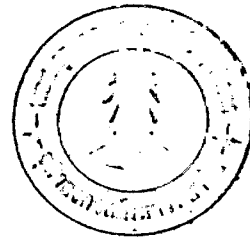


Chapter III

Results



The results of the research study are presented in the following order. First the calculations and comparison for central memory task are presented. Then the calculations and comparison for incidental memory task are presented. Lastly a comparison is made of the relationship between central and incidental memory performance.

Central Memory Scores. Performance on the central memory test was assessed for two sets of scores: total number of correct responses and number of correct responses for each serial position. Mean, standard deviation and proportion correct on the central memory task for each age group were computed from the total number of correct responses. The results of the comparison are presented in Table II.

Insert Table II

Figure 1. is a chart of the proportion of correct responses on central memory scores by age groups.

Table II Mean, S.D. and Proportion Correct on Central Memory Scores by Age Groups, and by sex

	Age 4 - 5			Age 7 - 8			Age 10 - 11			Age 14 - 15			Age 20 - 21		
	male	female	Total	male	female	Total	male	female	Total	male	female	Total	male	female	Toaal
\bar{X}	5.10	5.10	5.10	5.10	4.90	5.00	6.60	6.50	6.55	7.50	7.60	7.75	9.40	10.10	9.75
S.D.	0.74	1.79	1.33	1.19	0.87	0.23	1.64	1.71	1.63	1.66	2.71	2.72	2.58	1.52	2.10
Proportion Correct	0.36	0.36	0.36	0.36	0.35	0.35	0.47	0.46	0.47	0.56	0.54	0.55	0.67	0.72	0.69

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Figure 1
Central Task Recall over Age (Sum over Serial Position)

