221 90 29.6 6697 76 33.0 9.0 -

Average per Pupil 463 10.3 - 518 7.5 - 558 6.3 -

Average per pupil -
17% increase in gross number of words
39% decrease in number of errors
### Table: Performance Improvement Over Three Months

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<td>33.0</td>
<td>17.8</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>258</td>
<td>4</td>
<td>14.5</td>
<td>321</td>
<td>5</td>
<td>18.1</td>
<td>293</td>
<td>9</td>
<td>13.5</td>
<td>-</td>
<td>1.0</td>
</tr>
<tr>
<td>10</td>
<td>262</td>
<td>9</td>
<td>11.5</td>
<td>292</td>
<td>16</td>
<td>8.8</td>
<td>597</td>
<td>4</td>
<td>36.5</td>
<td>25.0</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>630</td>
<td>4</td>
<td>39.3</td>
<td>274</td>
<td>5</td>
<td>14.9</td>
<td>440</td>
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<td>24.0</td>
<td>-</td>
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</tr>
<tr>
<td>12</td>
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<td>7</td>
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<td>262</td>
<td>9</td>
<td>11.5</td>
<td>367</td>
<td>10</td>
<td>17.8</td>
<td>6.7</td>
<td>-</td>
</tr>
</tbody>
</table>

**All Pupils**
- Gross: 4360, Errors: 126, March Words: 17.2, April Words: 15.3, May Words: 25.2, Increase: 8.0
- Average per Pupil: 363, 10.5

**Average per Pupil**
- 26% increase in gross number of words
- 27% decrease in number of errors
Directly Supervised Graph: Gross number of words show an increase for each school. Note some schools as 1, 2, and 5, show a larger increase in April than in May. That is, more progress was made in April than in May.

Note the relative position of the various schools at the end of the first month's test, compared to the relative positions of the schools at the end of the last test. The relative positions of the schools vary in the three sections of the graphs, that is, gross number of words, errors and words per minute.

Gross Number of Words: Increase was consistent in both groups although the directly supervised were further advanced.

Errors: A decided drop in the number of errors in the second month for both groups and a slight rise again between the second and third test.

Words Per Minute: (Directly Supervised) - The rise was more marked between the first and second months than between the second and third.

(Indirectly Supervised) - The rise was more consistent.

In analyzing the work of the various pupils, we find a difference in the increase and decrease of the number of words per minute from a decrease of 16.9 words per minute (pupil #2, school #4) to an increase of 34.5 (for pupil #5, school #4) in the directly supervised classes, and in the indirectly supervised group from 15.6 decrease in the number of words per
<table>
<thead>
<tr>
<th>School No.</th>
<th>March Gross</th>
<th>March Errors</th>
<th>April Gross</th>
<th>April Errors</th>
<th>May Gross</th>
<th>May Errors</th>
<th>Increase</th>
<th>Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4454</td>
<td>127</td>
<td>17.7</td>
<td>6500</td>
<td>119</td>
<td>29.5</td>
<td>34.0</td>
<td>16.3</td>
</tr>
<tr>
<td>2</td>
<td>3403</td>
<td>82</td>
<td>15.6</td>
<td>4275</td>
<td>75</td>
<td>19.6</td>
<td>3805</td>
<td>19.8</td>
</tr>
<tr>
<td>3</td>
<td>2558</td>
<td>60</td>
<td>10.9</td>
<td>2767</td>
<td>50</td>
<td>12.6</td>
<td>4275</td>
<td>19.0</td>
</tr>
<tr>
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<td>2567</td>
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<td>3362</td>
<td>64</td>
<td>30.2</td>
<td>3896</td>
<td>37.8</td>
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<tr>
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<td>5910</td>
<td>120</td>
<td>26.2</td>
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<td>88</td>
<td>32.2</td>
<td>7132</td>
<td>33.9</td>
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<td>6</td>
<td>4360</td>
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<td>17.2</td>
<td>3873</td>
<td>112</td>
<td>15.3</td>
<td>5469</td>
<td>25.2</td>
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</table>

All Pupils

<table>
<thead>
<tr>
<th>Gross</th>
<th>Errors</th>
<th>In March (average)</th>
<th>Errors</th>
<th>In March (average)</th>
<th>Errors</th>
<th>In May (average)</th>
<th>Increase</th>
<th>Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>23252</td>
<td>604</td>
<td>17.7</td>
<td>27447</td>
<td>508</td>
<td>22.6</td>
<td>31576</td>
<td>10.0</td>
<td>-</td>
</tr>
</tbody>
</table>

Average per Pupil

<table>
<thead>
<tr>
<th>Gross</th>
<th>Errors</th>
<th>In March (average)</th>
<th>Errors</th>
<th>In March (average)</th>
<th>Errors</th>
<th>In May (average)</th>
<th>Increase</th>
<th>Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>348</td>
<td>9.3</td>
<td>416</td>
<td>7.5</td>
<td>493</td>
<td>7.8</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Average per pupil -
- 42% increase in gross number of words
- 16% decrease in number of errors

