APPENDIX II

RESULTS, TABLES AND CALCULATIONS

TABLE I

Coefficient of Correlation between scores
on Goodenough's Draw-a-man Scale (x)
and
Mental Ages on Kamat's Tests of Intelligence (y)

(Seven plus age group)

y \ x	0-3	4-7	8-11	12-15	16-19	20-23	24-27	28-31	32-35
41-47			1						
48-54	1								
55-61	1								
62-68	1	3	2	2					
69-75	1		5	2	1				
76-82		2	3	4					
83-89		1	3	3	2				
90-96		1	5		2	1			
97-103			5	2	1				
104-110			1		1	1			
111-117				1					1

$$N = 60$$

$$'r' = +.45 \pm .069$$

TABLE II

Coefficient of Correlation between Scores on Revised Goodenough's Draw-a-man Scale (x) and Mental Ages on Kamat's Tests of Intelligence (y)

(Seven plus age group)

x y	0-3	4-7	8-11	12-15	16-19	20-23	24-27	28-31	32-35
41-47				1					
48-54	1								
55-61	1								
62-68	1	3		1	3				
69-75	1		1	4	1	2			
76-82		1	2	4	1		1		
83-89			3	1	4	1			
90-96				4	2	1	1	1	
97-103			4	1	3				
104-110				1		1	1		
111-117				1					1

$$N = 60$$

$$'r' = + .43 \pm .07$$

TABLE III

Coefficient of Correlation between Scores on New Method (Draw-a-man) Scale (x) and Mental Ages on Kamat's Tests of Intelligence (y)

(Seven plus age group)

x / y	0-3	4-7	8-11	12-15	16-19	20-23	24-27	28-31	32-35	36-39	40-43	44-47
41-47				1								
48-54		1										
55-61	1											
62-68		4			1	3						
69-75		1		4	2	1		1				
76-82			1	2	2	2	1	1				
83-89				2	3	1	2		1			
90-96				2	1	2	2	1	1			
97-103				2	4	1		1				
104-110					1		1		1			
111-117						1						1

N = 60

'r' = + .52 ± ·053

TABLE IV

Coefficient of Correlation between Scores
on Modified New Method Scale (x)
and
Mental Ages on Kamat's Tests of Intelligence (y)
(Seven plus age group)

x \ y	0-3	4-7	8-11	12-15	16-19	20-23	24-27	28-31	32-35	36-39	40-43
41-47				1							
48-54		1									
55-61	1										
62-68		3	1		2	2					
69-75		1		3	2	2		1			
76-82				4	2		2		1		
83-89				2	3	1	2		1		
90-96				1	3	1	1	1	2		
97-103			1	1	4		1	1			
104-110					1		1			1	
111-117						1					1

$$N = 60$$

$$'r' = + .503 \pm .06$$

TABLE V

Verification of 'r' between the Modified
New Draw-a-man Scale and Kamat's Tests

(Seven plus age group)

Sr. No.	Kamat's Tests M.A. (Months) X	Drawing Score Y	x'	x'^2	y'	y'^2	$x'y'$
1	86	13	-9.8	96.04	-6.6	43.56	64.68
2	100	20	4.2	17.64	.4	.16	1.68
3	110	28	14.2	201.64	8.4	70.56	119.28
4	110	20	14.2	201.64	.4	.16	5.68
5	96	12	.2	.04	-7.6	57.76	-1.52
6	82	13	-13.8	190.44	-6.6	43.56	91.08
7	108	20	12.2	148.84	.4	.16	4.88
8	80	16	-15.8	249.64	-3.6	12.96	56.88
9	80	25	-15.8	249.64	5.4	29.16	-83.16
10	106	29	10.2	104.04	9.4	88.36	95.88
	958	196		1459.60		346.40	355.36

