

IMMEDIATE MEMORY FOR DIGITS
OF
CHILDREN IN FIVE MUNICIPAL SCHOOLS
IN
NAKORN PATHOM

THESIS

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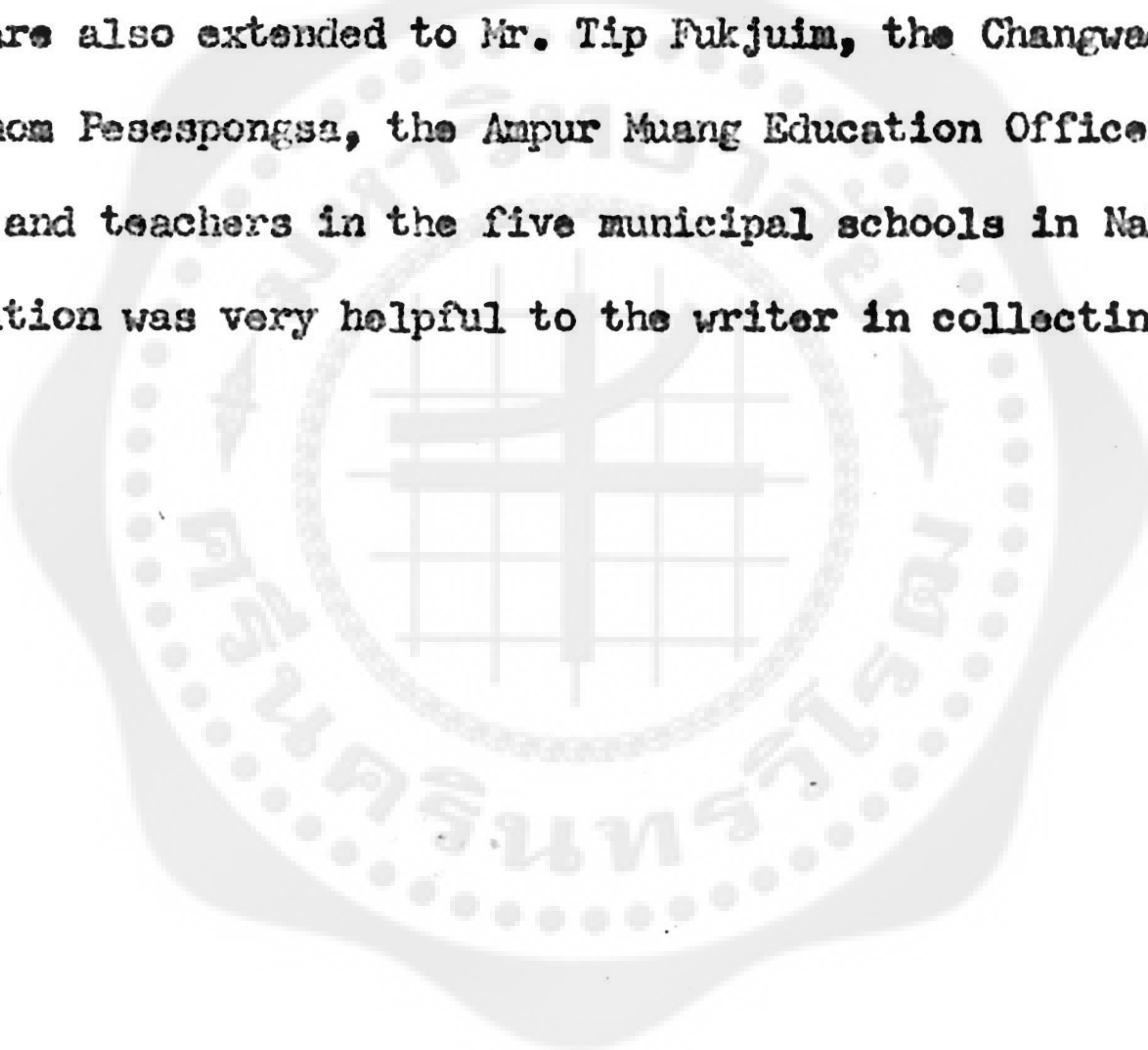


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CHAPTER I

INTRODUCTORY

1. 1 Introduction:

Some people can memorize learning materials correctly after they have seen or heard them only once, but others can remember them completely after they have seen or heard them many times. Psychologists defined the ability to memorize (memory) into many ways; Crow and Crow¹ defined memory as a special mental trait. They also said that people differ in what they remember, and how well or how long they retain in memory those situations or conditions that they have been associated. This means that the ability to memorize is an individual difference. The strength of memory is depended upon many factors, such as intensity, duration of stimulus, vividness, personal feeling, etc. They classified memory into two types, rote memory (verbatim reproduction of memorized material) and logical memory (recall of meaningful ideas presented in one's own words). Cruze² used remembering instead of memory, saying that memory is merely the process of remembering what has previously been learned; for instance, remembering the multiplication tables which were learned many years ago, remembering how to swim or drive a bicycle, etc. When one remembers things, he does not reach into a

1

Lester D. Crow and Alice Crow, Adolescent Development and Adjustment,

McGraw-Hill Book Company, Inc., New York, 1956, p. 121.

2

Wendell W. Cruze, General Psychology for College Students, Prentice-

Hall, Inc., Englewood Cliffs, N.J., New York, 1956, p. 586.

storehouse and pull them out as he needs them, but merely makes responses that are appropriate in the situation that is present. Munn¹ explained memory in three different aspects; recalling, recognizing and memorizing. For example, suppose that one learned a poem as a child; he may be able to recall it completely, reciting it word for word. Perhaps, he cannot recall the poem at all but he can recognize that it is the poem he learned in childhood. Even though it appears among many other familiar poems which he did not learn. Perhaps, he cannot even recognize the poem. But he can relearn it with a saving in the repetitions required. This means that he memorizes now much more readily than he memorized poems of comparable difficulty which he never learned before.

Memory is used both for the conscious recall of past events (I remember the last appearance of Halley's comet), and for retention of knowledge or skill (I remember how to ski).² Many psychologists believed that brain is the seat of memory,³ especially the frontal lobes. No memory can exist without the frontal association areas.⁴ There are experiments about

1

Normal L. Munn, Psychology, Houghton Mifflin Company, Boston, 1951, p. 197.

2

Encyclopedia Britannica, edited by Walter Yust, Encyclopedia Britannica, Ltd., London, 1953, vol. 15, p. 233.

3

Op. cit., Cruze, p. 586.

4

Op. cit., Munn, 1946, p. 52 - 54.

the frontal association areas and the ability to memorize. The results, as shown in the Psychology by Munn, are :-¹

1. When some parts of the frontal association areas are destroyed, there is no disturbance of ability to recall, but it does reduce the time which may elapse between seeing the food placed and ability to locate it correctly,

2. Destruction of only one frontal area, either the right or the left hemisphere, has no effect on ability to recall, and

3. When both frontal association areas are completely destroyed, the ability to recall is completely lost.

These results reveal that the frontal association areas are important to the ability to memorize of the animals and human beings.

People differ in ability to memorize, especially the brain damaged and the normal persons. There are tests developed for clinical use for measuring the ability to memorize. The famous one is the Wechsler Memory Scale. Anastasi² said about this scale that this scale, now available in two equivalent forms, provides a "memory quotient" comparable to the Wechsler-Bellevue IQ. There are seven subtests in each form. The sum of the raw scores on the seven subtests is converted into a memory quotient (MQ), which can be compared directly with the Wechsler-Bellevue IQ. The equivalence

¹

Op. cit., Munn, 1946, p. 52 - 54.

²

Anne Anastasi, Psychological Testing, The MacMillan Company, New York, 1954, p. 337.

4

of the two quotients was achieved by setting the mean MQ equal to the mean Wechsler-Bellevue IQ at each age level in a standardization sample of about one hundred normal persons.

This investigation is done to study the immediate memory for digits of Pratom children (Pratom means a primary grade, Pratom one is the first grade, Pratom two the second grade, and so on) in five municipal schools (a municipal school is a primary school which is situated in a municipal area and once supported by the municipality. This kind of school is now supported by the Ministry of Education) in Nakorn Pathom. To measure the immediate memory for digits the kind of test the writer used in this study is one of the subtests in the Wechsler-Bellevue Scale.

1. 2 Purposes of the study:

The purposes of this study are to find out whether:-

1. The immediate memory for digits of older children is longer than that of younger children,
2. There is any difference in the immediate memory for digits between boys and girls,
3. The immediate memory for digits of higher grade children is longer than that of lower grade children of the same age, and
4. The immediate memory for digits of the children whose school marks are high (one whose marks in the first term examination is in the upper seventy-five percentile) is longer than those whose school marks are low (one whose marks in the first term examination is in the lower twenty-five percentile).

1. 3 Significance of the study:

The immediate memory generally correlates with all other tests of intelligence. It correlates best with Digit-Symbol and worst with the Object Assembly Test.¹ A child can learn best if the learning materials he learns are suited to his ability. It will satisfy him if he can remember all the materials he learned at once or a few minutes later. To know the immediate memory of Thai school children is useful, because we can apply the knowledge in learning situations such as learning rules of games, and following general instructions.

1. 4 Survey of related literature:

Immediate memory is, usually, used for the ability to recall the materials after one presentation, either visual presentation or auditory presentation. Some use "memory span" instead of "immediate memory". The concept of span was derived from the span of hand and conveys the idea of width of grasp, i.e. how much can be spanned or grasped at once.² There are many kinds of materials used for measuring immediate memory, such as nonsense-syllables, series of digits, meaningful words, etc.

1

D. Wechsler, The Measurement of Adult Intelligence, The Williams & Wilkins Company, Baltimore, 1944, p. 85.

2

R.S. Woodworth, Experimental Psychology, Henry Holt and Company, New York, 1938, p. 7.

Immediate memory of a person is not constant. It can be varied according to age, task, procedure and other conditions. Immediate memory generally increases with age. The immediate memory of an adult is longer than that of the younger children. Russell¹ shows in his book that the three-years-old child can repeat the three-digits-series correctly whereas the ten-years-old child can perfectly reproduced the six-digits-series. Guildford² also found that for the average college student the immediate memory for digits is about seven. According to Terman and Merrill,³ the digit repetition is used as a test for measuring intelligence. Subjects in different ages required to repeat the different length of digits-series, for instance, the two years six months child repeats the two digits series, the three years old child repeats the three digits series, and so on. If the subject can reproduce correctly one of the three, he will pass the test and gets one score. This indicates that Terman and Merrill recognized that the immediate memory for digits of the older children is longer than that of the younger children.

¹ David H. Russell, Children's Thinking, Ginn and Company, Boston, 1956, p. 133.

² J.P. Guildford, General Psychology, D. Van Nostrand Company, Inc., New York, 1956, p. 197.

³ Lewis M. Terman and Muad A. Merrill, Measuring Intelligence, Houghton Mifflin Company, 1937, pp. 199.

The immediate memory also varies according to the types of materials. The number of words that can be correctly reproduced immediately after one presentation is much greater than that of digits.¹ The immediate memory may vary according to practice as well as age and task. Munn² found that the immediate memory for digits of the experimental group who practiced memorizing series of digits is greater than that of the control group who had no practice.

Besides, the study of Raymond³ showed that the immediate memory can be varied according to the procedure, such as the immediate memory for digits visually presented is longer than that when presented to subjects of the same group auditorily. Physical handicaps, such as hearing deficiency may influence immediate memory. Failure in repeating the digits correctly may be due to other factors as well, for example, lack of number concepts, faulty attention, and inadequate auditory imagery.⁴

¹
Op. cit., Walter Yust, vol. 15, p. 234.

²
Normal L. Munn, "Learning in Children" in Manual of Child Psychology,
edited by Carmichael, John Wiley & Sons, New York, 1946, p. 417.

³
Dorothy MacLean Raymond, "The Performance of Reading Achievers on Memory
Span and Associate Learning Tests", Journal of Educational Research,
48: 455-465, P. 55.

⁴
Arnold Gesell, The First Five Years of Life, Harper & Brothers Publishers,
New York, 1940, p. 177.

The immediate memory for digits has been universally used in scales of intelligence. "It forms part of the original Binet scale and all the revisions of it. It has been used for a long time by psychiatrists as a test of retentiveness and by psychologists for all sorts of psychological studies".¹ Subjects were asked to reproduce the digits in two ways, forwards and backwards. Such measure of immediate memory was found to be useful for clinical diagnosis. According to Wechsler,² an adult who cannot retain five digits forwards and three backwards will be found, in nine cases out of ten, to be feebleminded. Wells pointed out that where the difference between the immediate memory for digits forwards and backwards is large, it often indicates mental deterioration.³ As the test of the immediate memory for digits both forwards and backwards is very easy to administer and score, it is very widely used. This kind of test is usually used with those whose number concepts are developed, the immediate memory for digits test will be meaningful and valuable. The Mental Health Clinic, Dhonburi, has been using various tests in order to find out the mental ability of a child who is referred to clinic. Among these is the test of immediate memory for digits.