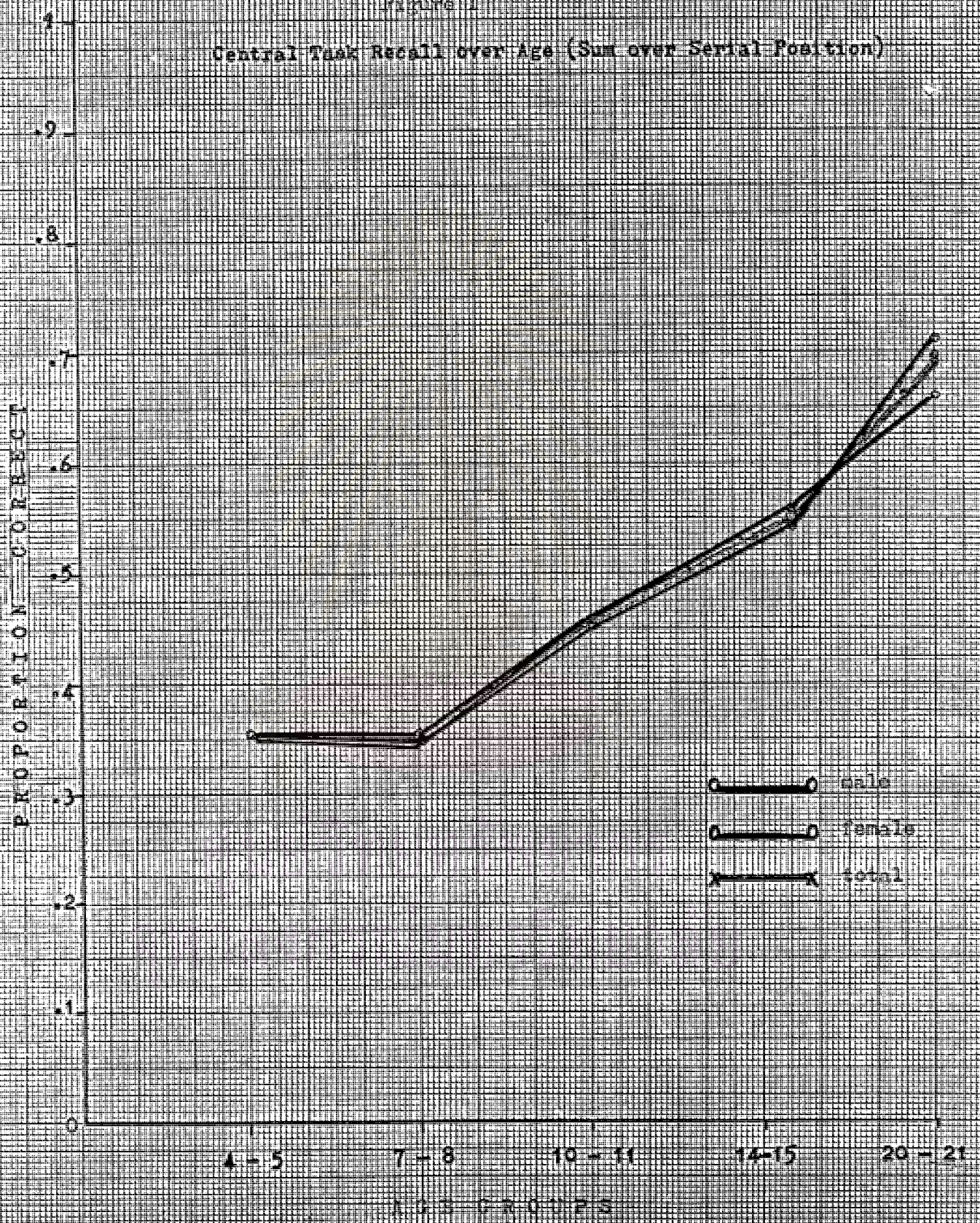


Figure 1. indicates that proportion of correct responses on central memory generally increases as a function of age.

Mean, standard deviation and proportion of correct responses on central memory scores for each serial position were computed. The results are presented in Table III.

Insert Table III

A chart of the proportion of correct responses of central task scores for each serial position is presented in Figure 2.

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Table III Mean, Standard Deviation and Proportion of Correct Responses on Central-Memory Scores for Each Serial Position.

Serial Position	Age 4 - 5			Age 7 - 8			Age 10 - 11			Age 14 - 15			Age 20 - 21			Total		
	\bar{X}	S.D.	Proportion Correct	\bar{X}	S.D.	Proportion Correct	\bar{X}	S.D.	Proportion Correct	\bar{X}	S.D.	Proportion Correct	\bar{X}	S.D.	Proportion Correct	\bar{X}	S.D.	Proportion Correct
1	0	0	0	0.10	0.30	0.05	0.85	0.90	0.43	0.80	0.76	0.40	1.10	0.71	0.55	0.57	0.76	0.29
2	0.30	0.56	0.15	0.15	0.44	0.08	0.70	0.87	0.35	1.10	0.74	0.58	1.50	0.23	0.75	0.76	0.82	0.38
3	0.40	0.60	0.20	0.15	0.44	0.08	0.45	0.60	0.23	0.55	0.60	0.28	1.05	0.65	0.63	0.52	0.64	0.26
4	0.80	0.80	0.40	0.50	0.68	0.25	0.60	0.70	0.30	0.40	0.50	0.20	1.20	0.68	0.60	0.70	0.70	0.35
5	0.50	0.50	0.25	0.55	0.60	0.28	0.85	0.81	0.43	1.20	0.75	0.60	1.05	0.68	0.53	0.83	0.73	0.42
6	1.15	0.81	0.56	1.60	0.71	0.80	1.45	0.75	0.73	1.70	0.56	0.85	1.90	0.30	0.95	1.56	0.69	0.78
7	1.95	0.22	0.98	1.95	0.22	0.98	1.65	0.58	0.83	1.95	0.22	0.98	1.85	0.22	0.98	1.89	0.35	0.95

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Figure 11

Central-Task Scores by Serial Positions
(as Different Age)