$$Mx = \frac{958}{10} = 95.8$$

$$My = \frac{196}{10} = 19.6$$

$$'r' = \frac{\Sigma x'y'}{\sqrt{\Sigma x'^2 \cdot \Sigma y'^2}} = \frac{355.36}{\sqrt{1459.6 \times 346.4}}$$

$$= \frac{355.36}{711.05} = +.490 , PE. \pm .11$$

TABLE VI

Objectivity of the New Draw-a-man Scoring Scale

'r' between scorings by Mr.X (x) and Mrs.P (y)

y \ x	0-3	4-7	8-11	12-15	16-19	20-23	24-27	28-31	32-35	36-39
0-3	1									
4-7		5		1						
8-11		1								
12-15			2	3	5	2				
16-19				2	6	4	2			
20-23				1	1	6	4			
24-27							4	1	1	
28-31							1	2	1	
32-35								1	1	1
36-39										
40-43										
44-47							1			

N = 60

$$'r' = +.76 \pm .032$$

TABLE VII

Objectivity of the Modified
New Draw-a-man Scale

'r' between Scorings by Mrs.P (y)
and Mr. X (x)

	x	0-3	4-7	8-11	12-15	16-19	20-23	24-27	28-31	32-35	36-39	40-43	44-47
y													
0-3		1											
4-7			5										
8-11			1	1									
12-15				1	9	2							
16-19					1	11	5						
20-23						2	5						
24-27							1	5	1				
28-31								2	1				
32-35									3	1			
36-39										1			
40-43													1

N = 60

'r' = +.959 ± .008

TABLE VIII

Objectivity of the Modified New Draw-a-man Scale

'r' between Scorings by Mr. Y (x) and Mrs. P (y)

	x 0-3	4-7	8-11	12-15	16-19	20-23	24-27	28-31	32-35
y 0-3	1								
4-7		5							
8-11		2							
12-15			1	9	2				
16-19			1	1	13	1			
20-23			1	1	3	2	1		
24-27					1	3	1	2	
28-31						1	1		1
32-35							1	2	1
36-39								1	
40-43									1

N = 60

'r' = + .90 ± .011

TABLE IX

Objectivity of the Modified New Draw-a-man Scale

'r' between Scorings by Mr. Z (x)
and Mrs. P (y)

	x	0-3	4-7	8-11	12-15	16-19	20-23	24-27	28-31	32-35	36-39	40-43
y 0-3		1										
4-7		4	1									
8-11		1		1								
12-15			1		4	7						
16-19				1	3	9	4					
20-23					3	1	3					
24-27						2	2	3				
28-31								3				
32-35								2	2			
36-39									1			
40-43												1

N = 60

'r' = +.884 ± .012

TABLE X

Extension of the Modified New Draw-a-man Scale.

Calculation of 'r' between Scores on the Modified
New Draw-a-man Scale and Mental Ages on Kamat's Tests

(Six plus age group)

Sr. No.	Kamat's Tests M.A. (Months) X	Drawing Score Y	x'	x'^2	y'	y'^2	$x'y'$
1	82	21	4	16	4	16	16
2	64	7	-14	196	-10	100	140
3	68	14	-10	100	-3	9	30
4	80	27	2	4	10	100	20
5	76	6	-2	4	-11	121	22
6	84	13	6	36	-4	16	-24
7	70	19	-8	64	2	4	-16
8	48	6	-30	900	-11	121	330
9	90	18	12	144	1	1	12
10	74	13	-4	16	-4	16	16
11	82	8	-4	16	-9	81	-36
12	66	16	-12	144	-1	1	12
13	70	13	-8	64	-4	16	32
14	100	22	22	484	5	25	110
15	98	28	20	400	11	121	220
16	78	33	0	0	16	256	0
17	70	14	-8	64	-3	9	24
18	72	18	-6	36	1	1	-6
19	80	15	2	4	-2	4	-4
20	88	15	10	100	-2	4	-20
			-20	2792	-14	1022	878