1

Op. cit., D. Wechsler, p. 83.

2

Ibid., p. 83.

3

Ibid., p. 84, (citing Mental Tests in Clinical Practice, by F.L. Wells, ch. VIII).

1. 5 Limitations of the study:

This study is limited to Pratom one to Pratom four children in five municipal schools in Nakorn Pathom. It deals with the immediate memory for digits forwards only.



CHAPTER II

METHODS AND PROCEDURE

2. 1 Sample:

Farming is the main occupation of Thai people. About eighty-five per cent of them are farmers. They usually need their children to help them and not allow their children to go to school before they are required by the Compulsory Law.* Few children go to a private school at an earlier age, because the public school admits only children who are seven years old. The pupils in the municipal schools in Nakorn Pathom are usually farmers' children. Thus, these pupils are selected to be sample in this study. There are five schools, in each school there is more than one class in the same grade. For example, there are seven classes in Pratom one and six classes in Pratom two in school A. The random sampling technique is used in selecting classes.

In each school, only one class from each grade was selected by drawing lots. The pupils in each selected class were divided into three groups according to their marks in the first term examination, the upper seventy-five percentile group, the twenty-five to seventy-five percentile group and the lower twenty-five percentile group. Only ten pupils from these three groups in each selected class were chosen, two pupils from the upper seventy-five percentile group, six pupils from the twenty-five to seventy-five percentile group and the other two pupils from the lower twenty-five percentile group. There are five schools, each of which has four grades.

* According to the Compulsory Law, a child who is seven years old must go to a primary school until he completes the four-years elementary courses or reach the age of fourteen.

The number of classes selected is twenty and the total number of subjects for this study is two hundred. The number of subjects divided according to sex are shown in the following table.

TABLE 2. 1
THE NUMBER OF SUBJECTS DIVIDED ACCORDING TO SEX

Schools	Total	Pratom 1		Pratom 2		Pratom 3		Pratom 4	
		B.	G.	B.	G.	B.	G.	B.	G.
A	40	4	6	5	5	7	3	4	6
B	40	6	4	6	4	4	6	4	6
C	40	6	4	4	6	7	3	6	4
D	40	5	5	5	5	4	6	5	5
E	40	4	6	5	5	6	4	6	4
Total	200	25	25	25	25	28	22	25	25

The subjects' age were computed from their birth date to the date of testing period and the writer raised the days to be one month if they are more than fourteen days. The number of subjects classified by age are in the Table 2. 1 (A)

TABLE 2. 1 (A)
THE NUMBER OF SUBJECTS IN NINE AGE GROUPS

Age	Total	Pratom 1	Pratom 2	Pratom 3	Pratom 4
6/9 - 6/11	9	7	2	-	-
7/0 - 7/11	43	32	11	-	-
8/0 - 8/11	38	7	21	10	-
9/0 - 9/11	45	2	11	25	7
10/0 -10/11	38	2	4	12	20
11/0 -11/11	18	-	1	2	15
12/0 -12/11	5	-	-	-	5
13/0 -13/11	3	-	-	-	3
15/5	1	-	-	1	-
Total	200	50	50	50	50

2. 2 Materials:

Three forms of digits-series were used in this study, quoted from
Woodworth.*

*
R.S. Woodworth, Experimental Psychology, Henry Holt and Company, New York,
1938, p. 7.

Three forms of digits-series are:-

<u>FORM A</u>	<u>FORM B</u>	<u>FORM C</u>
972	641	853
1406	2730	4097
39418	85943	21659
067285	706294	302481
2516927	1538796	6479038
58391204	29081357	71520863
764580129	042865129	039418276
2164089573	4790386215	5168047392
45382170369	39428107536	94350182675
870932614280	541962836702	176298305914

These three forms of digits-series were first administered to eighteen pupils in Pratom four in a school as a pre-test. Subjects No. 1 - 6 were given the digits-series in FORM A first. Until they cannot repeat the series correctly. The writer noted the series which they succeeded, and then gave them the series in FORM B and FORM C respectively. Subjects No. 7 - 12 began with FORM B, then FORM C and FORM A. Subjects No. 13 - 18 began with FORM C, then FORM A and FORM B. The results of the pre-test are in the Table 2. 2

TABLE 2. 2
THE RESULTS OF PRETESTING THREE FORMS OF DIGIT-SERIES

No. of subject	Age	Form A	Form B	Form C
1	12/4	4	5	5
2	11/4	4	4	3
3	10/5	5	5	5
4	11/1	5	5	5
5	10/6	5	5	5
6	9/4	5	5	4
7	10/10	5	5	5
8	11/4	5	4	5
9	14/0	5	5	4
10	10/9	4	5	4
11	10/6	6	5	6
12	9/7	5	5	4
13	10/7	5	5	5
14	10/7	5	4	5
15	9/9	5	6	6
16	10/0	5	5	6
17	9/11	5	5	4
18	10/2	4	5	4

The chi square test of mean and the test for homogeneity of variance by the chi square test^{*} are used in order to find out whether the immediate memory for digits of these three Forms of digits-series are different. The number of subjects in different length of immediate memory of three different Forms of digits-series are:-

Immediate Memory	Form A	Form B	Form C	Total
3	-	-	1	1
4	4	3	6	13
5	13	14	8	35
6	1	1	3	5
N	18	18	18	54
ΣX	87	88	85	260
ΣX^2	425	434	413	1272
ΣD^2	24.5	3.8	11.6	20.1

* Edwards, Allen L., Experimental Design in Psychological Research, Rinehart & Company, Inc., Publishers, New York, 1950, p. 196 - 198.

THE VALUE OF THE CHI SQUARE TEST OF MEAN

Immediate Memory		f_e	f_o	$f_o - f_e$	$(f_o - f_e)^2$	$\frac{(f_o - f_e)^2}{f_e}$
<u>Form A</u>	3	0.33	0	-0.33	0.1089	0.33000
	4	4.33	4	-0.33	0.1089	0.02515
	5	11.67	13	1.33	1.7689	0.15158
	6	1.67	1	-0.67	0.4489	0.26880
<u>Form B</u>	3	0.33	0	-0.33	0.1089	0.33000
	4	4.33	3	-1.33	1.7689	0.40852
	5	11.67	14	2.33	5.4289	0.46520
	6	1.67	1	-0.67	0.4489	0.26880
<u>Form C</u>	3	0.33	1	0.67	0.4489	1.36030
	4	4.33	6	1.67	2.7889	0.64409
	5	11.67	8	-3.67	13.4689	1.15415
	6	1.67	3	1.33	1.7689	1.05922
						6.46581

The chi square value = 6.46581, $df = 8$, the chi square is not significant

THE VALUE OF TEST FOR HOMOGENEITY OF VARIANCE BY THE CHI SQUARE TEST

Groups	N	df	$\sum D^2$	s^2	$\log s^2$
Form A	18	17	4.5	0.26470	$\bar{1}.42276$
Form B	18	17	3.8	0.22352	$\bar{1}.34927$
Form C	18	17	11.6	0.68235	$\bar{1}.83400$
				1.17057	$\bar{2}.60603$

$$\frac{\sum s^2}{r} = \frac{1.17057}{3} ; \quad \log \frac{\sum s^2}{r} = \bar{1}.59127$$

$$r(\log \frac{\sum s^2}{r}) = 3(\bar{1}.59127) = \bar{2}.77381$$

$$\text{diff.} = \bar{2}.77381 - \bar{2}.60603 = 0.16778$$

$$\text{chi square} = (2.3026)(df)(\text{diff.}) = (2.3026)(17)(0.16778) = 6.5676$$

The chi square value = 6.5676, df = 17, the chi square is not significant

The chi square test of mean and the test for homogeneity of variance by the chi square test are both not significant. Form A, therefore, is used in this study.

2. 3 Procedure:

The writer has at hand 3 - 12 digits-series and instructs the subjects as follows: "I will say some numbers, when I finished, you are supposed to repeat the numbers in the same order". The writer starts with the shortest series (3 digits-series). When subject repeats the series correctly, the writer gives him the longer series (4 digits-series), and so on. Each subject has only one trial in repeating the series. If subject fails in any series, the writer will give him another series which contain an equal number of digits in order to be sure that he really cannot repeat the series in such length correctly. In reading the series, each interval between the digits takes one second.

CHAPTER III

ANALYSIS OF DATA AND THE RESULTS OF THE STUDY

3. 1 Methods of analysis:

The length of the immediate memory is used as the amount of materials one can perfectly reproduced after one presentation. In this study, the length of the immediate memory for digits is the number of digits in series which subject can recall correctly after one presentation. If subject succeeds in repeating 5 digit - series but never beyond that point, his immediate memory for digits would be 5.5 digits, because his immediate memory for digits is at least 5 digits, but not quite 6 digits.

3. 2 Results of the study:

The results of the study will be discussed in the following manner:

1. The immediate memory for digits of children in the various grades,
2. The immediate memory for digits of children of varying ages,
3. The sex difference in the immediate memory for digits,
4. The immediate memory for digits of higher grade children and lower grade children of the same age, and
5. The immediate memory for digits of children whose school marks are high and those whose school marks are low.

3. 2.1 The immediate memory for digits of children in the various grades

The immediate memory for digits of children in Pratom 1, Pratom 2, Pratom 3 and Pratom 4 are in Table 3. 2.1

TABLE 3. 2.1
IMMEDIATE MEMORY FOR DIGITS OF CHILDREN IN PRATOM 1, PRATOM 2, PRATOM 3 AND
PRATOM 4

I.M.	P.1	P.2	P.3	P.4	TOTAL
3.5	11	2	-	-	13
4.5	24	13	10	1	48
5.5	14	30	29	38	111
6.5	1	5	10	9	25
7.5	-	-	1	2	3
N	50	50	50	50	200
ΣX	230	263	277	287	1057
$\frac{\Sigma X}{N}$	4.60	5.26	5.54	5.74	5.285
ΣX^2	1086.50	1406.50	1558.50	1662.50	5714.00
ΣD^2	28.50	23.12	23.92	15.12	127.75

From Table 3. 2.1 it reveals that the average immediate memory for digits of children increases with the increasing in grade, and the variance of the immediate memory for digits tends to be decreased according to the grade increment. Whether this trend is significant or not is tested by the chi square test of mean and the test for homogeneity of variance by the chi square test.

THE VALUE OF THE CHI SQUARE TEST OF MEAN

	I.M.	fe	fo	fo - fe	$(fo - fe)^2$	$\frac{(fo - fe)^2}{fe}$
P.1	3.5	3.25	11	7.75	60.0625	18.48076
	4.5	12.00	24	12.00	144.0000	12.00000
	5.5	27.75	14	-13.75	189.0625	6.81306
	6.5	6.25	1	- 5.25	27.5625	4.41000
	7.5	0.75	0	-0.75	0.5625	0.75000
P.2	3.5	3.25	2	- 1.25	1.5625	0.48076
	4.5	12.00	13	1.00	1.0000	0.08333
	5.5	27.75	30	2.25	5.0625	0.18243
	6.5	6.25	5	- 1.25	1.5625	0.25000
	7.5	0.75	0	- 0.75	0.5625	0.75000
P.3	3.5	3.25	0	- 3.25	10.5625	3.25000
	4.5	12.00	10	- 2.00	4.0000	0.33333
	5.5	27.75	29	1.25	1.5625	0.05630
	6.5	6.25	10	3.75	14.0625	2.25000
	7.5	0.75	1	0.25	0.0625	0.08333
P.4	3.5	3.25	0	- 3.25	10.5625	3.25000
	4.5	12.00	1	-11.00	121.0000	10.08333
	5.5	27.75	38	10.25	105.0625	3.78603
	6.5	6.25	9	2.75	7.5625	1.21000
	7.5	0.75	2	1.25	1.5625	2.08333
						70.58599

The chi square value = 70.58599, df = 12, $P < .001$,

The chi square is very significant.

THE VALUE OF TEST FOR HOMOGENEITY OF VARIANCE BY THE CHI SQUARE TEST

Group	n	df	$\sum D^2$	S^2	$\log S^2$
P.1	50	49	28.50	0.58163	$\bar{1}.76462$
P.2	50	49	23.12	0.47183	$\bar{1}.67379$
P.3	50	49	23.92	0.48816	$\bar{1}.68856$
P.4	50	49	15.12	0.30857	$\bar{1}.48935$
				1.85019	$\bar{2}.61632$

$$\frac{\sum S^2}{r} = \frac{1.85019}{4} = 0.46254; \quad \log \frac{\sum S^2}{r} = \bar{1}.66515$$

$$r \left[\log \frac{\sum S^2}{r} \right] = (4)(\bar{1}.66515) = \bar{2}.66060$$

$$\text{diff.} = \bar{2}.66060 - \bar{2}.61632 = 0.04428$$

$$\text{chi square} = (2.3026)(n - 1)(\text{diff.}) = (2.3026)(49)(0.04428) = 4.996$$

The chi square = 4.996, df = 3, $P > .10$, the chi square is not significant.