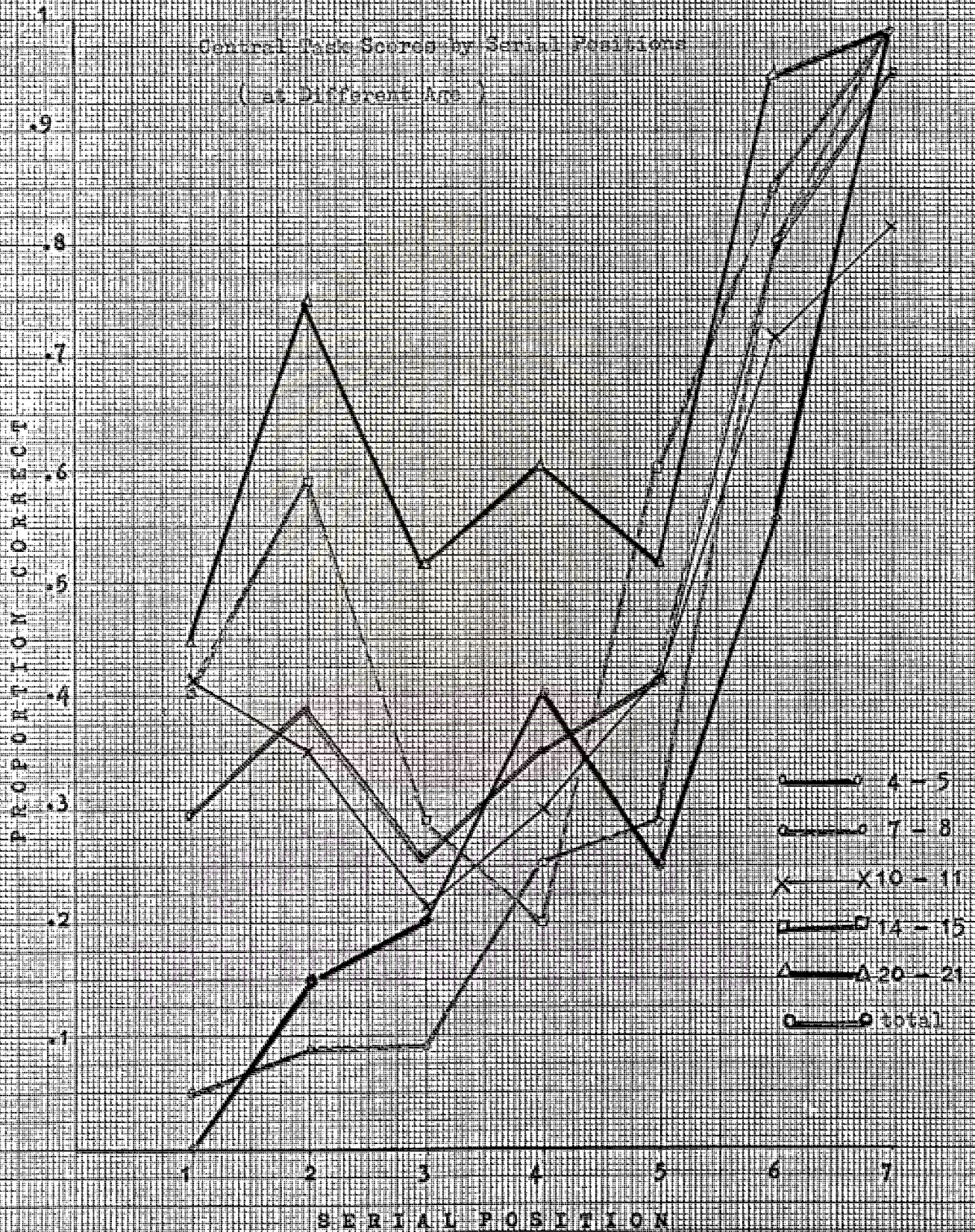


Figure 2, clearly indicates that the highest performance of each age group was in the last position, that is for the recency position.

A two way analysis of variance was computed on central memory scores at each position in all age groups by defining the variation in row as a function of serial positions and the variation in column as a function of age groups. The results are presented in Table IV.

Table IV A Two Way Analysis of Variance between Age and Serial Position on Central Memory Scores.

Source of Variation	SS	df	MS	F
Between Subjects	85.16	99	0.86	
A (Age groups)	49.12	4	11.28	
Subject within group	40.04	95	0.42	26.77*
Within Subject	407.43	600	0.68	
B (Serial Position)	169.34	6	28.22	15.59*
A x B	31.78	24	1.32	3.66*
B Subject within group	206.31	570	0.362	

* $p < .01$

The results on Table IV showed that there were significant differences both by age level ($F = 26.76$, $p < .01$) and serial position ($F = 15.59$, $p < .01$). There were statistically significant differences between the interaction of age groups and serial position ($F = 3.66$, $p < .01$).

T test comparison were made among age groups on total central memory scores to compare the performance between the age groups. The results are presented in Table V.