N = 20   A.Mx = 78   Cx = -1   Cy = -.7
          Mx = 78 -1 = 77

          A.My = 17 $Cx^2 = 1$ $Cy^2 = .49$
          My = 17 -.7 = 16.3 $\sigma x = \sqrt{\frac{\Sigma x^2}{N} - Cx^2} \times i = \sqrt{\frac{2792}{20}} - 1$

$r = \dfrac{\frac{\Sigma x'y'}{N} - Cx.Cy}{\sigma x .\sigma y}$ $= 11.77$

          $\sigma y = \sqrt{\frac{\Sigma x^2}{N} - Cy^2} \times i = \sqrt{\frac{1022}{20} - .49} \times i$

$= \dfrac{\frac{878}{20} - .7}{11.77 \times 7.11} = .51$,   PEr $= \pm .11$ $= 7.11$

TABLE XI

Extension of the Modified New Draw-a-man Scale.

Calculation of 'r' between Scores on the Modified
New Draw-a-man Scale and Mental Ages on Kamat's Tests

(Eight plus age group)

Sr. No.	Kamat's Tests M.A. (months) X	Drawing Score Y	x'	x'²	y'	y'²	x'y'
1	86	17	-12	144	- 7.1	50.41	85.2
2	72	12	-26	676	-12.1	146.41	314.6
3	80	30	-18	324	5.9	34.81	-106.2
4	86	17	-12	144	- 7.1	50.41	85.2
5	90	17	- 8	64	- 7.1	50.41	56.8
6	106	16	8	64	- 8.1	65.61	- 64.8
7	72	14	-26	676	-10.1	102.01	262.6
8	96	11	- 2	4	-13.1	171.61	26.2
9	102	29	4	16	4.9	24.01	19.6
10	114	32	16	256	7.9	62.41	126.4
11	94	13	- 4	16	-11.1	123.21	44.4
12	104	41	6	36	16.9	285.61	101.4
13	122	21	24	576	- 3.1	9.61	- 74.4
14	114	23	16	256	- 1.1	1.21	- 17.6
15	108	39	10	100	14.9	222.01	149.0
16	122	36	24	576	11.9	141.61	285.6
17	116	47	18	324	22.9	524.41	412.2
18	116	30	18	324	5.9	34.81	106.2
19	70	20	-28	784	- 4.1	16.81	114.8
20	94	17	- 4	16	- 7.1	50.41	28.4
21	88	26	-10	100	1.9	3.61	- 19.0
22	84	26	-14	196	1.9	3.61	- 26.6
23	102	15	4	16	- 9.1	82.81	- 36.4
24	96	21	- 2	4	- 3.1	9.61	6.2
25	116	32	18	324	7.9	62.41	142.2
	2450	602		6016		2329.85	2022.0

$$M_x = \frac{2450}{25} = 98$$

$$M_y = \frac{602}{25} = 24.08 = 24.1$$

$$r = \frac{\Sigma\, x'y'}{\sqrt{\Sigma x'^2 . \Sigma y'^2}}$$

$$= \frac{2022.0}{\sqrt{6016 \times 2329.85}}$$

$$= \frac{2022}{3743.84} = +.54, \quad PE_r = \pm .11$$

TABLE XII

Coefficient of Variation
for Study Groups

$$V = \frac{100 \times \sigma}{M}$$

Six years : $M = 16.3;$ $\sigma = 7.11$

$$V = \frac{100 \times 7.11}{16.3} = \frac{711}{16.3} = 44$$

Seven years : $M = 18.94;$ $\sigma = 8.32$

$$V = \frac{100 \times 8.32}{18.94} = \frac{832}{18.94} = 43.9 = 44$$

Eight years : $M = 24.1;$ $\sigma = 9.7$

$$V = \frac{100 \times 9.7}{24.1} = \frac{970}{24.1} = 40.2 = 40$$

TABLE XIII

Reliability Coefficient of the
Modified New Draw-a-man Scale

(Method of Retest)