The chi square test of mean (chi square = 70.58599, df = 12) is significant and the test for homogeneity of variance by the chi square test (chi square = 0.46586, df = 3) is not significant. This reveals that the immediate memory for digits of children increases with the increasing grade, but the variance of the immediate memory for digits seems to be decrease according to grade increment. It indicates, in this study, that the immediate memory for digits of the lower grade children is short, but its variation is large; whereas the immediate memory for digits of the higher grade children is getting longer but its variation is getting smaller.

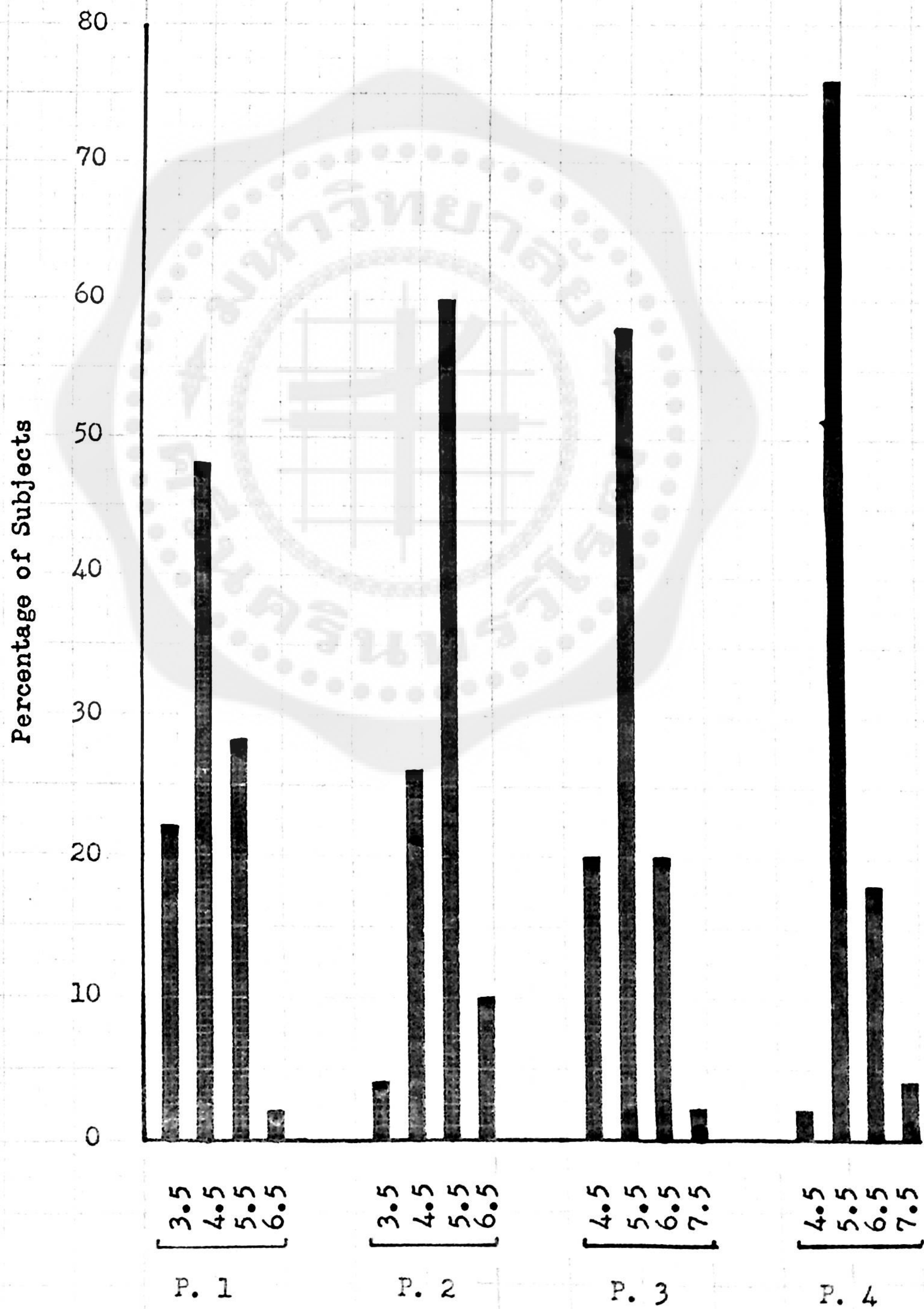
The immediate memory for digits of the four grades children in this study begins with 4.60 digits in Pratom one and then 5.26, 5.54 and 5.74 digits in Pratom two, Pratom three and Pratom four respectively. The immediate memory for digits increases rapidly from Pratom one to Pratom two, slightly increase from Pratom two to Pratom three and Pratom three to Pratom four. The variances of the immediate memory for digits of the four grade children are 28.50, 23.12, 23.92 and 15.12 in Pratom one, Pratom two, Pratom three and Pratom four respectively. It tends to decrease with the grade increasing. The computation of the chi square test of mean and the test for homogeneity of variance by the chi square test between pairs (Pratom one and Pratom two, Pratom two and Pratom three, Pratom three and Pratom four) shows that the difference between the immediate memory for digits of children in Pratom one and Pratom two is significant (chi square = 17.9858, df = 3), Pratom two and Pratom three is not significant (chi square = 5.075, df = 3) and Pratom three and Pratom four is again significant (chi square = 8.9586, df = 3); but the differences of the variance of the immediate memory for digits of children between pairs are all not significant (chi square = 0.53321, 0.01459 and 2.54257 respectively with df = 1).

The range of the immediate memory for digits of four grades children are 3.5 to 6.5, 3.5 to 6.5, 4.5 to 7.5 and 4.5 to 7.5 digits respectively. The frequency of the children in various lengths of the immediate memory for digits is shown in Table 3. 2.1 (A).

TABLE 3. 2.1 (A)
FREQUENCY IMMEDIATE MEMORY FOR DIGITS

Grades	Total		The length of the immediate memory for digits				
			3.5	4.5	5.5	6.5	7.5
P.1	n	50	11	24	14	1	-
	%	100	22	48	28	2	-
P.2	n	50	2	13	30	5	-
	%	100	4	26	60	10	-
P.3	n	50	-	10	29	10	1
	%	100	-	20	58	20	2
P.4	n	50	-	1	38	9	2
	%	100	-	2	76	18	4

FIGURE 3. 2.1 (A)
HISTOGRAM OF TABLE 3. 2.1 (A)



3. 2.2 The immediate memory for digits of children of varying ages

In this section, the writer shall discuss the increase in the immediate memory for digits in relation to increasing age. The data are given in Table 3. 2.2

TABLE 3. 2.2
IMMEDIATE MEMORY FOR DIGITS OF CHILDREN OF VARYING AGES

Age	Immediate memory for digits					N	ΣX	$\frac{\Sigma X}{N}$	ΣX^2	ΣD^2
	3.5	4.5	5.5	6.5	7.5					
6/9 - 6/11	2	4	3	-	-	9	41.5	4.61	196.25	4.89
7/0 - 7/11	9	16	14	4	-	43	206.5	4.80	1026.75	35.07
8/0 - 8/11	1	9	23	5	-	38	203.0	5.34	1101.50	17.05
9/0 - 9/11	1	10	27	6	1	45	243.5	5.41	1341.25	23.64
10/0-10/11	-	8	22	6	2	38	211.0	5.55	1193.50	21.89
11/0-11/11	-	1	14	3	-	18	101.0	5.61	570.50	3.78
12/0-12/11	-	-	4	1	-	5	28.5	5.70	163.25	0.80
13/0-13/11	-	-	3	-	-	3	16.5	5.50	90.75	0.00
15/5	-	-	1	-	-	1	5.5	5.50	30.25	0.00
Total	13	48	111	25	3	200	1057.0	5.285	5774.0	127.75

This table reveals that the immediate memory for digits tends to increase with the increasing age. The immediate memory for digits increases from 4.61 digits at the age of 6/9 - 6/11 up to 5.70 digits at the age of 12/0 - 12/11, and drops to 5.50 digits at the age of 13/0 - 13/11 and 15/5. The immediate memory for digits ascends sharply at the beginning and then declines. The immediate memory for digits of the 13/0 - 13/11 and 15/5 years old children is shorter than that of the 12/0 - 12/11 years old children. This can be explained that the writer obtained a small number of subjects in these two age groups (three subjects in 13/0 - 13/11 and only one in 15/5 age group). Besides, the age of children of these two age groups is higher than the general age of primary school children (a child attends school at seven years of age, and he has to complete the primary school at eleven or twelve years old). They may be slower children.

The variance of the immediate memory for digits seem to be getting less and less according to the increase in age. The chi square test of mean and the test for homogeneity of variance by the chi square test will show whether the increment of means and the decrement of variance of the immediate memory for digits according to the increasing age are significant or not.

THE VALUE OF THE CHI SQUARE TEST OF MEAN						
I.M.	fe	fo	fo - fe	$(fo - fe)^2$	$\frac{(fo - fe)^2}{fe}$	
6/9-6/11 3.5	0.585	2	1.415	2.002225	3.42261	
4.5	2.160	4	1.840	3.385600	1.56741	
5.5	4.995	3	-1.995	3.980025	0.79680	
6.5	1.125	0	-1.125	1.265625	1.12500	
7.5	0.135	0	-0.135	0.018225	0.13500	

	I.M.	f_e	f_o	$f_o - f_e$	$(f_o - f_e)^2$	$\frac{(f_o - f_e)^2}{f_e}$
7/0-7/11	3.5	2.795	9	6.205	38.502025	13.77532
	4.5	10.320	16	5.640	31.809600	3.08233
	5.5	23.865	14	-9.865	97.318225	4.07786
	6.5	5.375	4	-1.375	1.890625	0.35174
	7.5	0.645	0	-0.645	0.416025	0.64500
8/0-8/11	3.5	2.470	1	-1.470	2.160900	0.87486
	4.5	9.120	9	-0.120	0.014400	0.00158
	5.5	21.090	23	1.910	3.648100	0.17298
	6.5	4.750	5	0.250	0.062500	0.01316
	7.5	0.570	0	-0.570	0.324900	0.57000
9/0-9/11	3.5	2.925	1	-1.925	3.705625	1.26688
	4.5	10.800	10	-0.800	0.640000	0.05926
	5.5	24.975	27	2.025	4.100625	0.16419
	6.5	5.625	6	0.375	0.140625	0.02500
	7.5	0.675	1	0.325	0.105625	0.15648
10/0-10/11	3.5	2.470	0	-2.470	6.100900	2.47000
	4.5	9.120	8	-1.120	1.254400	0.13754
	5.5	21.090	22	0.910	0.828100	0.03927
	6.5	4.750	6	1.250	1.562500	0.32895
	7.5	0.570	2	1.430	2.044900	3.58754
11/0-11/11	3.5	1.170	0	-1.170	1.368900	1.17000
	4.5	4.320	1	-3.320	11.022400	2.55148
	5.5	9.990	14	4.010	16.080100	1.60962
	6.5	2.250	3	0.750	0.562500	0.25000
	7.5	0.270	0	-0.270	0.072900	0.27000

	I.M.	fe	fo	fo - fe	$(fo - fe)^2$	$\frac{(fo - fe)^2}{fe}$
12/0-15/5	3.5	0.585	0	-0.585	0.342225	0.58500
	4.5	2.160	0	-2.160	4.665600	2.16000
	5.5	4.995	8	3.005	9.030025	1.80781
	6.5	1.125	1	-0.125	0.015625	0.01389
	7.5	0.135	0	-0.135	0.018225	0.13500
						49.39956

The chi square = 49.39956, df = 24, $P < .01$; chi square is significant.

THE VALUE OF TEST FOR HOMOGENEITY OF VARIANCE BY THE CHI SQUARE TEST

There are very few children in the 13/0 - 13/11 and 15/5 age groups. Therefore, the writer combined these two age groups with the age group of 12/0 - 12/11. Thus, there are nine subjects in age group of 12/0 - 15/5, and its variation (D^2) is 0.89.

Group	n	n-1	$\frac{1}{n-1}$	$\sum D^2$	S^2	$\log S^2$	$(n-1)(\log S^2)$
6/9 - 6/11	9	8	0.12500	4.89	0.61125	1.78621	2.28966
7/0 - 7/11	43	42	0.02381	35.07	0.83500	1.92169	4.71098
8/0 - 8/11	38	37	0.02632	17.05	0.46081	1.66351	13.54987
9/0 - 9/11	45	44	0.02273	23.64	0.53727	1.73019	12.12836
10/0 - 10/11	38	37	0.02632	21.89	0.59162	1.77204	9.56548
11/0 - 11/11	18	17	0.05882	3.78	0.22235	1.34693	12.89951
12/0 - 15/5	9	8	0.12500	0.89	0.11125	1.04610	8.37032
		193	0.40800	107.21		-	57.51418

$$\frac{\sum \sum D^2}{\sum (n-1)} = \frac{107.21}{193} = 0.55549; \quad \log \frac{\sum \sum D^2}{\sum (n-1)} = \bar{1}.74467$$

$$\left[\sum (n-1) \right] \left[\log \frac{\sum \sum D^2}{\sum (n-1)} \right] = (193)(\bar{1}.74467) = \bar{50}.72131$$

$$\text{diff.} = \bar{50}.72131 - \bar{57}.51418 = 7.20713$$

$$\text{chi square} = (2.3026)(7.20713) = 16.595138$$

$$\begin{aligned} \text{correction} &= 1 + \frac{1}{(3)(7-1)} \left(\frac{1}{n-1} - \frac{1}{(n-1)} \right) \\ &= 1 + \frac{1}{(3)(7-1)} \left(0.408 - \frac{1}{193} \right) \\ &= 1 + \frac{1}{18} (0.408 - 0.0052) \\ &= 1 + \frac{1}{18} (0.4028) \\ &= 1.022378 \end{aligned}$$

$$\text{corrected chi square} = \text{chi square} / \text{correction} = \frac{16.595138}{1.022378} = 16.2319$$

The chi square = 16.2319, df = 6, chi square is significant.