Table V T test Comparison among Age Groups on Central Memory Scores

Age Groups	4-5 $\bar{X}=5.1$	7-8 $\bar{X}=5.0$	10-11 $\bar{X}=6.55$	14-15 $\bar{X}=7.75$	20-21 $\bar{X}=9.75$
4 - 5	-	0.11	3.09*	3.95*	8.45*
7 - 8	-	-	4.30*	4.50*	10.10*
10 - 11	-	-	-	1.66	5.42*
14 - 15	-	-	-	-	2.63
20 - 21	-	-	-	-	-

* $p < .01$

The results indicated that performance of central task at age 20 - 21 was significantly different from the performance of central task of age 10 - 11 ($t = 5.42$, $p < .01$), age 7 - 8 ($t = 10.01$, $p < .01$), age 4 - 5 ($t = 8.45$, $p < .01$). The performance of central task at age 14 - 15 was significantly different from the performance of central task of age 7 - 8 ($t = 4.50$, $p < .01$) and at age 4 - 5 ($t = 3.95$, $p < .01$). And the performance of central task at age 10 - 11 was significantly different from the performance of central task at age 7 - 8 ($t = 4.30$, $p < .01$) and at age 4 - 5 ($t = 3.09$, $p < .01$), but there were no statistically significant differences between age groups 7 - 8 and 4 - 5, between age groups 10 - 11 and 14 - 15, and between age groups 20 - 21 and 14 - 15 on the central memory performance.

One way analysis of variance was performed in order to examine the differences in serial position performance within each age group. The results are presented in Table VI for age 4 - 5, Table VII for age 7 - 8, Table VIII for age 10 - 11, Table IX for age 14 - 15 and Table X for age 20 - 21.

Table VI Analysis of Variance on Serial Position
Performance for Central Memory Scores at
age 4 - 5.

Source of Variation	SS	df	MS	F
Between People	4.82	19	0.25	
Within People	84.85	120	0.76	
Treatment	50.98	6	8.49	28.60*
Residual	33.87	114	0.27	
Total	89.68	139	0.64	

* $p < .01$

The results showed that there were significant differences among the serial positions for central memory scores for the 4 - 5 years age group ($F = 28.60$, $p < .01$)

Table VII Analysis of Variance on Serial Position Performance for Central Memory Scores at age 7 - 8.

Source of Variation	SS	df	MS	F
Between People	2.87	19	0.15	
Within People	101.71	120	0.25	
Treatment	67.97	6	11.33	38.27*
Residual	33.74	114	0.30	
Total	104.57	139	0.75	

* $p < .01$

The results showed that there were significant difference among the serial positions for central memory scores for 7 - 8 year age group ($F = 38.28$, $p < .01$).

Table VIII Analysis of Variance on Serial Position Performance for Central Memory Scores Age 10 - 11.

Source of Variation	SS	df	MS	F
Between People	7.28	19	0.38	
Within People	91.14	120	7.59	
Treatment	23.87	6	3.98	6.74*
Residual	67.27	114	0.59	
Total	98.42	139	0.71	

* $p < .01$

The results showed that there were significant differences among the serial position for central memory scores for 10 - 11 year age group ($F = 6.75, p < .01$).

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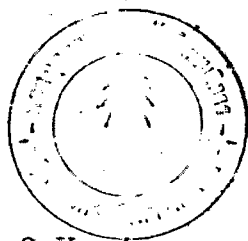


Table IX Analysis of Variance on Serial Position Performance for Central Memory Scores at Age 14 - 15.

Source of Variation	SS	df	MS	F
Between People	13.11	19	0.69	
Within People	78.28	120	0.65	
Treatment	39.54	6	6.59	19.57*
Residual	38.39	114	0.34	
Total	91.39	139	0.66	

* $p < .01$

The results showed that there were significant differences among the serial positions for central memory scores for 14 - 15 year age group ($F = 19.57$, $p < .01$).

Table X Analysis of Variance on Serial Position Performance for Central Memory Scores at Age 20 - 21.

Source of Variation	SS	df	MS	F
Between People	11.96	19	0.63	
Within People	51.43	120	0.43	
Treatment	18.74	6	3.12	10.89*
Residual	32.68	114	0.29	
Total	164.61	139	1.18	

* $p < .01$

The results showed that there were significant differences among the serial positions for central memory scores for 20 - 21 year age group ($F = 10.89$, $p < .01$).

