ADULT LEARNING

BY

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PREFACE

This volume presents the results of two years of research done with the aid of a grant from the Carnegie Corporation, together with such a general treatment of the topic as seemed desirable. Much of the evidence for our conclusions, especially that of a technical nature, has been segregated in a series of appendices. The general text will, we trust, be intelligible and useful to all those who are concerned with the teaching of adults. The author named first is responsible for the general plan of the work and for the presentation of it in this volume. The detailed planning and execution of the experiments are to be credited largely to Dr. Bregman, Dr. Tilton, and Dr. Woodyard. Dr. Bregman and Dr. Tilton had practically entire responsibility for the work with adult evening school pupils and prisoners respectively; Dr. Woodyard, assisted by Parrish Little, secured the data from secretarial schools and coöperated in nearly all of the work. Dr. Bregman, assisted by Mrs. G. J. Ruger, directed part of the work with adults of superior intellect. We are glad to acknowledge also the aid of Mr. A. Grove Day and Miss Mabel Wilcox, members of the staff of the Institute, and the valuable coöperation of the Superintendent of Schools of New York City, the Director of its evening schools, the Principal of the New York Evening High School, the Educational Director of the New York State Prison at Ossining, the International Auxiliary Language Association, and the authorities of the Conklin, Katherine Gibbs, Packard, Miller, and United States Secretarial Schools.

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CONTENTS

APPENDICES

ADULT LEARNING

CHAPTER I

Introduction

It is the purpose of this book to report the facts concerning changes in the amount and changes in the nature of ability to learn from about age fifteen to about age forty-five, and especially from age twenty-five to age forty-five. This information should be useful in the guidance of adult education in all its multifarious forms. Public evening schools, educational departments of the Young Men's Christian Association, other philanthropic agencies for the welfare of adults, and correspondence schools, which are the most conspicuous forms of systematic education of adults, need a better scientific basis both for selecting students and for training them. The training of workers to use new machines and new methods, the training of recruits in times of war, and the self-education of individuals are the product of custom and intuition rather than of ascertained facts. The most successful of the teachers and supervisory officers in these fields would be almost unanimous in acknowledging the lack of any surety concerning the changes, either quantitative or qualitative, which age brings in the ability to learn. They have had to trust to their intuitions and practical experience with the adults whom they have taught.

Such practical experience develops in the gifted an insight into concrete particular educational situations and skill and readiness in meeting them, but it does not as a

rule produce general truths about learning or of teaching. The insight and skill are not transmissible to all by rule and precept, but have to be acquired slowly and expensively, at the best by imitation and at the worst by a repetition of the experience itself in each teacher. There have been many instances of very great success by many individual teachers and directors in many varieties of education with many adult classes. But they have not produced a general theory or technique. A compilation of records of teaching experience with adult classes, including both notable successes and notable failures, would be of very great value. It would stimulate thought and action and provide for the beginner a partial substitute for direct experience and imitation. An analysis of it would help to settle certain disagreements amongst those engaged in adult education, and might bring striking and useful facts to light.

But even if all the experiences of all the teachers of adults were fully and accurately reported, they would probably still not provide a general theory and technique. These experiences are too complicated and confused by a multiplicity of varying factors. Old learners, for example, may be the specially ambitious old who make sacrifices to learn more, or the dull old who did not learn when they were young because they were dull, or the foreign old or the gullible old who are enticed by seductive advertisements.

Even the far simpler problems of learning by the young in the fairly standardized situations of the regular elementary-school and high-school subjects require more than experience to provide clear answers. Even with them, definite experiments, with the number of variables reduced (to one, if possible) and with expert protection against sources of error, have been found necessary in order to secure facts of demonstrable truth and general import.

Psychology and general educational science have provided no satisfactory answers to our questions. There has been in the main a neglect of the problem, or an acceptance of the proverbial conventional opinion that it is especially important to train up the *child* in the way he should go, and that it is hard to teach an old dog new tricks. The best known statement is by James, who wrote, in a discussion of the waning of curiosity: "Outside of their own business, the ideas gained by men before they are twenty-five are practically the only ideas they shall have in their lives. They *cannot* get anything new. Disinterested curiosity is past, the mental grooves and channels set, the power of assimilation gone. Whatever individual exceptions might be cited to these are of the sort that 'prove the rule.'" ('93, vol. II, p. 402.)[1]

The latest authoritative statement is that of Hollingworth ('27, p. 310 f.) who writes: "Very few experimental data or measures are available on the mental changes after the period of early maturity [by which is meant the years from eighteen on]. . . . In general the fact seems to be that with increasing age, after maturity, learning capacity declines while general alertness and ability to utilize factors already acquired are still at their maximum. . . . Even if these tentative results point to the actual limitations of the establishment of new associations in age, they do not yet prove that learning capacity ever completely ceases in the average case. The exact determination of the rate of mental changes in age is a matter for future research."