The chi square test of mean and the test for homogeneity of variance by the chi square test are both significant (chi square = 49.399546, df =24 and 16.2319, df = 6 respectively). This indicates that the immediate memory for digits of children increases significantly with the increasing age, the variance of the immediate memory for digits tends to decrease according to the increase in age. These results tell that the immediate memory for digits of the younger children is short, but its variation is large; whereas the immediate memory for digits of the older children is getting longer, but its variation is getting smaller.

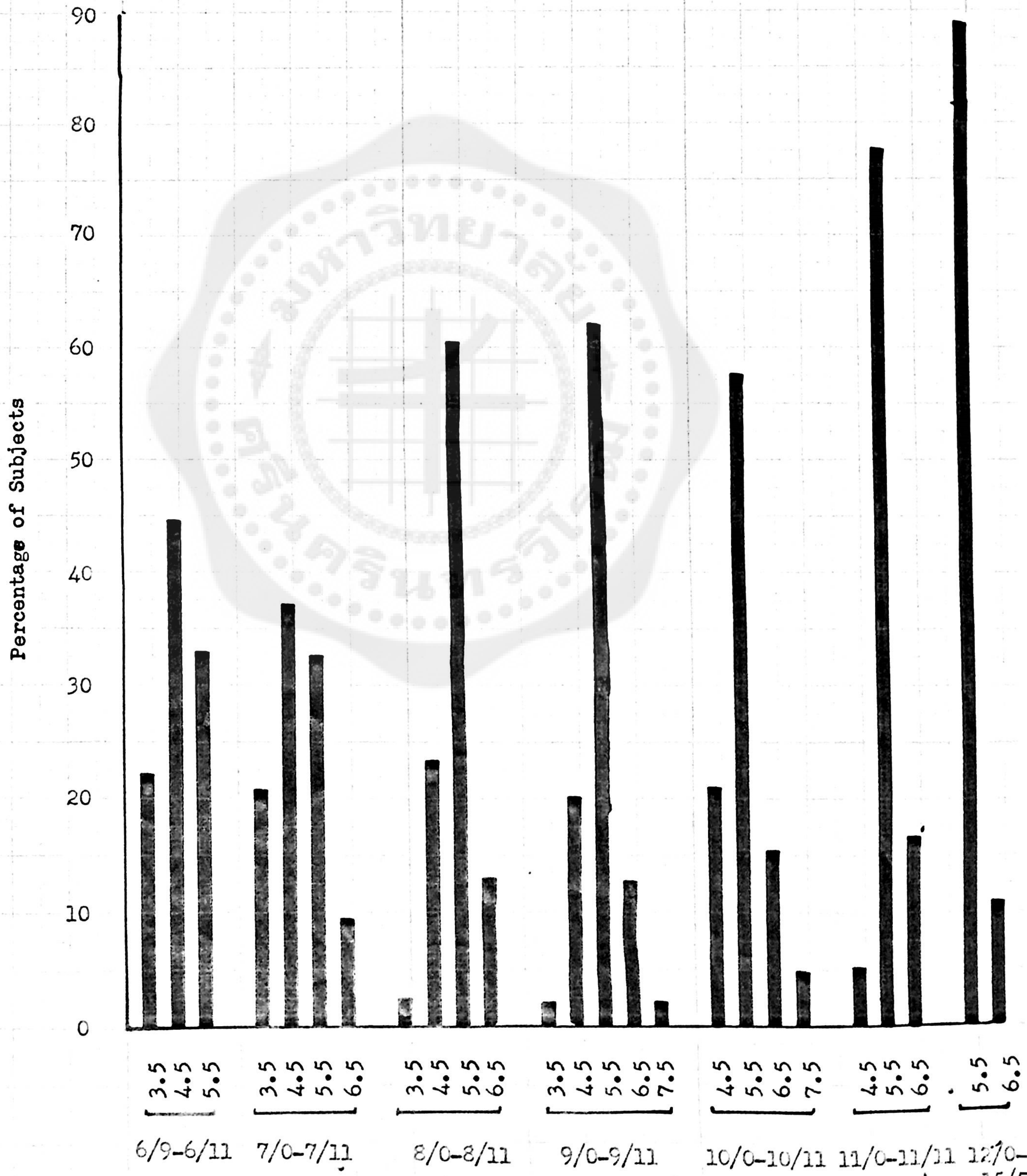
The range of the immediate memory for digits is 3.5 to 7.5 digits, the frequency is shown in Table 3. 2.2 (A).

TABLE 3. 2.2 (A)
FREQUENCY IMMEDIATE MEMORY FOR DIGITS

Ages	Total		The length of the immediate memory for digits				
			3.5	4.5	5.5	6.5	7.5
6/9 - 6/11	n	9	2	4	3	-	-
	%	100	22.22	44.44	33.33	-	-
7/0 - 7/11	n	43	9	16	14	4	-
	%	100	20.93	37.21	32.56	9.30	-
8/0 - 8/11	n	38	1	9	23	5	-
	%	100	2.63	23.68	60.53	13.16	-
9/0 - 9/11	n	45	1	9	28	6	1
	%	100	2.22	20.00	62.22	13.34	2.22
10/0 -10/11	n	38	-	8	22	6	2
	%	100	-	21.05	57.89	15.79	5.27
11/0 -11/11	n	18	-	1	14	3	-
	%	100	-	5.56	77.78	16.66	-
12/0 -15/5	n	9	-	-	8	1	-
	%	100	-	-	88.89	11.11	-

FIGURE 3. 2.2 (A)

HISTOGRAM OF TABLE 3. 2.2 (A)



3. 2.3 Sex difference in the immediate memory for digits

In this section, the writer will discuss the difference in the immediate memory for digits between boys and girls. The number of boys and girls in different lengths of the immediate memory for digits are in Table 3. 2.3 (A) and Table 3. 2.3 (B).

TABLE 3. 2.3 (A)
FREQUENCY DISTRIBUTION BY DIFFERENT GRADES

I.M.	P.1		P.2		P.3		P.4		Total	
	B.	G.	B.	G.	B.	G.	B.	G.	B.	G.
3.5	6	5	1	1	-	-	-	-	7	6
4.5	11	13	7	6	4	6	1	-	23	25
5.5	7	7	16	14	15	14	19	19	57	54
6.5	1	-	1	4	8	2	4	5	14	11
7.5	-	-	-	-	1	-	1	1	2	1
N	25	25	25	25	28	22	25	25	103	97
									ΣX	547.5 509.5
									ΣX^2	2979.75 2734.25
									ΣD^2	69.4952 58.0619

TABLE 3. 2.3 (B)
FREQUENCY DISTRIBUTION BY DIFFERENT AGES

I.M.	6/9- 6/11		7/0- 7/11		8/0- 8/11		9/0- 9/11		10/0- 10/11		11/0- 11/11		12/0- 12/11		13/0- 13/11		15/5		Total	
	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
3.5	-	2	6	3	1	-	-	1	-	-	-	-	-	-	-	-	-	-	7	6
4.5	3	1	7	9	3	6	4	6	6	2	-	1	-	-	-	-	-	-	23	25
5.5	2	1	7	7	14	9	12	15	9	13	8	6	3	1	1	2	1	-	57	54
6.5	-	-	2	2	2	3	5	1	4	2	1	2	-	1	-	-	-	-	14	11
7.5	-	-	-	-	-	-	1	-	1	1	-	-	-	-	-	-	-	-	2	1
N	5	4	22	21	20	18	22	23	20	18	9	9	3	2	1	2	1	-	103	97
																			ΣX	547.5 509.5
																			ΣX^2	2979.75 2734.25
																			ΣD^2	69.4952 58.0619

The chi square test of mean and the test for homogeneity of variance by the chi square are used in order to find out whether the difference in the immediate memory for digits between boys and girls are significant or not.

THE VALUE OF THE CHI SQUARE TEST OF MEAN

	I.M.	f_e	f_o	$f_o - f_e$	$(f_o - f_e)^2$	$\frac{(f_o - f_e)^2}{f_e}$
Boys	3.5	6.695	7	0.305	0.093025	0.013894
	4.5	24.720	23	-1.720	2.958400	0.119676
	5.5	57.165	57	-0.165	0.027225	0.000476
	6.5	12.875	14	1.125	1.265625	0.098300
	7.5	1.545	2	0.455	0.207025	0.133996
Girls	3.5	6.305	6	-0.305	0.093025	0.014754
	4.5	23.230	25	1.720	2.958400	0.127079
	5.5	53.835	54	0.165	0.027225	0.000505
	6.5	12.125	11	-1.125	1.265625	0.104381
	7.5	1.455	1	-0.455	0.207025	0.142285
						0.755346

The chi square = 0.755346, df = 4; chi square is not significant.

THE VALUE OF TEST FOR HOMOGENEITY OF VARIANCE BY THE CHI SQUARE TEST

Group	n	n-1	$\frac{1}{n-1}$	$\sum d^2$	s^2	$\log s^2$	$(n-1)(\log s^2)$
Boys	103	102	0.009804	69.4952	0.681325	1.83335	17.00170
Girls	97	96	0.010417	58.6619	0.604811	1.78163	21.03648
		198	0.020221	127.5571			38.03818

$$\frac{\sum \sum D^2}{\sum (n-1)} = \frac{127.5571}{198} = 0.6442; \quad \log \frac{\sum \sum D^2}{\sum (n-1)} = 1.80902$$

$$\left[\sum (n-1) \right] \left[\log \frac{\sum \sum D^2}{\sum (n-1)} \right] = (198)(1.80902) = 358.18596$$

$$\text{diff.} = 358.18596 - 358.03818 = 0.14778$$

$$\text{chi square} = (2.3026)(\text{diff}) = (2.3026)(0.14778) = 0.34028$$

The chi square = 0.34028, df = 1, chi square is not significant.

The chi square test of mean (chi square = 0.775, df = 4) and the test for homogeneity of variance by the chi square test (chi square = 0.34028, df = 1) are both not significant. This indicates that there is no difference in the immediate memory for digits between boys and girls.

3. 2.4 The immediate memory for digits of higher grade children and lower grade children of the same age

It is one of the purposes of this study to find out whether the ability to memorize learning materials of the higher grade children is longer than that of the lower grade children of the same age. The data which is shown in the following table tells us about the immediate memory for digits of the higher grade children and the lower grade children of the same age.

TABLE 3. 2.4

IMMEDIATE MEMORY FOR DIGITS OF HIGHER GRADE CHILDREN AND LOWER GRADE CHILD-
REN OF THE SAME AGE

Age	I.M.	P.1	P.2	P.3	P.4	Total
6/9 - 6/11	3.5	2	-	-	-	2
	4.5	4	-	-	-	4
	5.5	1	2	-	-	3
7/0 - 7/11	3.5	8	1	-	-	9
	4.5	14	2	-	-	16
	5.5	9	5	-	-	14
	6.5	1	3	-	-	4
8/0 - 8/11	3.5	1	-	-	-	1
	4.5	3	5	1	-	9
	5.5	3	14	6	-	23
	6.5	-	2	3	-	5
9/0 - 9/11	4.5	2	4	4	-	10
	5.5	-	6	16	5	27
	6.5	-	-	4	2	6
	7.5	-	-	1	-	1

Age	I.M.	P.1	P.2	P.3	P.4	Total
10/0-10/11	2.5	1	2	4	1	8
	5.5	1	2	5	14	22
	6.5	-	-	3	3	6
	7.5	-	-	-	2	2
11/0-11/11	4.5	-	-	1	-	1
	5.5	-	1	1	12	14
	6.5	-	-	-	3	3
12/0-12/11	5.5	-	-	-	4	4
	6.5	-	-	-	1	1
13/0-13/11	5.5	-	-	-	3	3
15/5	5.5	-	-	1	-	1
N		50	50	50	50	200

The number of subjects in some age groups are so small that it might affect the validity of comparing the differences by any statistical method. The writer, therefore, finds out the difference of the immediate memory for digits only of the higher grade children and those of the lower grade children in age groups that contain large number of subjects (age group of 7/0 - 7/11, 8/0 - 8/11, 9/0 - 9/11 and 10/0 - 10/11).