T tests were performed to find out differences on central memory scores between males and females in each age group. The results are presented in Table XI.

Table XI T Test Comparison between Males and Females on Central Memory Scores.

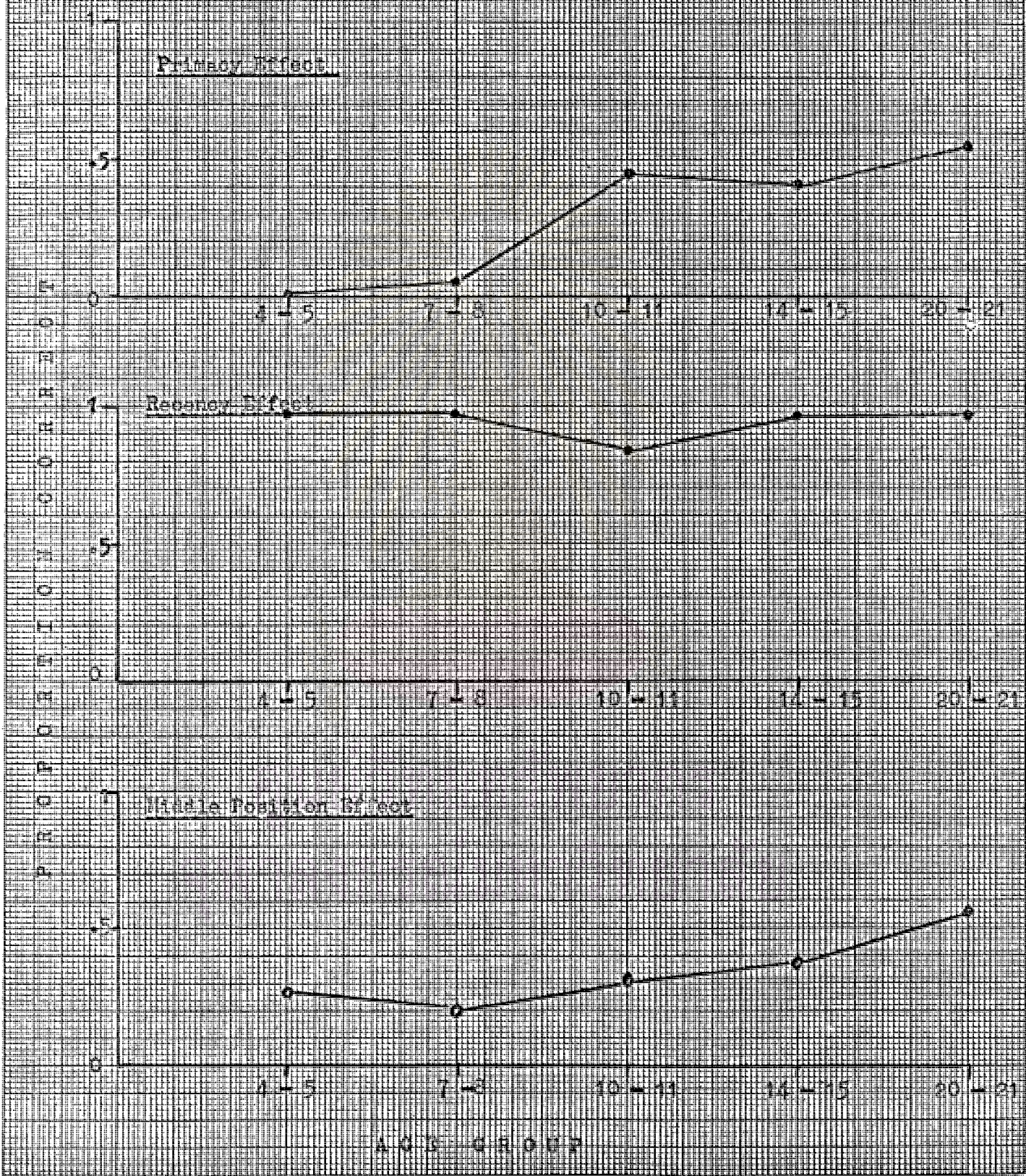
Age	\bar{X} of males	\bar{X} of females	t
4 - 5	5.10	5.10	0
7 - 8	5.10	4.90	0.99
10 - 11	6.60	6.50	0.39
14 - 15	7.90	7.60	0.09
20 - 21	9.40	10.10	0.71

The results showed that there were no statistically significant differences between male and female subjects at any age level.