Sr. No.	Drawing Score I X	Drawing Score II Y	x'	x'^{2}	y'	y'^{2}	x'y'
1	21	27	1	1	7	49	7
2	7	12	-13	169	- 8	64	104
3	6	12	-14	196	- 8	64	112
4	7	10	-13	169	-10	100	130
5	19	19	- 1	1	- 1	1	1
6	16	12	- 4	16	- 8	64	32
7	29	33	9	81	13	169	117
8	22	22	2	4	2	4	4
9	12	15	- 8	64	- 5	25	40
10	18	17	- 2	4	- 3	9	6
11	17	9	- 3	9	-11	121	33
12	13	13	- 7	49	- 7	49	49
13	20	33	0	0	1	1	0
14	28	25	8	64	5	25	40
15	20	17	0	0	- 3	9	0
16	13	14	- 7	49	- 6	36	42
17	20	17	0	0	- 3	9	0
18	16	18	- 4	16	- 2	4	8
19	25	20	5	25	0	0	0
20	29	29	9	81	9	81	81

(Table XIII)

Sr. No.	Drawing Score I X	Drawing Score II Y	x'	x'^{2}	y'	y'^{2}	x'y'
21	17	10	− 3	9	−10	100	30
22	17	13	− 3	9	− 7	49	21
23	17	19	− 3	9	− 1	1	3
24	16	12	− 4	16	− 8	64	32
25	11	13	− 9	81	− 7	49	63
26	29	28	9	81	8	64	72
27	31	25	11	121	5	25	55
28	13	17	− 7	49	− 3	9	21
29	22	16	2	4	− 4	16	− 8
30	19	23	− 1	1	3	9	− 3
31	17	15	− 3	9	− 5	25	15
32	15	10	− 5	25	−10	100	50
33	21	14	1	1	− 6	36	− 6
34	15	15	− 5	25	− 5	25	25
35	14	11	− 6	36	− 9	81	54
			−57	1413	−83	1431	1151

$N = 35$ A.Mx = 20   Cx = −1.73   Cy = −2.67

Mx = 20 − 1.73 = 18.27   Cx^2 = 2.9584   Cy^2 = 7.1289

A.My = 20   My = 20 − 2.67 = 17.33

$$\sigma x = \sqrt{\frac{\Sigma x^2}{N} - Cx^2} \times 1 = \sqrt{\frac{1413}{35} - 2.9584} \times 1 = 6.31$$

$$\sigma y = \sqrt{\frac{\Sigma y^2}{N} - Cy^2} \times 1 = \sqrt{\frac{1431}{35} - 7.1289} \times 1 = 6.02$$

$$r = \frac{\frac{\Sigma x'y'}{N} - Cx.Cy}{\sigma x . \sigma y} = \frac{\frac{1151}{35} - 1.73 \times 2.67}{6.31 \times 6.02} = .817, \quad PEr = \pm.041$$

TABLE XIV

Mean Score and S.D. on the
Modified New Draw-a-man Scale
SIX YEARS

Step Intervals	Mid point	f	x'	fx'	fx'^2
4 - 7	5.5	21	- 2	-42	84
8 - 11	9.5	38	- 1	-38	38
12 - 15	13.5	62	0	0	0
16 - 19	17.5	47	1	47	47
20 - 23	21.5	29	2	58	116
24 - 27	25.5	22	3	66	198
28 - 31	29.5	8	4	32	128
32 - 35	33.5	3	5	15	75
36 - 39	37.5	4	6	24	144
		234		242-80 =162	830