THE IMMEDIATE MEMORY FOR DIGITS OF CHILDREN IN AGE GROUP OF 7/0 - 7/11

I.M.	P.1	P.2	Total
3.5	8	1	9
4.5	14	2	16
5.5	9	5	14
6.5	1	3	4
N	32	11	43
ΣX	147.0	59.5	
$\frac{\Sigma X}{N}$	4.59	5.41	
ΣX^2	696.0	330.75	
ΣD^2	20.72	8.91	

THE VALUE OF THE CHI SQUARE TEST OF MEAN

	I.M.	fe	fo	fo - fe	$(fo - fe)^2$	$\frac{(fo - fe)^2}{fe}$
P.1	3.5	6.70	8	1.30	1.6900	0.25224
	4.5	11.91	14	2.09	4.3681	0.36676
	5.5	10.42	9	-1.42	2.0164	0.19351
	6.5	2.98	1	-1.98	3.9204	1.31557
P.2	3.5	2.30	1	-1.30	1.6900	0.73478
	4.5	4.09	2	-2.09	4.3681	1.06800
	5.5	3.58	5	1.42	2.0164	0.56324
	6.5	1.02	3	1.98	3.9204	3.84353
						8.33763

The chi square = 8.33763, df = 3; $P < .05$, chi square is significant

THE VALUE OF TEST FOR HOMOGENEITY OF VARIANCE BY THE CHI SQUARE TEST

Group	n	n-1	$\frac{1}{n-1}$	$\sum D^2$	S^2	$\log S^2$	$(n-1)(\log S^2)$
P.1	32	31	0.032258	20.72	0.668387	1.82503	6.57593
P.2	11	10	0.100000	8.91	0.891000	1.94988	1.49880
		41	0.132258	29.63			6.07473

$$\frac{\sum \sum D^2}{\sum (n-1)} = \frac{29.63}{41} = 0.72268, \quad \log \frac{\sum \sum D^2}{\sum (n-1)} = 1.85895$$

$$\left(\sum (n-1) \right) \left(\log \frac{\sum \sum D^2}{\sum (n-1)} \right) = (41)(1.85895) = 6.21695$$

$$\text{diff.} = 6.21695 - 6.07473 = 0.14222$$

$$\text{chi square} = (2.3026)(\text{diff.}) = (2.3026)(0.14222) = 0.32747577$$

The chi square = 0.32748, df = 1; chi square is not significant.

The chi square test of mean (chi square = 8.3376, df = 3) is significant . The test for homogeneity of variance by the chi square test (chi square = 0.32748, df = 1) is not significant. This reveals that the immediate memory for digits of Pratom two children is longer than that of Pratom one children of the same age (7/0 - 7/11), but its variation is not different.

THE IMMEDIATE MEMORY FOR DIGITS OF CHILDREN IN AGE GROUP OF 8/0 - 8/11

I.M.	P.1	P.2	P.3	Total
3.5	1	-	-	1
4.5	3	5	1	9
5.5	3	14	6	23
6.5	-	2	3	5
N	7	21	10	38
ΣX	33.5	112.5	57.0	
$\frac{\Sigma X}{N}$	4.79	5.36	5.70	
ΣX^2	163.75	609.25	328.50	
ΣD^2	3.43	6.57	3.60	

THE VALUE OF THE CHI SQUARE TEST OF MEAN (P.1 and P.2)

	I.M.	fe	fo	fo - fe	$(fo - fe)^2$	$\frac{(fo - fe)^2}{fe}$
P.1	3.5	0.25	1	0.75	0.5625	0.2250
	4.5	2.00	3	1.00	1.0000	0.5000
	5.5	4.25	3	-1.25	1.5625	0.3676
	6.5	0.50	0	-0.50	0.2500	0.5000
P.2	3.5	0.75	0	-0.75	0.5625	0.7500
	4.5	6.00	5	-1.00	1.0000	0.1667
	5.5	12.75	14	1.25	1.5625	0.1225
	6.5	1.50	2	0.50	0.2500	0.1667
						2.7985

The chi square = 2.7985, df = 3; chi square is not significant.

THE VALUE OF TEST FOR HOMOGENEITY OF VARIANCE BY THE CHI SQUARE TEST (P.1 & P.2)

Group	n	n-1	$\frac{1}{n-1}$	$\sum D^2$	s^2	$\log s^2$	$(n-1)(\log s^2)$
P.1	7	6	0.16667	3.43	0.57167	1.75715	2.54290
P.2	21	20	0.05000	6.57	0.32850	1.51654	10.33080
		26		10.00			12.87370

$$\frac{\sum \sum D^2}{\sum (n-1)} = \frac{10.00}{26} = 0.384615; \quad \log \frac{\sum \sum D^2}{\sum (n-1)} = 1.58503$$

$$\left[\sum (n-1) \right] \left[\log \frac{\sum \sum D^2}{\sum (n-1)} \right] = (26)(1.58503) = 11.21078$$

$$\text{diff.} = 11.21078 - 12.87370 = 0.33708$$

$$\text{chi square} = (2.3026)(\text{diff.}) = (2.3026)(0.33708) = 0.77616$$

The chi square = 0.77616, df = 1; chi square is not significant.

THE VALUE OF THE CHI SQUARE TEST OF MEAN (P.1 and P.3)

	I.M.	fe	fo	fo - fe	$(fo - fe)^2$	$\frac{(fo - fe)^2}{fe}$
P.1	3.5	0.412	1	0.588	0.345744	0.83918
	4.5	1.647	3	1.353	1.830609	1.11148
	5.5	3.706	3	-0.706	0.498436	0.13449
	6.5	1.235	0	-1.235	1.525225	1.23500
P.3	3.5	0.588	0	-0.588	0.345744	0.58800
	4.5	2.353	1	-1.353	1.830609	0.77799
	5.5	5.294	6	0.706	0.498436	0.09415
	6.5	1.765	3	1.235	1.525225	0.86415
						5.64444

The chi square = 5.64444, df = 3; chi square is not significant.

THE VALUE OF TEST FOR HOMOGENEITY OF VARIANCE BY THE CHI SQUARE TEST (P.1 & P.3)

Group	n	n-1	$\frac{1}{n-1}$	$\sum D^2$	s^2	$\log s^2$	$(n-1)(\log s^2)$
P.1	7	6	0.16667	3.43	0.57167	1.75715	2.54290
P.3	10	9	0.11111	3.60	0.40000	1.60206	4.41854
		15		7.03			6.96144

$$\frac{\sum \sum D^2}{\sum (n-1)} = \frac{7.03}{15} = 0.46867; \quad \log \frac{\sum \sum D^2}{\sum (n-1)} = 1.67086$$

$$\left[\sum (n-1) \right] \left[\log \frac{\sum \sum D^2}{\sum (n-1)} \right] = (15)(1.67086) = 5.06290$$

$$\text{diff.} = 5.06290 - 6.96144 = 0.10146$$

$$\text{chi square} = (2.3026)(\text{diff.}) = (2.3026)(0.10146) = 0.233622$$

The chi square = 0.233622, df = 1; chi square is not significant.

THE VALUE OF THE CHI SQUARE TEST OF MEAN (P.2 and P.3)

	I.M.	fe	fo	fo - fe	(fo - fe) ²	$\frac{(fo - fe)^2}{fe}$
P.2	4.5	4.60	5	0.94	0.8836	0.19209
	5.5	13.55	14	0.45	0.2025	0.01494
	6.5	3.39	2	-1.39	1.9321	0.56994
P.3	4.5	1.94	1	-0.94	0.8836	0.45546
	5.5	6.45	6	-0.45	0.2025	0.03140
	6.5	1.61	3	1.39	1.9321	1.20006
						2.46389

The chi square = 2.46389, df = 2; chi square is not significant.

THE VALUE OF TEST FOR HOMOGENEITY OF VARIANCE BY THE CHI SQUARE TEST (P.2 & P.3)

Group	n	n-1	$\frac{1}{n-1}$	$\sum D^2$	S^2	$\log S^2$	$(n-1)(\log S^2)$
P.2	21	20	0.05000	6.57	0.32850	1.51654	10.33080
P.3	10	9	0.11111	3.60	0.40000	1.60206	4.41854
		29		10.17			14.74934

$$\frac{\sum \sum D^2}{\sum (n-1)} = \frac{10.17}{29} = 0.35069; \quad \log \frac{\sum \sum D^2}{\sum (n-1)} = 1.54493$$

$$\left[\sum (n-1) \right] \left[\log \frac{\sum \sum D^2}{\sum (n-1)} \right] = (29)(1.54493) = 14.80297$$

$$\text{diff.} = 14.80297 - 14.74934 = 0.05363$$

$$\text{chi square} = (2.3026)(\text{diff.}) = (2.3026)(0.05363) = 0.123488$$

The chi square = 0.123488, df = 1; chi square is not significant.

THE IMMEDIATE MEMORY FOR DIGITS OF CHILDREN IN AGE GROUP OF 9/0 - 9/11

I.M.	P.1	P.2	P.3	P.4	Total
3.5	-	1	-	-	1
4.5	2	4	4	-	10
5.5	-	6	16	5	27
6.5	-	-	4	2	6
7.5	-	-	1	-	1
N	2	11	25	7	45
ΣX	9.0	54.5	139.5	40.5	
$\frac{\Sigma X}{N}$	4.50	4.95	5.58	5.79	
ΣX^2	40.5	274.75	790.25	235.75	
ΣD^2	0.0	4.73	11.84	1.43	

THE VALUE OF THE CHI SQUARE TEST OF MEAN (P.2 and P.3)

	I.M.	fe	fo	fo - fe	$(fo - fe)^2$	$\frac{(fo - fe)^2}{fe}$
P.2	3.5	0.306	1	0.694	0.481636	1.57397
	4.5	2.444	4	1.556	2.421136	0.99064
	5.5	6.722	6	-0.722	0.521284	0.07755
	6.5	1.222	0	-1.222	1.493284	1.22200
	7.5	0.306	0	-0.306	0.093636	0.30600
P.3	3.5	0.694	0	-0.694	0.481636	0.69400
	4.5	5.556	4	-1.556	2.421136	0.43577
	5.5	15.278	16	0.722	0.521284	0.03412
	6.5	2.778	4	1.222	1.493284	0.53754
	7.5	0.694	1	0.306	0.093636	0.13492

The chi square = 6.00651, df = 4; chi square is not significant.

THE VALUE OF TEST FOR HOMOGENEITY OF VARIANCE BY THE CHI SQUARE TEST (P.2 & P.3)

Group	n	n-1	$\frac{1}{n-1}$	$\sum D^2$	S^2	$\log S^2$	$(n-1)(\log S^2)$
P.2	11	10	0.10000	4.73	0.47300	$\bar{1}.67486$	$\bar{4}.74860$
P.3	25	24	0.04167	11.84	0.49333	$\bar{1}.69314$	$\bar{8}.63536$
		34		16.57			$\bar{11}.38396$

$$\frac{\sum \sum D^2}{\sum (n-1)} = \frac{16.57}{34} = 0.48735; \quad \log \frac{\sum \sum D^2}{\sum (n-1)} = \bar{1}.68785$$

$$\left[\sum (n-1) \right] \left[\log \frac{\sum \sum D^2}{\sum (n-1)} \right] = (34)(\bar{1}.68785) = \bar{11}.38690$$

$$\text{diff.} = \bar{11}.38690 - \bar{11}.38396 = 0.00294$$

$$\text{chi square} = (2.3026)(\text{diff.}) = (2.3026)(0.00294) = 0.006770$$

The chi square = 0.006770, df = 1; chi square is not significant.

THE VALUE OF THE CHI SQUARE TEST OF MEAN (P.2 and P.4)

	I.M.	fe	fo	fo - fe	¹ (fo - fe) ²	$\frac{(fo - fe)^2}{fe}$
P.2	3.5	0.611	1	0.389	0.151321	0.24766
	4.5	2.444	4	1.556	2.421136	0.99064
	5.5	6.722	6	-0.722	0.521284	0.07755
	6.5	1.222	0	-1.222	1.493284	1.22200
P.4	3.5	0.389	0	-0.389	0.151321	0.38900
	4.5	1.556	0	-1.556	2.421136	1.55600
	5.5	4.278	5	0.722	0.521284	0.12185
	6.5	0.778	2	1.222	1.493284	1.91939
						6.52409

The chi square = 6.52409, df = 3; chi square is not significant.

THE VALUE OF TEST FOR HOMOGENEITY OF VARIANCE BY THE CHI SQUARE TEST (P.2 & P.4)

Group	n	n-1	$\frac{1}{n-1}$	$\sum D^2$	S^2	$\log S^2$	$(n-1)(\log S^2)$
P.2	11	10	0.10000	4.73	0.47300	1.67486	4.74860
P.4	7	6	0.16667	1.43	0.23833	1.37719	4.26314
		16		6.16			7.01174

$$\frac{\sum \sum D^2}{\sum (n-1)} = \frac{6.16}{16} = 0.385; \quad \log \frac{\sum \sum D^2}{\sum (n-1)} = 1.58546$$

$$\left[\sum (n-1) \right] \left[\log \frac{\sum \sum D^2}{\sum (n-1)} \right] = (16)(1.58546) = 7.36736$$

$$\text{diff.} = 7.36736 - 7.01174 = 0.35562$$

$$\text{chi square} = (2.3026)(\text{diff.}) = (2.3026)(0.35562) = 0.81885$$

The chi square = 0.81885, df = 1; chi square is not significant.