Central memory scores on seven serial positions were combined in the three groups, primacy, middle-position and recency. The primacy effect was represented by the first position scores; the recency effect was represented by the last position; and the middle-position effect was represented by the average of the scores on position 3, 4 and 5. Proportion correct on primacy, recency and middle-position are presented in Figure 3.

Figure 11A

Primacy, Recency, and Middle Position Scores by Age



In Figure 3, the top panel shows the primacy effect; the middle panel shows the recency effect; and the last panel shows the middle-position effect.

Figure 3 showed that the first position scores and the middle-position scores increased with age but the last position scores were almost constant.

Three one way analysis of variance tests were performed to compare separately the primacy, the recency and middle-position effects among age groups. The results are presented in Table XII for primacy effect, Table XIII for recency effect and Table XIV for middle-position effect.

Table XII Analysis of Variance for the Central Memory Performance of the Primacy Effect among the five Age Groups.

Source of Variation	SS	df	MS	F
Between Groups	19.16	4	4.79	12.18*
Within Groups	37.35	95	0.39	
Total	56.51	99	0.57	

* $p < .01$

The results showed that there were statistically significant differences among the age groups for primacy effect ($F = 12.18, p < .01$)

Thable XIII Analysis of Variance of Recency Effect for the Central Memory Performance among the five age groups.

Source of Variation	SS	df	MS	F
Between Groups	1.44	4	0.36	3.26
Within Groups	10.50	95	0.11	
Total	11.79	99	0.12	

The results of analysis of the recency effect showed that there were no statistically significant differences among the age groups.

Table XIV Analysis of Variance of middle-position effect for the Central memory Performance among the five age groups.

Source of Variation	SS	df	MS	F
Between Groups	48.80	4	12.20	9.21*
Within Groups	125.95	95	1.33	
Total	174.75	99	1.77	

* $p < .01$

The results showed that there were statistically significant differences among the age groups for middle-position effect ($F = 9.21, p < .01$).

T test comparison were made to investigate differences in memory performance as a function of the position of the stimuli, that is between primacy and recency effect, between primacy and middle-position effect and between recency and middle-position effect for central memory scores. The results are presented in Table XV.

Table XV T Test Comparisons between the Different Serial Position for Central Memory Scores.

Serial Position	Primacy	Recency	Middle-Position
Primacy	-	15.90*	1.01
Recency	-	-	15.50*
Middle-Position	-	-	-

* $p < .01$

The results showed that recency effect performance was significantly different from primacy effect performance ($t = 15.90$, $p < .01$) and middle-position performance ($t = 15.50$, $p < .01$). But there was no statistically significant differences between the primacy effect and middle-position effect for all age groups.

Incidental Memory Scores Performance on the incidental memory scored was the number of correct pairing of animals and objects recalled following completion of the central memory scores. Mean, standard deviation and proportion correct on central memory scores for each age groups were computed. The results are presented in Table XVI.

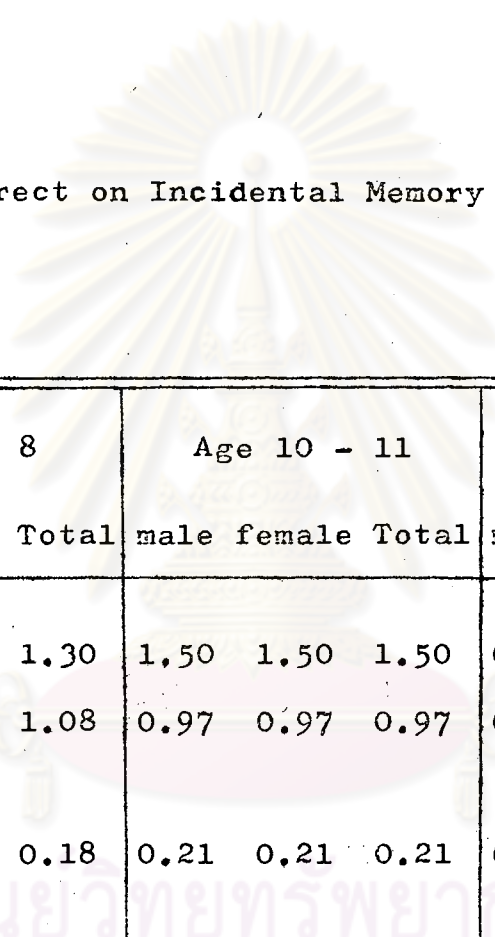


Table XVI Mean S.D. Proportion Correct on Incidental Memory Scores at Each Age Group and by Sex