**Pupils -**
- March 65
- April 66
- May 64
<table>
<thead>
<tr>
<th>School No.</th>
<th>March Gross</th>
<th>March Errors</th>
<th>March Avg.</th>
<th>April Gross</th>
<th>April Errors</th>
<th>April Avg.</th>
<th>May Gross</th>
<th>May Errors</th>
<th>May Avg.</th>
<th>Increase</th>
<th>Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4183</td>
<td>127</td>
<td>16.2</td>
<td>6655</td>
<td>116</td>
<td>30.6</td>
<td>7379</td>
<td>110</td>
<td>34.9</td>
<td>18.7</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>3599</td>
<td>117</td>
<td>16.2</td>
<td>5345</td>
<td>81</td>
<td>25.2</td>
<td>5839</td>
<td>114</td>
<td>26.1</td>
<td>12.6</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>2628</td>
<td>53</td>
<td>11.7</td>
<td>3163</td>
<td>45</td>
<td>15.1</td>
<td>5345</td>
<td>81</td>
<td>25.2</td>
<td>13.5</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>2499</td>
<td>93</td>
<td>20.9</td>
<td>2825</td>
<td>78</td>
<td>27.2</td>
<td>3026</td>
<td>75</td>
<td>30.3</td>
<td>9.4</td>
<td>-</td>
</tr>
<tr>
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<td>7214</td>
<td>101</td>
<td>34.5</td>
<td>7989</td>
<td>101</td>
<td>38.8</td>
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<td>-</td>
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<tr>
<td>6</td>
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<td>124</td>
<td>24.0</td>
<td>6221</td>
<td>90</td>
<td>29.6</td>
<td>6697</td>
<td>76</td>
<td>33.0</td>
<td>9.0</td>
<td>-</td>
</tr>
</tbody>
</table>

**All Pupils**

- March: 24184, 617, 19.1
- April: 31433, 511, 27.0
- May: 36275, 557, 31.5

**Average per Pupil**

- March: 384, 9.8
- April: 484, 7.9
- May: 558, 8.6

**Average per pupil**

- 45% increase in gross number of words
- 12% decrease in number of errors

**Pupils**

- March: 63
- April: 65
- May: 65
minute (pupil #2, school #4) to an increase of 43.2 (pupil #4, school #4).

Analysis of the Summaries of the Various School Tabulations

Increase in gross number of words average per pupil:

<table>
<thead>
<tr>
<th>School - No.</th>
<th>Directly Supervised</th>
<th>Indirectly Supervised</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>76% Increase</td>
<td>57% Increase</td>
</tr>
<tr>
<td>No.1</td>
<td>25%</td>
<td>23%</td>
</tr>
<tr>
<td>No.2</td>
<td>103%</td>
<td>67%</td>
</tr>
<tr>
<td>No.3</td>
<td>21%</td>
<td>52%</td>
</tr>
<tr>
<td>No.4</td>
<td>42%</td>
<td>17%</td>
</tr>
<tr>
<td>No.5</td>
<td>17%</td>
<td>26%</td>
</tr>
</tbody>
</table>

Note: The discrepancy in the various schools explained.

Summary of the decrease in the number of errors:

<table>
<thead>
<tr>
<th>School - No.</th>
<th>Directly Supervised</th>
<th>Indirectly Supervised</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15% Decrease</td>
<td>31% Decrease</td>
</tr>
<tr>
<td>No.1</td>
<td>26%</td>
<td>12% Increase</td>
</tr>
<tr>
<td>No.2</td>
<td>52% Increase</td>
<td>42%</td>
</tr>
<tr>
<td>No.3</td>
<td>19% Decrease</td>
<td>45% Decrease</td>
</tr>
<tr>
<td>No.4</td>
<td>2%</td>
<td>14%</td>
</tr>
<tr>
<td>No.5</td>
<td>39%</td>
<td>27%</td>
</tr>
</tbody>
</table>

Note: The discrepancy here also in the various schools, some even showing increase in the number of errors. The in-
crease of errors may be due to the stress put on speed. The increase in errors occurs in the directly supervised classes, as well as in the Control group or indirectly supervised classes.

Analysis of the Summary of the Six Schools

1. The number of pupils taking the test each month remained the same except in School No. 4. (Table No. IV).

2. The increase in the number of words written at the end of the third test (May) compared with the first test (March) showed the following increase:

   Directly Supervised -- 12.4 words per minute
   Indirectly Supervised -- 10.0 " " "

3. The gross number of words written increased in the Directly Supervised class:

   From 384 words on the first test to 558 words on the last test, or a 45% gain.

   The increase in April test over March -- 26% gain.
   The increase in May test over April -- 15% gain.

Indirectly Supervised class:

   From 348 words on the first test to 493 on the last test, or a 45% gain.

   The increase in April test over March -- 20% gain.
   The increase in May test over April -- 19% gain.