$N = 234$; $c = \dfrac{162}{234} = .6923$; $ci = .692 \times 4 = 2.768$

$c^2 = (.69)^2 = .4761$

Assumed Mean $=$ 13.5

Mean $=$ $13.5 + 2.768$

$=$ 16.268

$=$ 16.27

Standard Deviation (S.D.) $= \sqrt{\dfrac{\Sigma fx'^2}{N} - c^2} \times i$

$= \sqrt{\dfrac{830}{234} - .4761} \times 4 = 7.00$

$\sigma_m = \dfrac{S.D.}{\sqrt{N}} = \dfrac{7}{15.297}$

$= .46$ $(\sigma_m)^2 = (.46)^2 = .2116$

TABLE XV

Mean Score and S.D. on the
Modified New Draw-a-man Scale
SEVEN YEARS

Step Intervals	Mid point	f	x'	fx'	fx'^{2}
4 - 7	5.5	3	-3	- 9	27
8 - 11	9.5	21	-2	-42	84
12 - 15	13.5	51	-1	-51	51
16 - 19	17.5	63	0	0	0
20 - 23	21.5	61	1	61	61
24 - 27	25.5	38	2	76	152
28 - 31	29.5	22	3	66	198
32 - 35	33.5	12	4	48	192
36 - 39	37.5	3	5	15	75
40 - 43	41.5	3	6	18	108
44 - 47	45.5	3	7	21	147
		280		305-102 =203	1095

$N = 280$ $c = \frac{203}{280} = .73$ $ci = .73 \times 4 = 2.92$

$$(c)^2 = (.73)^2 = .5329$$

Assumed Mean = 17.5
Mean = 17.5 + 2.92
= 20.42

$$\text{Standard Deviation (S.D.)} = \sqrt{\frac{\Sigma fx^2}{N} - c^2} \times i$$

$$= \sqrt{\frac{1095}{280} - .5329} \times 4 = 7.36$$

$$\sigma m = \frac{S.D.}{\sqrt{N}} = \frac{7.37}{\sqrt{280}} = \frac{7.36}{16.733} = .44$$

$$(\sigma m)^2 = (.44)^2 = .1936$$

TABLE XVI

Mean Score and S.D. on the
Modified New Draw-a-man Scale

EIGHT YEARS

Step Intervals	Mid point	f	x'	fx'	fx'^2
8 - 11	9.5	9	-3	-27	81
12 - 15	13.5	26	-2	-52	104
16 - 19	17.5	41	-1	-41	41
20 - 23	21.5	46	0	0	0
24 - 27	25.5	34	1	34	34
28 - 31	29.5	15	2	30	60
32 - 35	33.5	17	3	51	153
36 - 39	37.5	7	4	28	112
40 - 43	41.5	6	5	30	150
44 - 47	45.5	4	6	24	144
48 - 51	49.5	2	7	14	98
52 - 55	53.5	1	8	8	64
		208		219-120 =99	1041

$N = 208$ $c = \dfrac{99}{208} = .476$ $ci = .476 \times 4 = 1.904$

$$(c)^2 = (.476)^2 = .226576$$

Assumed Mean = 21.5
Mean = 21.5+1.90
= 23.40

$$\text{Standard Deviation (S.D.)} = \sqrt{\frac{\Sigma fx'^2}{N} - c^2} \times i$$

$$= \sqrt{\frac{1041}{208} - .226576} \times 4$$

$$= 2.19 \times 4 = 8.76$$

$$\sigma m = \frac{S.D.}{\sqrt{N}} = \frac{8.76}{\sqrt{208}} = \frac{8.76}{14.422} = .607 = .61$$

$$(\sigma m)^2 = (.61)^2 = .3721$$

TABLE XVII

Critical Ratios to test the Significance
of differences in the Mean Scores of the
Age Groups six, seven and eight years

Six years and seven years

Mean Scores

6 years $= 16.27$ (m_1)

7 years $= 20.4$ (m_2) $D = 20.4 - 16.3 = 4.1$

$$\sigma D = \sqrt{(\sigma m_1)^2 + (\sigma m_2)^2}$$ Critical Ratio (C.R.) $= \dfrac{D}{\sigma D}$

$$= \sqrt{.2116 + .1936}$$

$$= \sqrt{.4052}$$ $= \dfrac{4.1}{.68}$

$$= .68$$ $= 6.4$

Seven years and eight years

Mean Scores

7 years $= 20.4$ (m_1)