	Age 4 - 5			Age 7 - 8			Age 10 - 11			Age 14 - 15			Age 20 - 21		
	male	female	Total	male	female	Total	male	female	Total	male	female	Total	male	female	Total
\bar{X}	0.70	0.30	0.50	1.40	1.20	1.30	1.50	1.50	1.50	0.90	0.90	0.09	1.30	1.10	1.30
S.D.	0.30	0.48	0.76	1.17	1.03	1.08	0.97	0.97	0.97	0.99	0.73	0.85	1.16	0.87	1.01
Proportion Correct	0.10	0.04	0.07	0.20	0.17	0.18	0.21	0.21	0.21	0.13	0.13	0.13	0.19	0.16	0.17

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FIGURE IV

Incidental Night Swarms over Age

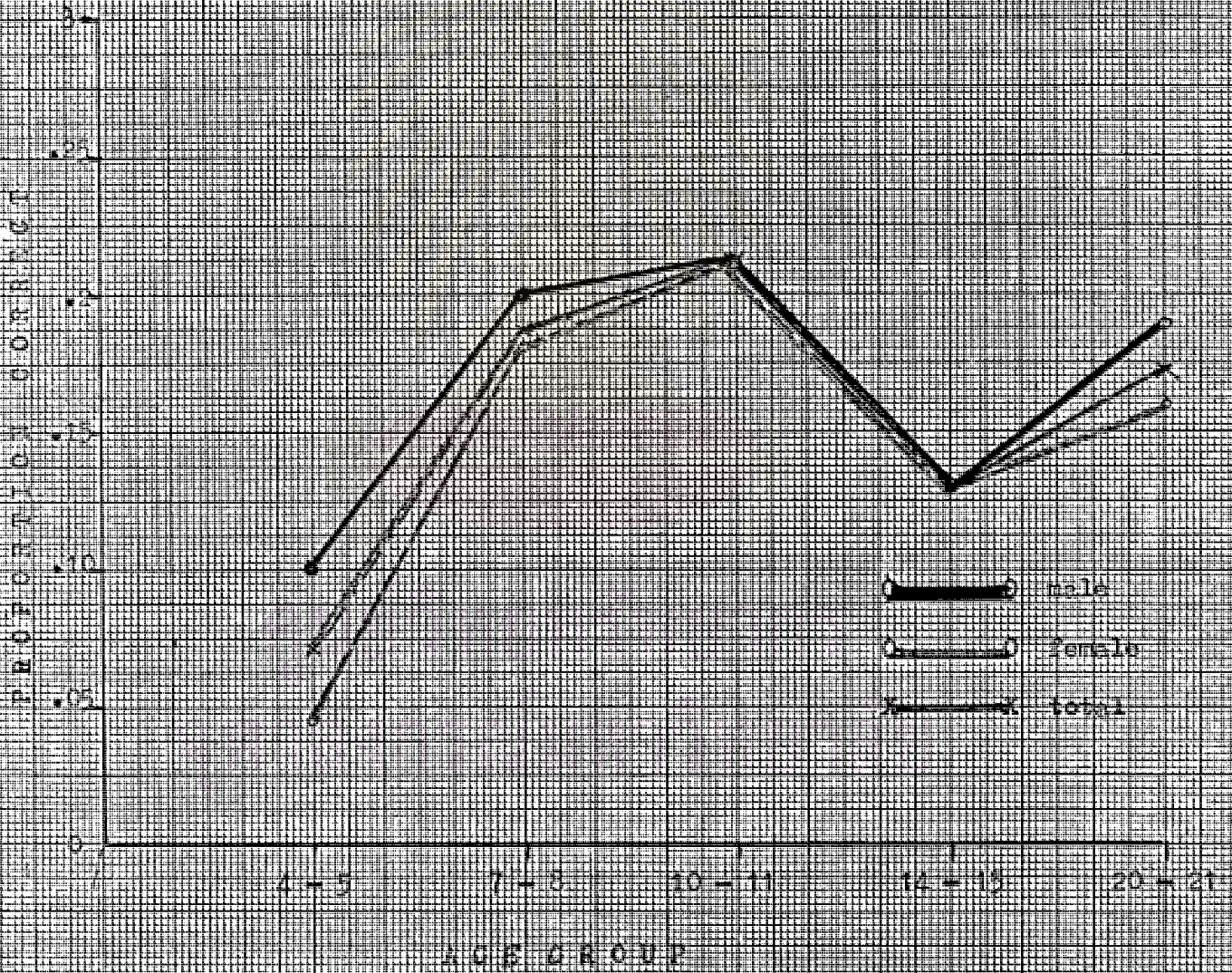


Figure 4 is a chart on the proportion of the correct number of responses on incidental memory scores by age groups.

Insert Figure 4

Figure 4 indicated that proportion of correct responses on incidental memory increased from age 4 - 5 to age 10 - 11, then declined at age 14 - 15, but increased again at age 20 - 21.

A one way analysis of variance was computed to examine the differences among the different age groups for incidental memory scores. The results are presented in Table XVII.

Table XVII Analysis of Variance to Compare Differences among the Different Age Groups.

Source of Variation	SS	df	MS	F
Between Groups	12.16	4	3.04	3.49*
Within Group	33.20	95	0.87	
Total	95.36	99		

* $p < .01$

The results from Table XVII indicated that there were statistically significant differences among the age groups on incidental memory performance ($F = 3.49$, $p < .01$).

T test comparison were made on incidental memory scores between age groups to compare the performance among all age groups. The results are presented in Table XVIII

Table XVIII T Test Comparison among all age groups on incidental memory scores.

Age group	4-5	7-8	10-11	14-15	20-21
	$\bar{X}=0.50$	$\bar{X}=1.30$	$\bar{X}=1.50$	$\bar{X}=0.90$	$\bar{X}=1.20$
4 - 5	-	2.75*	3.70*	1.60	2.50*
7 - 8	-	-	0.62	1.30	0.07
10 - 11	-	-	-	2.14*	0.97
14 - 15	-	-	-	-	1.03