THE VALUE OF THE CHI SQUARE TEST OF MEAN (P.3 and P.4)

	I.M.	fe	fo	fo - fe	$(fo - fe)^2$	$\frac{(fo - fe)^2}{fe}$
P.3	4.5	3.125	4	0.875	0.765625	0.24500
	5.5	16.406	16	0.406	0.164836	0.01005
	6.5	4.687	4	-0.687	0.471969	0.10070
	7.5	0.781	1	0.219	0.047961	0.06141
P.4	4.5	0.875	0	-0.875	0.765625	0.87600
	5.5	4.594	5	0.496	0.164836	0.03588
	6.5	1.313	2	0.687	0.471969	0.35946
	7.5	0.219	0	-0.219	0.047961	0.21900
						1.90650

The chi square = 1.90650, df = 3; chi square is not significant.

THE VALUE OF TEST FOR HOMOGENEITY OF VARIANCE BY THE CHI SQUARE TEST (P.3 & P.4)

Group	n	n-1	$\frac{1}{n-1}$	$\sum D^2$	S^2	$\log S^2$	$(n-1)(\log S^2)$
P.3	25	24	0.04167	11.84	0.49333	1.69314	8.63536
P.4	7	6	0.16667	1.43	0.23833	1.37719	4.26314
		30		13.27			12.89850

$$\frac{\sum \sum D^2}{\sum (n-1)} = \frac{13.27}{30} = 0.44233; \quad \log \frac{\sum \sum D^2}{\sum (n-1)} = 1.64574$$

$$\left(\sum (n-1) \right) \left(\log \frac{\sum \sum D^2}{\sum (n-1)} \right) = (30)(1.64574) = 11.37220$$

$$\text{diff.} = 11.37220 - 12.89850 = 0.47370$$

$$\text{chi square} = (2.3026)(\text{diff.}) = (2.3026)(0.47370) = 1.090742$$

The chi square = 1.090742, df = 1; chi square is not significant.

THE IMMEDIATE MEMORY FOR DIGITS OF CHILDREN IN AGE GROUP OF 10/0 - 10/11

I.M.	P.1	P.2	P.3	P.4	Total
4.5	1	2	4	1	8
5.5	1	2	5	14	22
6.5	-	-	3	3	6
7.5	-	-	-	2	2
N	2	4	12	20	38
$\sum X$	10.0	20.0	65.0	116.0	
$\frac{\sum X}{N}$	5.0	5.0	5.42	5.80	
$\sum X^2$	50.50	101.0	359.0	683.0	
$\sum D^2$	0.50	1.0	6.92	10.2	

THE VALUE OF THE CHI SQUARE TEST OF MEAN (P.2 and P.3)

	I.M.	fe	fo	fo - fe	$(fo - fe)^2$	$\frac{(fo - fe)^2}{fe}$
P.2	4.5	1.500	2	0.500	0.25000	0.16667
	5.5	1.750	2	0.250	0.06250	0.03571
	6.5	0.750	0	-0.750	0.56250	0.75000
P.3	4.5	4.500	4	-0.500	0.25000	0.05556
	5.5	5.250	5	-0.250	0.06250	0.01190
	6.5	2.250	3	0.750	0.56250	0.25000
						1.26984

The chi square = 1.26984, df = 2, chi square is not significant.

THE VALUE OF TEST FOR HOMOGENEITY OF VARIANCE BY THE CHI SQUARE TEST (P.2 & P.3)

Group	n	n-1	$\frac{1}{n-1}$	$\sum D^2$	s^2	$\log s^2$	$(n-1)(\log s^2)$
P.2	4	3	0.33333	1.00	0.33333	$\bar{1}.52277$	$\bar{2}.56831$
P.3	12	11	0.09091	6.92	0.62909	$\bar{1}.79871$	$\bar{3}.78581$
		14		7.92			$\bar{4}.35412$

$$\frac{\sum \sum D^2}{\sum (n-1)} = \frac{7.92}{14} = 0.56571; \quad \log \frac{\sum \sum D^2}{\sum (n-1)} = \bar{1}.75260$$

$$\left[\sum (n-1) \right] \left[\log \frac{\sum \sum D^2}{\sum (n-1)} \right] = (14)(\bar{1}.75260) = \bar{4}.53640$$

$$\text{diff.} = \bar{4}.53640 - \bar{4}.35412 = 0.18228$$

$$\text{chi square} = (2.3026)(\text{diff.}) = (2.3026)(0.18228) = 0.419718$$

The chi square = 0.419718, df = 1; chi square is not significant.

THE VALUE OF THE CHI SQUARE TEST OF MEAN (P.2 and P.4)

	I.M.	fe	fo	fo - fe	(fo - fe) ²	$\frac{(fo - fe)^2}{fe}$
P.2	4.5	0.500	2	1.500	2.250000	4.50000
	5.5	2.667	2	-0.667	0.444889	0.16681
	6.5	0.500	0	-0.500	0.250000	0.50000
	7.5	0.333	0	-0.333	0.110889	0.33300
P.4	4.5	2.500	1	-1.500	2.250000	0.90000
	5.5	13.333	14	0.667	0.444889	0.03337
	6.5	2.500	3	0.500	0.250000	0.10000
	7.5	1.667	2	0.333	0.110889	0.06652
						6.59970

The chi square = 6.59970, df = 3; chi square is not significant.

THE VALUE OF TEST FOR HOMOGENEITY OF VARIANCE BY THE CHI SQUARE TEST (P.2 & P.4)

Group	n	n-1	$\frac{1}{n-1}$	$\sum D^2$	S^2	$\log S^2$	$(n-1)(\log S^2)$
P.2	4	3	0.33333	1.00	0.33333	1.52277	2.5683
P.4	20	19	0.05363	10.20	0.53684	1.72984	7.86696
		22		11.20			7.43527

$$\frac{\sum \sum D^2}{\sum (n-1)} = \frac{10.20}{22} = 0.50909; \quad \log \frac{\sum \sum D^2}{\sum (n-1)} = 1.70680$$

$$\left[\sum (n-1) \right] \left[\log \frac{\sum \sum D^2}{\sum (n-1)} \right] = (22)(1.70680) = 7.54960$$

$$\text{diff.} = 7.54960 - 7.43527 = 0.11433$$

$$\text{chi square} = (2.3026)(\text{diff.}) = (2.3026)(0.11433) = 0.263256$$

The chi square = 0.263256, df = 1, chi square is not significant.

THE VALUE OF THE CHI SQUARE TEST OF MEAN (P.3 and P.4)

	I.M.	fe	fo	fo - fe	(fo - fe) ²	$\frac{(fo - fe)^2}{fe}$
P.3	4.5	1.875	4	2.125	4.515625	2.40833
	5.5	7.125	5	-2.125	4.515625	0.63377
	6.5	2.250	3	0.750	0.562500	0.25000
	7.5	0.750	0	-0.750	0.562500	0.75000
P.4	4.5	3.125	1	-2.125	4.515625	1.44500
	5.5	11.875	14	2.125	4.515625	0.38026
	6.5	3.750	3	-0.750	0.562500	0.15000
	7.5	1.250	2	0.750	0.562500	0.45000
						6.46736

The chi square = 6.46736, df = 3, chi square is not significant.

THE VALUE OF TEST FOR HOMOGENEITY OF VARIANCE BY THE CHI SQUARE TEST (P.3 & P.4)

Group	n	n-1	$\frac{1}{n-1}$	$\sum D^2$	s ²	log S ²	(n-1)(log S ²)
P.3	12	11	0.09091	6.92	0.62909	1.79871	3.78581
P.4	20	19	0.05363	10.20	0.53684	1.72984	7.86696
		30		17.12			8.65277

$$\frac{\sum \sum D^2}{\sum (n-1)} = \frac{17.12}{30} = 0.57067; \quad \log \frac{\sum \sum D^2}{\sum (n-1)} = 1.75639$$

$$\left[\sum (n-1) \right] \left[\log \frac{\sum \sum D^2}{\sum (n-1)} \right] = (30)(1.75639) = 8.69170$$

$$\text{diff.} = 8.69170 - 8.65277 = 0.03893$$

$$\text{chi square} = (2.3026)(\text{diff.}) = (2.3026)(0.03893) = 0.08964$$

The chi square = 0.08964, df = 1; chi square is not significant.

The average immediate memory for digits of the higher grade children is longer than that of the lower grade children of the same age, but the chi square test of mean is significant only in age group of 7/0-7/11. This reveals that the immediate memory for digits of the higher grade children is longer than that of the lower grade children of the same age; anyhow the difference is small. The variations of the immediate memory for digits of children of the same age are homogeneous.

3. 2.5 The immediate memory for digits of children whose school marks are high and those whose school marks are low

It should be recalled that the last purpose of this study is to find out whether the immediate memory for digits of children whose school marks are high is longer than that of those whose school marks are low.

TABLE 3. 2.5

IMMEDIATE MEMORY FOR DIGITS OF CHILDREN WHOSE SCHOOL MARKS ARE HIGH AND THOSE WHOSE SCHOOL MARKS ARE LOW OF VARYING GRADES

I.M.	P.1		P.2		P.3		P.4	
	U	L	U	L	U	L	U	L
3.5	-	4	-	1	-	-	-	-
4.5	3	6	5	3	2	3	-	-
5.5	6	-	3	6	5	7	4	10
6.5	1	-	2	-	3	-	6	-
N	10	10	10	10	10	10	10	10
ΣX	53.0	41.0	52.0	50.0	56.0	52.0	61.0	55.0
$\frac{\Sigma X}{N}$	5.30	4.10	5.20	5.00	5.60	5.20	6.10	5.50
ΣX^2	284.50	170.50	276.50	254.50	318.50	272.50	374.50	302.50
ΣD^2	3.60	2.40	6.10	4.50	4.90	2.10	2.40	0.0

U = Upper 75 percentile, L = Lower 25 percentile

From Table 3. 2.5, it reveals that the average immediate memory for digits of children whose school marks are high (upper 75 percentile) is longer than that of those whose school marks are low (lower 25 percentile) in all four grades. The chi square test of mean and the test for homogeneity of variance by the chi square test are determined to see whether the difference between the children whose school marks are high and those whose school marks are low is significant. The following table contains the total number of children whose school marks are high and those whose school marks are low.

TABLE 3. 2.5 (A)
TOTAL NUMBER OF CHILDREN WHOSE SCHOOL MARKS ARE HIGH AND THOSE WHOSE SCHOOL MARKS ARE LOW AND THEIR IMMEDIATE MEMORY FOR DIGITS

I.M.	U.	L.	Total
3.5	-	5	5
4.5	10	12	22
5.5	18	23	41
6.5	12	-	12
N	40	40	80
ΣX	222	198	
$\frac{\Sigma X}{N}$	5.55	4.95	
ΣX^2	1254	1000	
ΣD^2	21.9	19.9	

THE VALUE OF THE CHI SQUARE TEST OF MEAN

	I.M.	fe	fo	fo - fe	(fo - fe) ²	$\frac{(fo - fe)^2}{fe}$
U.	3.5	2.50	0	-2.50	6.2500	2.50000
	4.5	11.00	10	-1.00	1.0000	0.09091
	5.5	20.50	18	-2.50	6.2500	0.30488
	6.5	6.00	12	6.00	36.0000	6.00000
L.	3.5	2.50	5	2.50	6.2500	2.50000
	4.5	11.00	12	1.00	1.0000	0.09091
	5.5	20.50	23	2.50	6.2500	0.30488
	6.5	6.00	0	-6.00	36.0000	6.00000
						17.79158

The chi square = 17.79158, df = 3; chi square is significant.

THE VALUE OF TEST FOR HOMOGENEITY OF VARIANCE BY THE CHI SQUARE TEST

Group	n	df	$\sum D^2$	s^2	$\log s^2$
U.	40	39	21.9	0.56154	$\bar{1}.74939$
L.	40	39	19.9	0.51026	$\bar{1}.70779$
				1.07180	$\bar{1}.45718$

$$\frac{\sum s^2}{r} = \frac{1.07180}{2} = 0.53590; \quad \log \sum_r s^2 = \bar{1}.72908$$

$$r \left(\log \frac{\sum s^2}{r} \right) = (2)(\bar{1}.72908) = \bar{1}.45816$$

$$\text{diff.} = \bar{1}.45816 - \bar{1}.45718 = 0.00098$$

$$\text{chi square} = (2.3026)(\text{diff.}) = (2.3026)(0.00098) = 0.002257$$

The chi square = 0.002257, df = 1; chi square is not significant.