There has never been an extensive and systematic inquiry seeking to discover whether and to what extent infancy, childhood, and adolescence do have by nature an advantage over the years from twenty to forty in respect of ability to learn.

[1] The years, volumes, and pages cited in this text in parentheses refer the reader to the Bibliography of References Made in the Text, page 319

We have made such an inquiry so far as time and means were available and present the results in the next ten chapters. In Chapter XII, we deal very imperfectly with the still more difficult question of qualitative differences in learning.

CHAPTER II

Facts of Adult Learning Reported in the General Literature of Psychology and Education

Although psychology offers no accepted general account of the relation of age to ability to learn, there are many facts concerning learning by adults scattered through the records of experiments on learning. Indeed most of the early investigations of learning concern the learning of persons twenty to thirty years old or older. The subjects of these experiments were often graduate students and instructors.

The following summaries or samples demonstrate that the adults in question made large amounts of improvement and made them at rapid rates in all sorts of mental operations — in simple sensorimotor abilities, in observing details, in simple association or habit formation, in learning elaborate systems of motor and mental habits, in memorizing (save when that ability has been already brought to a rather high status), and in other still more complex functions which have been tested.

Improvement in Simple Sensorimotor Abilities

Partridge ('00) measured the amount of practice required by two adults, in learning not to wink when a hammer of rubber struck a plate of glass in front of the eye. The course of learning not to wink at the sight and sound of the hammer was as follows, each number giving

the number of times that the wink was inhibited in each successive hundred trials:

Subject A: 0, 0, 11, 6, 16, 20, 34, 53, 36, 42, 57, 45, 42, 53, and 50.

Subject B: 0, 0, 2, 4, 4, 0, 8, 2, 6, 4, 0, 28, 8, 4, 21, 32, 65, 39 81, 83, 77, 92, 86, 97, 99, 88, 98.

Bair ('02, p. 30) tested four subjects' gain in tossing shot into a glass, sixty tosses being made a day for twenty days. The score being the number of successes out of sixty, the four adult males improved from 32, 23, 17, and 15 to 56, 37, 43, and 42.

Whitley ('11, pp. 112 and 130 f.) found that twenty practices in drawing a line between the two parallel lines of a maze, one being taken daily except Sundays, reduced the score from 194 to 123 for the average of nine individuals. The score is the time plus one tenth for 1 or 2 touches, two tenths for 3 or 4 touches, three tenths for 5 or 6 touches, and so on.

Swift ('03) had five adult men practice at "keeping two balls going (in the air) with one hand, receiving and throwing one while the other is in the air. . . . The balls used were of solid rubber and weighed 122.6 and 130.2 grams. . . . Their diameters were 42 and 44 mm., respectively. . . . The daily program consisted of ten trials, the subject in each case [i.e., trial] continuing the throwing until he failed to catch one or both of the balls." ('03, p. 210 f.) "The number of catches made in each trial was immediately recorded," the sum of these ten numbers forming the score for the day. "After each trial the subject rested as long as seemed necessary." [ibid.] At the start these men could make only from 1 to 10 tosses before failing, but after about an hour spent in tossing they could make 30 or more. Four of them attained (in from 2 to 5 hours of practice) a skill such that they could average over a hundred tosses before failing;

and the fifth man doubtless would have done so, except that he practiced for only a short time.[1]

Wells ('08-*b*) found with two adult subjects that thirty days of practice at tapping a telegraph key at maximal speed for thirty seconds, ten times a day, five with each hand, separated by nine rests, each of one hundred and fifty seconds, produced an improvement from an initial score of about 186 taps in thirty seconds to a final score of 215 taps in thirty seconds, averaging the two subjects' records for right hand and left hand.

Improvement in Observing and Reacting to Simple Details

Wells ('12) found, with ten adult subjects (hospital nurses), in cancelling a hundred zeros in a page specially constructed of a thousand mixed digits, that one hundred and ten such tests, one a day for ten days and five a day for twenty days (Sundays being omitted), involving on the average about 140 minutes of practice, raised the number of zeros cancelled per minute from an average of about 45 to one of about 100, without (if we understand Dr. Wells' report) diminishing precision.