20 - 21	-	-	-	-	-

* $p < .05$

The results showed that there were significant differences between ages 4 - 5 and 7 - 8 ($t = 2.75$, $p < .05$), between ages 4 - 5 and 10 - 11 ($t = 3.70$, $p < .05$), between ages 4 - 5 and 20 - 21 ($t = 2.50$, $p < .05$) and between ages 10 - 11 and 14 - 15 ($t = 2.14$, $p < .05$). But there were no statistically significant differences between ages 7 - 8 and 10 - 11, between ages 4 - 5 and 14 - 15, between ages 7 - 8 and 14 - 15, between ages 7 - 8 and ages 20 - 21 between ages 10 - 11 and 20 - 21, between ages 14 - 15 and 20 - 21.

T test comparison were also made to compare differences between males and females for each age group on incidental memory scores. The results are presented in Table XIX.

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Table XIX T Test Comparison between Male and Female on Incidental Memory Scores.

Age	\bar{X} of males	\bar{X} of females	t
4 - 5	0.70	0.30	1.21
7 - 8	1.40	1.20	0.40
10 - 11	1.50	1.50	0
14 - 15	0.90	0.90	0
20 - 21	1.30	1.10	0.44

The results indicated that there were no statistically significant differences between males and females on incidental memory scores for any age group.

Relationship between Central and Incidental Memory Scores.

Scores on central and incidental memory tests were correlated to examine the relationship between the central and incidental memory scores. The results are presented in Table XX.

Table XX Correlation between Central and Incidental Task Performance for all Age Groups.

Age Group	\bar{X} of central Task scores	\bar{X} of incidental Task scores	r_{xy}
4 - 5	5.10	0.50	0.05
7 - 8	5.00	1.30	-0.05
10 - 11	6.55	1.50	0.20
14 - 15	7.75	0.90	0.07
20 - 21	9.75	1.20	0.25
Total	6.83	1.08	0.15

The results showed that there was no relationship between central and incidental memory scores for all age groups.

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