The chi square test of mean (chi square = 17.79158, df = 3) is significant, but the variances are homogeneous. This indicates that the immediate memory for digits of children whose school marks are high is longer than that of those whose school marks are low, but its variation is not different. The chi square test of mean in each grade is computed in order to find out whether the immediate memory for digits of the children whose school marks are high is longer than that of those whose school marks are low of the same grade.

THE IMMEDIATE MEMORY FOR DIGITS OF CHILDREN WHOSE SCHOOL MARKS ARE HIGH AND THOSE WHOSE SCHOOL MARKS ARE LOW IN P.1

I.M.	U.	L.	Total
3.5	-	4	4
4.5	3	6	9
5.5	6	-	6
6.5	1	-	1
N	10	10	20

THE VALUE OF THE CHI SQUARE TEST OF MEAN

I.M.	fe	fo	fo - fe	$(fo - fe)^2$	$\frac{(fo - fe)^2}{fe}$
U. 3.5	2.00	0	-2.00	4.0000	2.0000
4.5	4.50	3	-1.50	2.2500	0.5000
5.5	3.00	6	3.00	9.0000	3.0000
6.5	0.50	1	0.50	0.2500	0.5000
L. 3.5	2.00	4	2.00	4.0000	2.0000
4.5	4.50	6	1.50	2.2500	0.5000
5.5	3.00	0	-3.00	9.0000	3.0000
6.5	0.50	0	-0.50	0.2500	0.5000
					12.0000

The chi square = 12.00, df = 3; chi square is significant.

THE IMMEDIATE MEMORY FOR DIGITS OF CHILDREN WHOSE SCHOOL MARKS ARE HIGH
AND THOSE WHOSE SCHOOL MARKS ARE LOW IN P.2

I.M.	U.	L.	Total
3.5	-	1	1
4.5	5	3	8
5.5	3	6	9
6.5	2	-	2
N	10	10	20

THE VALUE OF THE CHI SQUARE TEST OF MEAN

	I.M.	fe	fo	fo - fe	$(fo - fe)^2$	$\frac{(fo - fe)^2}{fe}$
U.	3.5	0.5	0	-0.5	0.2500	0.50
	4.5	4.0	5	1.0	1.0000	0.25
	5.5	4.5	3	-1.5	2.2500	0.50
	6.5	1.0	2	1.0	1.0000	1.00
L.	3.5	0.5	1	0.5	0.2500	0.50
	4.5	4.0	3	-1.0	1.0000	0.25
	5.5	4.5	6	1.5	2.2500	0.50
	6.5	1.0	0	-1.0	1.0000	1.00
						4.50

The chi square = 4.50, df = 3; chi square is not significant.

THE IMMEDIATE MEMORY FOR DIGITS OF CHILDREN WHOSE SCHOOL MARKS ARE HIGH
AND THOSE WHOSE SCHOOL MARKS ARE LOW IN P.3

I.M.	U.	L.	Total
4.5	2	3	5
5.5	5	7	12
6.5	3	-	3
N	10	10	20

THE VALUE OF THE CHI SQUARE TEST OF MEAN

I.M.	fo	fo	fo - fe	$(fo - fe)^2$	$\frac{(fo - fe)^2}{fe}$
U. 4.5	2.5	2	-0.5	0.25	0.10000
5.5	6.0	5	-1.0	1.00	0.16667
6.5	1.5	3	1.5	2.25	1.50000
L. 4.5	2.5	3	0.5	0.25	0.10000
5.5	6.0	7	1.0	1.00	0.16667
6.5	1.5	0	-1.5	2.25	1.50000
					3.53334

The chi square = 3.53334, df = 2, chi square is not significant/

THE IMMEDIATE MEMORY FOR DIGITS OF CHILDREN WHOSE SCHOOL MARKS ARE HIGH
AND THOSE WHOSE SCHOOL MARKS ARE LOW IN P.4

I.M.	U.	L.	Total
5.5	4	10	14
6.5	6	-	6
N	10	10	20

THE VALUE OF THE CHI SQUARE TEST OF MEAN

I.M.	I.M.	fe	fo	fo - fe	(fo - fe) ²	$\frac{(fo - fe)^2}{fe}$
U.	5.5	7.0	4	-3.0	9.0000	1.28571
	6.5	3.0	6	3.0	9.0000	3.00000
L.	5.5	7.0	10	3.0	9.0000	1.28571
	6.5	3.0	0	-3.0	9.0000	3.00000
						8.57142

The chi square = 8.57142, df = 1; chisquare is significant.

The chi square test of mean is significant in Pratom one and Pratom four but not significant in Pratom two and Pratom three. This reveals that the immediate memory for digits of children whose school marks are high are longer than that of those whose school marks are low in Pratom one and Pratom four but the immediate memory for digits of children in other grades are not different. This can be explained that may be the writer obtained a small number of subjects.

3. 3 Summary:

The findings of this study can be summarized as follows:-

1. The immediate memory for digits of the lower grade children is short, but its variation is large; whereas the immediate memory for digits of the higher grade children is getting longer, but its variation is getting smaller. The increment of the immediate memory for digits is irregular.
2. The immediate memory for digits of the younger children is short, but its variation is large while that of the older children is getting longer but its variation is getting smaller. The immediate memory for digits is irregular increased according to the increase in age.
3. There is no difference of the immediate memory for digits between boys and girls of the same grade and/or age.
4. The immediate memory for digits of the higher grade children is longer than that of the lower grade children of the same age; anyhow the difference is small. The variations of the immediate memory for digits of children of the same age are homogeneous.
5. The immediate memory for digits of the children whose school marks are high (upper 75 percentile) is seemed to be longer than that of those whose school marks are low (lower 25 percentile). The differences are significant in the Pratom one and Pratom four but not significant in Pratom two and Pratom three.

CHAPTER IV

RECAPITULATION, CONCLUSIONS AND RECOMMENDATIONS

4. 1 Abstract of the background of the study:

The immediate memory is in the memory test. Western psychologists studied the immediate memory long ago. In studying the immediate memory they used many kinds of materials such as nonsense - syllables, series of digits, meaningful words. etc. They found that the immediate memory increases according to the increase in age. It can vary according to task, procedure and other conditions such as practice in memorizing. The immediate memory relates to intelligence and general ability of subject. There is no study concerning the immediate memory for Thai children. The writer, therefore, realizes that it will be of great value to study the immediate memory of Thai children. This present investigation is intended to study the immediate memory for digits of the pupils in five municipal schools in Nakorn Pathom.

4. 2 Restatement of the purposes:

The purposes of this study are to find out whether:-

1. The immediate memory for digits of the older children is longer than that of the younger children,
2. There is any difference in the immediate memory for digits between boys and girls,
3. The immediate memory for digits of the higher grade children is longer than that of the lower grade children of the same age, and

4. The immediate memory for digits of children whose school marks are high is longer than that of those whose school marks are low.

4. 3 Abstract of the methods and techniques;

4. 3.1 Sample. A total number of two hundred pupils are randomly selected for this investigation. There are five schools and each of which has four grades. The number of classes selected is twenty. The pupils in each selected class were divided into three groups; the upper 75 percentile group, the 25 - 75 percentile group and the lower 25 percentile group, according to their marks in the first term examination. Only ten pupils in each selected class were chosen by drawing lots; two pupils from the upper 75 percentile group, six pupils from the 25 - 75 percentile group and the other two pupils from the lower 25 percentile group. The subjects' ages were counted from their birth date to the date of testing, and the writer raised the fifteen days and more than that to be one month.

4. 3.2 Materials. Digit - series were used in this study. They are:-

972

1406

39418

067285

2516927

58391204

764580129

2164689573

45382170369

870932614280

4. 3.3 Procedure. The writer has at hand the digit - series and gives the following instruction "I am going to say some numbers. When I finished, you are supposed to repeat the numbers in the same order". The writer read the first series. When the subject recalled the numbers correctly, the writer gave him the longer one. Each interval between digits in the series was one second.

4. 3.4 Methods of analysis. If the subject repeated the digit - series correctly up to the 5 - digit - series, his immediate memory for digits is 5.5, because his immediate memory is at least 5 but not quite 6. The chi square test of mean and the test for homogeneity of variance by the chi square test were used in order to find out whether the difference of the immediate memory and the variation of the immediate memory are significant or not.

4. 4 Summary of the findings and conclusions:

The findings of this study can be summarized as follows:-

1. The immediate memory for digits of the younger children is short, but its variation is large; whereas the immediate memory for digits of the older children is getting longer, but its variation is getting smaller.
2. The immediate memory for digits of boys and girls in the same grade and/or age are not different.
3. The immediate memory for digits of the higher grade children seems to be longer than that of the lower grade children of the same age.

4. The immediate memory for digits of the children whose school marks are high is longer than that of those whose school marks are low.

4. 5 Recommendations:

This study suggests any further study that uses a larger sample. It may be more useful if there are more subjects in order that it might represent the children all over Thailand. Another recommendation is to study the immediate memory for digits of children who are in higher grades. Besides, the writer suggests other types of materials should be tried in studying the difference of the immediate memory in the different types of tasks.

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APPENDIX A: THE PROCEDURE IN THAI VERSION

ผู้ทดสอบถือกระดาษที่เขียนตัวเลขเป็นอนุกรมไว้แล้วบอกกับผู้ถูกทดสอบว่า "ครูจะอ่านตัวเลขให้หนูฟัง เมื่อครูอ่านจบแล้ว ครูจะให้หนูพูดตาม หนูก็พูดเหมือนอย่างทีครูอ่านให้ฟัง สมมติว่า ครูอ่าน ๑..... ๓ พอครูบอกให้พูด หนูก็พูดว่า ๑,๒,๓, เข้าใจไหม เอาละ คอยฟังให้ดีนะว่าตัวเลขทีครูจะอ่านให้หนูฟังนี้มีอะไรบ้าง เมื่อครูบอกให้พูดตาม หนูคอยพูดนะ คอยฟัง"

ผู้ทดสอบเริ่มต้นอ่านตัวเลขในอนุกรมที่สั้นที่สุดก่อน เว้นระยะระหว่างตัวเลขในอนุกรมตัวเลข ๑ วินาที เมื่อผู้ถูกทดสอบตอบถูกโดยเรียงลำดับได้ถูกต้อง ผู้ทดสอบพูดว่า "ต่อไปนะ ครูบอกให้พูด หนูคอยพูดนะ คอยฟัง" ผู้ทดสอบอ่านตัวเลขในอนุกรมที่ยาวขึ้น ทำดังนี้เรื่อยไป จนผู้ถูกทดสอบตอบผิด เมื่อผู้ถูกทดสอบตอบผิดในอนุกรมใด ผู้ทดสอบอ่านอนุกรมอื่นที่มีตัวเลขเท่า ๆ กับอนุกรมที่ผู้ถูกทดสอบตอบผิดให้ผู้ถูกทดสอบตอบอีกครั้งหนึ่ง เพื่อเป็นการตรวจว่า ผู้ถูกทดสอบตอบอนุกรมที่ยาวเท่านั้นไม่ได้จริง ๆ

APPENDIX B: THE IMMEDIATE MEMORY FOR DIGITS OF THE PRATOM ONE CHILDREN

Subject	Age	Group	I.M.
G	10/10	Upper 75 percentile	5.5
B	8/2	"	5.5
B	10/10	"	4.5
B	7/6	"	5.5
G	7/3	"	4.5
B	7/0	"	5.5
G	7/2	"	4.5
B	7/9	"	6.5
G	7/11	"	5.5
G	7/9	"	5.5
G	7/2	25 - 75 percentile	5.5
B	6/9	"	4.5
G	7/2	"	5.5
G	7/8	"	5.5
B	7/1	"	4.5
G	7/2	"	4.5
B	7/9	"	4.5
B	8/8	"	5.5
B	7/9	"	5.5
C	7/0	"	5.5
G	7/11	"	3.5
G	8/4	"	4.5
G	7/4	"	4.5
G	6/11	"	4.5
B	6/11	"	4.5

Subject	Age	Group	I.M.
B	7/4	25 - 75 percentile	4.5
B	7/3	"	3.5
B	8/11	"	3.5
G	9/10	"	4.5
B	7/9	"	4.5
B	7/9	"	3.5
B	7/4	"	5.5
G	8/7	"	4.5
B	8/7	"	5.5
B	7/8	"	4.5
G	7/10	"	4.5
B	9/1	"	4.5
B	7/2	"	3.5
G	6/11	"	3.5
G	7/3	"	3.5
B	6/11	Lower 25 percentile	4.5
G	7/4	"	4.5
G	6/10	"	3.5
B	7/3	"	4.5
B	7/7	"	3.5
G	7/2	"	3.5
G	7/2	"	3.5
G	7/8	"	4.5
G	8/5	"	4.5
B	7/7	"	3.5