Forming Simple Habits

Bair ('02, 15 ff.) studied the improvement in a very simple form of typewriting, only six keys being used and only six corresponding colors or letters arranged in a fixed "sentence" or sequence of fifty-five colors or letters. The time taken to write this series without error was taken after seven repetitions of it at fixed rates in time with a metronome; then after another set of seven such;

[1] Joseph Peterson ('17) has repeated Swift's ball tossing experiments with twenty-five undergraduate college students. He does not give ages and his method makes any exact comparison of these younger persons' gains with those reported by Swift impossible. Our general impression is that there is no great difference.

and so on until (including the series at the learner's minimum time for errorless writing) one hundred and twenty-eight repetitions were made. The average time for four subjects was 61 seconds for the eighth, and 37½ seconds for the hundred and twenty-eighth repetition.

In another similar experiment three different individuals repeated the same series at maximum errorless rate five times a day for seven successive days. The average times required for the first and thirty-fifth repetitions were, respectively, 74 and 40 seconds. The individuals scored 62, 79, and 82 in the first trial and 40, 38, and 42 in the thirty-fifth. In a third similar experiment, but with seven keys and with letters instead of colors, the series of fifty-five was written three times daily for nine days, twice with the metronome at one stroke per second, and once as rapidly as possible without errors. The number of errors at the specified rate dropped from 35 to 0; the time at maximum errorless rate dropped from 79 at the end of the first day to 47 at the end of the ninth.

Bair also studied the simultaneous formation of four habits requiring the attachment of different bonds to the same general situation according to differences in the mental set. "Each day's experiment was as follows: First, the alphabet was repeated as rapidly as possible forward; secondly, the letter *n* was intercepted between each (pair) of the letters; thirdly, the alphabet was repeated as rapidly as possible backward; and lastly, the alphabet was repeated backward, intercepting *n* between each (pair) of the letters." (Bair, '02, p. 28.) On the whole, an initial time of 123.9 seconds fell to 24 seconds. Even by the fifth time it had fallen to 45.6 seconds.

Thorndike ('10) studied the improvement of nineteen university students from 22 to 35 years old, in adding daily, for seven days, 48 columns each of 10 one-place numbers (no *0's* or *1's* being included). Seven printed blanks of equal difficulty were used. The forty-eight

sums were written. The improvement was as shown in Table 1, below. An addition of half the time required for one example was made for each wrong sum. The time of writing the sum of a column of ten numbers was treated as equivalent to the time of one addition. The "time spent in practice" as recorded in this table is not the total time, but the time from the point for which initial efficiency was measured (that is, a point at the middle of the first day's practice period) to the point for which final efficiency was measured (that is, a point at the middle of the last day's practice period).

TABLE 1
IMPROVEMENT IN ADDITION: ADULTS

Amount of improvement in relation to length of practice and initial ability (after Thorndike ['10])

INDIVIDUAL	LENGTH OF PRACTICE IN MINUTES	ADDITIONS IN FIVE MINUTES		GROSS GAIN
		First day	Seventh day	
K	32	313	600	287
H	35	301	456	155
M	38	235	400	165
D	38	253	441½	188½
B	39½	228	398	170
I	44	336	294½	−41½ (loss)
A	44½	254	362	108
L	48	238	356	118
O	49	326½	470	143½
G	50	240	316	76
C	51	247	301	54
R	57	204	297½	93½
J	59	218	303	85
N	63	178	271½	93½
S	64½	163	271½	108½
P	69½	145	247	102
F	71	175	178	3
Q	71½	165	228½	63½
E	74	137	235½	98½

Wells ('12) found, with ten adult subjects (hospital nurses), in oral addition of one-place numbers, printed vertically one close above the other and in convenient

columns, that 150 minutes, distributed over five weeks, six days a week, raised the amount done to nearly double without (if we understand him) decreasing the precision. A rough computation from Wells' curves gives the average ratio of the work of the thirtieth to that of the first day as 1.96, the individual scores being, as estimated from the curves, those shown in Table 2, below.