4. The decrease in errors in the Directly supervised was 12%. In the Indirectly supervised it was 16%.

In both classes, the directly supervised and the
indirectly supervised, the number of errors per pupil decreased in April compared to March, but increased again in May.

5. In the words per minute, there is a wide discrepancy in the various schools. That may be accounted for (1) in the way that the tests were given; (2) by any of the reasons that are given for plateaus in the learning of Typewriting.

School No. 3: March test -- directly supervised

- 11.7 words per minute
- March test -- indirectly supervised

- 10.9 words per minute

School No. 5 March test -- directly supervised

- 26.1 words per minute
- March test -- indirectly supervised

- 26.2 words per minute

School No. 3 May test -- directly supervised

- 25.2 words per minute
- May test -- indirectly supervised

- 19.0 words per minute

School No. 5 May test -- directly supervised

- 38.8 words per minute
- May test -- indirectly supervised

- 39.9 words per minute
CHAPTER V

SUMMARY OF CONCLUSIONS AND APPLICATIONS

1. In the gross number of words, increase was consistent in both groups, although the directly supervised classes made the great gains. There was marked fluctuations in efficiency from test to test.

2. A decided drop in the number of errors in the second month for both groups and a slight rise again between the second and the third test, indicated that periods of advance and retardation alternated in this study.

3. Words per minute:
   In the directly supervised group the rise was more marked between the first and second months than between the second and third.
   In the indirectly supervised group the rise was more consistent.

4. The number of words written at the end of the third test shows the following increase:
   Directly supervised -- 12.4 per minute
   Indirectly supervised -- 10.0 per minute

5. Gross number of words written increased:
   Directly Supervised -- 384 on first test to
558 on last test, or 45%.

Increase in April test over March -- 26%
Increase in May test over April -- 15%

Indirectly Supervised -- 385 on first test to 493 on last test, increase 42%.
Increase in April test over March -- 20%
Increase in May test over April -- 19%

6. Decrease in errors:
   Directly supervised -- 12%
   Indirectly supervised -- 16%

Directly Supervised Graph:
Gross number of words show an increase for each school. Note that some schools as Nos. 1, 2, and 5 show a larger increase in April than in May. In other words, better progress was made in the second month than in the third month.

Note the relative positions of the various schools at the end of the first month's test compared to the relative position of the schools at the end of the last test. Also that the relative positions of the school varies in the three sections of the graph, that is, gross number of words, errors and words per minute.

The indirectly supervised graph to be analyzed the same as the directly supervised graph.
Analysis of the Summary of the Various School Tabulations

Increase in Gross Number of Words

Average per Pupil

<table>
<thead>
<tr>
<th>Schools</th>
<th>Increase</th>
<th>Schools</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.1</td>
<td>76%</td>
<td>No.1</td>
<td>57%</td>
</tr>
<tr>
<td>No.2</td>
<td>35%</td>
<td>No.2</td>
<td>23%</td>
</tr>
<tr>
<td>No.3</td>
<td>103%</td>
<td>No.3</td>
<td>67%</td>
</tr>
<tr>
<td>No.4</td>
<td>21%</td>
<td>No.4</td>
<td>52%</td>
</tr>
<tr>
<td>No.5</td>
<td>42%</td>
<td>No.5</td>
<td>17%</td>
</tr>
<tr>
<td>No.6</td>
<td>17%</td>
<td>No.6</td>
<td>26%</td>
</tr>
</tbody>
</table>

Analyzing the work of the various pupils, we have a difference in the increase or decrease of number of words per minute from a decrease of 16.9 words per minute (pupil #2, School #4) to an increase of 34.5 (pupil #5, School #4) for the directly supervised, and in the indirectly supervised group from 15.6% decrease in the number of words per minute (pupil #2, School #4) to an increase of 43.2 (Pupil #4, School #4).

Teachers of typing know only too well that the high degree of manipulative skill required by the business office can only be acquired by repetitive practice. Practice and perfection are the Martha and Mary Sisters of skill development.
To reach perfection there is only the one road of practice to transverse, guided by patience and persistence.

Through all the ages men have sought a royal road to learning. Wiseacres in each age tell us there is no such road, just the one highway of self-activity chartered out by limitations of the nervous system of the human being.

In spite of science, despite the well-established facts, many a quack appears in the market place to cry his magic wares of Get-Rich-Quick methods of skill development.

Quiet old Mother Nature smiles serenely. She shakes her finger at the eager learner. "Make haste slowly, my child," she says; "remember, dear young impatient learner, Rome was not built in a day. One brick and then another and the highest wall is laid."

The commercial student must practice long and carefully to develop the operating skill necessary for general use.
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The thesis "Directly Supervised versus Indirectly Supervised Typewriting," written by Sister Mary Brendan Troy, O.M., has been accepted by the Graduate School of Loyola University, with reference to form, and by the readers whose names appear below, with reference to content. It is, therefore, accepted as a partial fulfillment of the requirements of the degree conferred.

Austin G. Schmidt, S.J. 
July, 1933

William H. Johnson, Ph.D. 
July, 1933