APPENDIX C: THE IMMEDIATE MEMORY FOR DIGITS OF THE PRATOM TWO CHILDREN

Subject	Age	Group	I.M.
G	7/1	Upper 75 percentile	4.5
G	7/5	"	6.5
B	10/4	"	4.5
G	9/4	"	4.5
G	11/6	"	5.5
B	9/4	"	4.5
B	7/2	"	5.5
B	8/3	"	4.5
G	8/5	"	6.5
B	8/9	"	5.5
G	7/1	25 - 75 percentile	6.5
B	7/5	"	5.5
G	6/10	"	5.5
B	7/8	"	5.5
B	7/2	"	6.5
B	6/11	"	5.5
G	9/0	"	5.5
B	8/5	"	4.5
B	8/4	"	5.5
B	8/9	"	5.5
B	7/10	"	3.5
G	8/10	"	4.5
B	10/6	"	4.5
B	8/4	"	5.5
G	8/6	"	4.5

Subject	Age	Group	I.M.
G	8/5	25 - 75 percentile	6.5
G	8/7	"	5.5
G	8/9	"	4.5
B	8/10	"	5.5
G	10/11	"	5.5
B	8/4	"	5.5
G	8/2	"	5.5
G	8/2	"	5.5
B	9/10	"	5.5
B	7/1	"	5.5
B	9/2	"	5.5
G	9/5	"	5.5
G	8/8	"	5.5
G	8/3	"	5.5
B	9/0	"	5.5
B	7/7	Lower 25 percentile	4.5
G	7/9	"	5.5
B	9/4	"	4.5
G	8/8	"	5.5
B	8/0	"	5.5
G	10/0	"	5.5
G	9/0	"	4.5
G	9/2	"	5.5
B	8/5	"	5.5
G	9/0	"	3.5

APPENDIX D: THE IMMEDIATE MEMORY FOR DIGITS OF THE PRATOM THREE CHILDREN

Subject	Age	Group	I.M.
B	9/3	Upper 75 percentile	5.5
B	9/5	"	4.5
B	8/11	"	5.5
G	9/6	"	5.5
B	9/3	"	6.5
B	9/10	"	6.5
G	9/6	"	5.5
B	10/1	"	6.5
B	9/4	"	5.5
B	8/5	"	4.5
G	8/8	25 - 75 percentile	5.5
B	10/10	"	6.5
B	8/10	"	5.5
B	10/2	"	4.5
B	11/3	"	5.5
G	9/3	"	5.5
G	9/3	"	6.5
G	9/6	"	4.5
G	9/8	"	5.5
B	8/10	"	6.5
G	10/4	"	4.5
B	9/10	"	5.5
B	9/1	"	7.5
B	10/11	"	6.5
B	9/10	"	5.5

Subject	Age	Group	I.M.
G	9/5	25 - 75 percentile	5.5
G	10/1	"	4.5
G	9/2	"	5.5
G	8/11	"	5.5
B	9/5	"	5.5
B	8/2	"	6.5
G	8/5	"	6.5
G	9/7	"	4.5
B	10/4	"	5.5
G	9/8	"	5.5
G	10/1	"	5.5
B	9/3	"	5.5
G	9/8	"	5.5
B	9/10	"	6.5
G	9/4	"	5.5
B	8/3	Lower 25 percentile	5.5
G	11/1	"	4.5
G	8/10	"	5.5
B	9/8	"	5.5
B	15/5	"	5.5
B	10/11	"	5.5
G	10/3	"	5.5
G	9/9	"	4.5
B	10/1	"	5.5
B	10/5	"	4.5

APPENDIX E: THE IMMEDIATE MEMORY FOR DIGITS OF THE PRATOM FOUR CHILDREN

Subject	Age	Group	I.M.
G	12/9	Upper 75 percentile	5.5
G	10/5	"	6.5
G	10/1	"	5.5
B	9/10	"	6.5
B	12/4	"	5.5
G	12/4	"	6.5
G	11/0	"	6.5
G	10/1	"	6.5
B	9/6	"	6.5
B	12/7	"	5.5
B	12/0	25 - 75 percentile	5.5
B	10/8	"	6.5
B	9/11	"	5.5
G	9/7	"	5.5
G	10/5	"	7.5
B	10/10	"	5.5
G	10/0	"	5.5
G	9/3	"	5.5
G	11/9	"	5.5
B	9/10	"	5.5
G	10/0	"	5.5
G	10/10	"	5.5
B	10/11	"	4.5
B	11/4	"	5.5
B	11/5	"	5.5

Subject	Age	Group	I.M.
B	11/5	25 - 75 percentile	5.5
G	11/4	"	5.5
G	11/7	"	5.5
G	10/8	"	5.5
B	11/0	"	6.5
B	11/1	"	5.5
G	10/0	"	6.5
B	10/5	"	7.5
G	13/11	"	5.5
G	9/11	"	5.5
B	10/8	"	5.5
G	11/5	"	5.5
B	11/0	"	5.5
G	11/0	"	5.5
B	10/10	"	5.5
G	10/3	Lower 25 percentile	5.5
G	10/0	"	5.5
B	11/6	"	5.5
B	10/9	"	5.5
B	13/9	"	5.5
G	13/5	"	5.5
B	11/9	"	5.5
B	10/11	"	5.5
B	10/3	"	5.5
G	10/7	"	5.5

APPENDIX F: THE CONCLUSIONS IN THAI VERSION

คำถาม นักจิตวิทยาชาวตะวันตกได้ศึกษากันถึงเรื่อง *immediate memory*
 เป็นเวลานานมาแล้ว นักจิตวิทยาเหล่านั้นได้ใช้แบบทดสอบหลายอย่างเป็น
 เครื่องมือในการศึกษาเรื่องนี้ เป็นตัวว่า *nonsense - syllables, series*
of digits และ *meaningful words* เขาได้พบว่า *immediate mem*
memory ของเด็กนั้นเพิ่มขึ้นตามอายุ *immediate memory* ของเด็ก
 โตจะยาวกว่าของเด็กเล็กนอกจากนั้น *immediate memory* ยังสามารถ
 เปลี่ยนแปรไปตามขอบข่ายในการทดสอบและลักษณะอื่น ๆ ที่เกี่ยวข้องกับการ
 ทดสอบนี้ เช่น การฝึกให้เด็กหัดจำก่อนที่จะทำการทดสอบจริง ๆ *immediate*
memory เกี่ยวพันกับเชาวน์ปัญญาและความสามารถทั่วไปของเด็กด้วย สิ่ง
 ต่าง ๆ ที่กล่าวมานี้เป็นสิ่งที่นักจิตวิทยาชาวตะวันตกได้ค้นพบมาแล้ว แต่เป็น
 การค้นคว้ากับเด็กทางตะวันตกเท่านั้น ส่วนเด็กไทยนั้นยังไม่ได้มีการค้นคว้าที่
 เกี่ยวข้องกับเรื่อง *immediate memory* เลย ผู้เขียนจึงเกิดความสนใจ
 ในอันที่จะศึกษาเรื่องนี้ของเด็กไทย การศึกษาเรื่อง *immediate memory*
 ของเด็กไทยนี้ผู้เขียนตั้งใจจะศึกษาแต่เพียง *immediate memory for digits*
 เท่านั้น และเป็น *immediate memory for digits* ของเด็กนักเรียนชั้น
 ประถมในโรงเรียนเทศบาลในจังหวัดนครปฐม
จุดมุ่งหมาย จุดมุ่งหมายในการศึกษาเรื่องนี้ ผู้เขียนต้องการจะศึกษาว่า
 ๑. *immediate memory for digits* ของเด็กโตจะยาวกว่า
 ของเด็กเล็กหรือไม่ เพียงไร
 ๒. *immediate memory for digits* ของเด็กชายและเด็กหญิง
 จะแตกต่างกันหรือไม่
 ๓. *immediate memory for digits* ของนักเรียนชั้นสูงกว่าจะ
 ยาวกว่าของนักเรียนชั้นต่ำกว่าที่มีอายุเท่า ๆ กันหรือไม่ และ
 ๔. *immediate memory for digits* ของนักเรียนที่เรียนดีจะยาว
 กว่าของนักเรียนที่เรียนอ่อนหรือไม่
 หมายเหตุ

๑. *immediate memory for digits* ในที่นี้หมายความว่า จำ
นวนตัวเลขในอนุกรมที่เด็กสามารถจำได้ภายหลังการได้ยินเพียงครั้งเดียว

๒. นักเรียนที่เรียนดี หมายความว่า นักเรียนที่คะแนนในการสอบ
ประจำเทอมแรกอยู่ในพวกสูงกว่า ๗๕ เปอร์เซนต์

๓. นักเรียนที่เรียนอ่อน หมายความว่า นักเรียนที่คะแนนในการ
สอบประจำเทอมแรกอยู่ในพวกต่ำกว่า ๒๕ เปอร์เซนต์

กลุ่มตัวอย่าง นักเรียนชั้นประถมศึกษาปีที่ ๑ ถึงชั้นประถมศึกษาปีที่ ๕ ในโรงเรียน
เทศบาลทั้ง ๕ โรงเรียนในจังหวัดนครปฐมมีรวมกันประมาณ ๒๕๕๑ คน
ผู้เขียนต้องการกลุ่มตัวอย่างขนาด ๓๐๐ คนเท่านั้น จึงได้เลือกกลุ่มตัวอย่าง
ด้วยวิธีการดังนี้

ในแต่ละชั้นของแต่ละโรงเรียน จับฉลากเอาเพียงห้องเดียว จำนวน
ห้องที่จับฉลากได้ ๒๐ ห้อง ในแต่ละห้องที่จับฉลากมาได้นี้ แบ่งนักเรียน
ออกเป็น ๓ พวกตามคะแนนของการสอบประจำเทอมแรก ได้แก่ พวก
สูงกว่า ๗๕ เปอร์เซนต์ พวก ๒๕ เปอร์เซนต์ ถึง ๗๕ เปอร์เซนต์
และพวกต่ำกว่า ๒๕ เปอร์เซนต์ จากนั้น เลือกกลุ่มตัวอย่างเพียงห้องละ
๑๐ คน คือ ๒ คน จากพวกสูงกว่า ๗๕ เปอร์เซนต์ ๖ คน จากพวก
๒๕ เปอร์เซนต์ ถึง ๗๕ เปอร์เซนต์ และอีก ๒ คน จากพวกต่ำกว่า
๒๕ เปอร์เซนต์ ดังนั้นจำนวนตัวอย่างในกลุ่มตัวอย่างจึงเป็น ๒๐๐ คน
สำหรับอายุของนักเรียนนั้น คิดตั้งแต่วันเกิดจนถึงวันที่ทำการทดสอบ เช่น
ของวันตั้งแต่ ๑๕ วันขึ้นไป นับเป็น ๑ เดือน

เครื่องมือ อนุกรมตัวเลข เป็นเครื่องมือในการทดสอบเด็กกลุ่มนี้

ขบวนการในการทดสอบ ขบวนการในการทดสอบได้อธิบายไว้โดยละเอียด
ใน APPENDIX A แล้ว

วิธีวิเคราะห์ข้อมูล สมมติว่าผู้ถูกทดสอบสามารถตอบตัวเลขในอนุกรมที่ผู้ทดสอบ
อ่านให้ฟังได้ถูกต้องเรื่อยไป จนถึงอนุกรมที่มีตัวเลข ๖ ตัวจึงตอบไม่ถูก

immediate memory for digits ของเขาเป็น ๕.๕ ทั้งนี้เพราะว่า *immediate*
memory for digits ของเขานั้น อย่างน้อยที่สุดเป็น ๕ แต่ยังไม่ถึง ๖

สรุปผลที่ได้

๑. immediate memory for digits ของเด็กโตยาวกว่าของเด็กเล็ก
๒. immediate memory for digits ของเด็กชายและเด็กหญิงไม่แตกต่างกัน
๓. immediate memory for digits ของนักเรียนชั้นสูงกว่ายาวกว่าของนักเรียนชั้นต่ำกว่าที่มีอายุเท่า ๆ กัน แต่ความแตกต่างไม่มีนัยสำคัญทางสถิติ
๔. immediate memory for digits ของนักเรียนที่เรียนคียาวกว่าของนักเรียนที่เรียนนอก

Recommendations

การศึกษาในเรื่องนี้เป็นผลแสดงให้เห็นว่า ในการค้นคว้าต่อไป ควรจะเลือกกลุ่มตัวอย่างให้มีจำนวนมากกกว่านี้ ผู้เขียนหวังว่าคงจะมีผู้สนใจศึกษาค้นคว้าเรื่อง immediate memory for digits ของเด็กไทยเพิ่มเติมไปจากที่ผู้เขียนได้ทำไว้แล้ว และศึกษาอย่างกว้างขวางจนสามารถใช้เป็นประโยชน์ได้กับเด็กไทยโดยทั่วไป อีกสิ่งหนึ่งที่ผู้เขียนต้องการให้มีการค้นคว้าเพิ่มเติมก็คือ การศึกษาเรื่อง immediate memory ของเด็กไทยโดยใช้แบบทดสอบต่างชนิดออกไป เพื่อเป็นการศึกษา immediate memory ในแบบทดสอบที่ต่างชนิดกัน