TABLE 2

IMPROVEMENT IN ADDITION: ADULTS

Amount of improvement in relation to length of practice and initial ability (after Wells ['12])

INDIVIDUAL AND SEX	NUMBER OF ADDITIONS IN FIVE MINUTES			PERCENTAGE WHICH AMOUNT DONE ON 30TH DAY WAS OF AMOUNT DONE ON FIRST DAY
	First day	Thirtieth day	Gross gain	
1 *f*	150	280	130	187
2 *m*	180	380	200	211
3 *m*	200	430	230	215
4 *f*	220	380	160	173
5 *m*	225	368	143	164
6 *m*	225	460	235	204
7 *f*	235	570	335	243
8 *f*	250	440	190	176
9 *f*	260	540	280	208
10 *m*	290	540	250	186

Pyle ('13) had adult subjects transcribe a book into 26 characters, "simple and easily made," one for each letter of the alphabet, for half an hour daily for fifteen days. The number of words transcribed nearly quadruples from the first to the fifteenth period.

Dearborn and Brewer ('18) conducted experiments in learning to translate prose into a secret code in the case of college and graduate students. The practice consisted of twenty-one periods, each of 5 minutes. Every individual made substantial gains. On the average the thirty-five men rose from 43 to 239 units done in 5 minutes.

Learning More Elaborate Systems of Habits

Swift ('04) practiced typewriting by the sight method for an hour a day for fifty days, at the age of forty-three, making in the last five days scores averaging about 1060 words per hour, or 17½ per minute.

Book ('08) had two adults, X and Z, practice at typewriting by the sight method 30 minutes a day for 174 and 86 days respectively. X rose from 30 strokes per minute to 90 in about 15 hours, and then improved more slowly to about 160 strokes per minute. Z rose from about 45 strokes per minute to 110 in about 15 hours, and then more slowly to about 150 strokes at the end of the 43 hours. Book also had another adult (Y-1) practice an hour a day for 130 days, using the touch method. At the end of 15 hours he had not quite reached 90 strokes per minute. He reached 210 in about 100 hours. In these experiments, "Each letter and mark of punctuation, not requiring a shift of the carriage, was counted as one stroke; striking the word-spacer was counted as half a stroke; making a capital or any mark requiring the use of the 'shift key' was counted as two strokes; moving the carriage back to make a line was counted as three strokes." ('08, p. 18)

Hill and Rejall ('13) practiced typewriting by the sight method, using a page of approximately 300 words as the unit task. At the first writing, they required 43 minutes 50 seconds and 42 minutes to complete the page, writing at the rate of 6.8 and 7.1 words per minute, with 34 and 57 errors. This improvement was as follows:

After	10.0	hours of	practice	R	wrote	16.3	words	per	minute:	36	errors
"	10.3	"	"	H	"	13.3	"	"	"	13	"
"	20.9	"	"	R	"	19.4	"	"	"	11	"
"	19.6	"	"	H	"	17.5	"	"	"	11	"
"	30.5	"	"	R	"	25.2	"	"	"	10⅔	"
"	29.7	"	"	H	"	20.9	"	"	"	8⅓	"

At the age of forty-two, Swift ('03) studied shorthand sixty-eight days for an hour and a half a day, writing James' Talks to Teachers from dictation and reading his own copy written ten days or more before. The

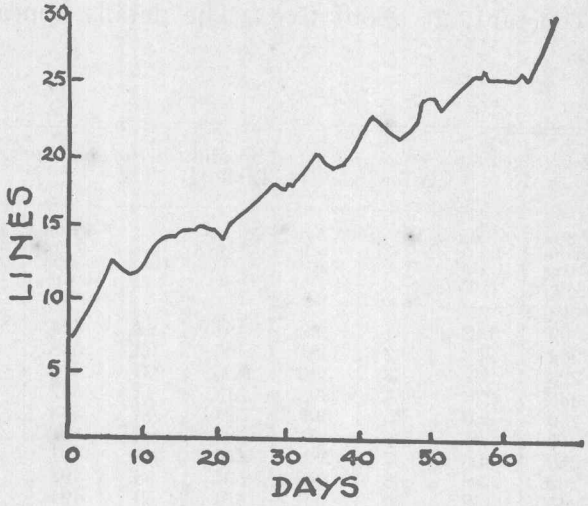

FIG. 1. SWIFT'S IMPROVEMENT IN WRITING SHORTHAND

improvement in writing was as shown in Fig. 1, each point on the graph representing the average of three successive days.

Pyle ('14) measured the improvement of two groups of adults (summer-session students at the University of Missouri) in typewriting. One group of five practiced ten half-hour periods a day with half-hour rests between for nine days, (successive except for an omitted Sunday), making 45 hours in all. Another group of five practiced for two half-hour periods a day at 8 or 9 A.M. and at 2 or 3 P.M., for forty-five days (successive except for the omission of Sundays and an occasional Saturday). The first group averaged 99 words in the first half-hour period and 600,