8 years $= 23.4$ (m_2) $D = 23.4 - 20.4 = 3$

$$\sigma D = \sqrt{(\sigma m_1)^2 + (\sigma m_2)^2}$$ Critical Ratio (C.R.) $= \dfrac{D}{\sigma D}$

$$= \sqrt{.1936 + .3721}$$ $= \dfrac{3}{.75}$

$$= \sqrt{.5657}$$

          $= 4$

$$= .75$$

TABLE XVIII

Percentage of Total Scores for Individual Points of the
Modified New Draw-a-man Scale at Different Age Levels

Sr. No.	Description of point	Weightage	6 years (234)		7 years (280)		8 years (208)	
			Total Score obtained	Percentage	Total Score obtained	Percentage	Total Score obtained	Percentage
1	Head	3	519/720	72.08	687/840	81.77	519/624	83.17
2	Eyes	3	349/720	48.47	457/840	54.40	354/624	56.73
3	Nose	4	300/936	32.05	479/1120	42.76	399/832	47.95
4	Ears	4	92/936	9.83	133/1120	11.88	118/832	14.18
5	Hair or Hat	2	97/468	20.72	137/560	24.46	132/416	31.73
6	Forehead	1	103/234	44.01	173/280	61.78	138/208	66.34
7	Chin & Mouth	5	314/1170	26.83	548/1400	39.14	429/1040	41.25
8	Neck & Trunk	8	546/1872	29.12	802/2240	35.80	776/1664	46.63
9	Arms & Hands	10	566/2340	24.18	899/2800	32.11	745/2080	35.81
10	Legs & Feet	9	496/2106	23.55	1002/2520	39.76	861/1872	45.99
11	Motor Co-ordination	4	93/936	9.93	162/1120	14.46	170/832	20.43
12	Dress	2	2/468	.43	10/560	1.78	20/416	4.80
13	Proportion and Symmetry	5	94/1170	8.03	171/1400	12.21	179/1040	17.21
14	Indication of Environment OR Action	1	4/234	1.70	16/280	5.71	21/208	10.09

TABLE XIX

Mean Score and S.D.on the Modified New
Draw-a-man Scale according to the Grades

GRADE I

Step Intervals	Mid point	f	x'	fx'	fx'^2
4 - 7	5.5	24	-1	-24	24
8 - 11	9.5	44	0	0	0
12 - 15	13.5	38	1	38	38
16 - 19	17.5	20	2	40	80
20 - 23	21.5	15	3	45	135
24 - 27	25.5	8	4	32	128
28 - 31	29.5	5	5	25	125
		154		180-24 =156	530

$N = 154$ $c = \dfrac{156}{154} = 1.012$ $ci = 1.012 \times 4 = 4.048$

$$(c)^2 = (1.01)^2 = 1.0201$$

Assumed Mean = 9.5
Mean = 9.5 + 4.048
= 13.548
= 13.5

Standard Diviation (S.D.) $= \sqrt{\dfrac{\Sigma fx'^2}{N} - c^2} \times 1$

$= \sqrt{\dfrac{530}{154} - 1.0201} \times 4$

$= 1.597 \times 4 = 6.388$

$\sigma m = \dfrac{S.D.}{\sqrt{N}} = \dfrac{6.388}{\sqrt{154}} = \dfrac{6.388}{12.41} = .514 = .51$

$$(\sigma m)^2 = (.51)^2 = .2601$$

TABLE XX

Mean Score and S.D. on the Modified New
Draw-a-man Scale according to the Grades

GRADE II

Step Intervals	Mid point	f	x'	fx'	fx'^2
4 – 7	5.5	8	-3	-24	72
8 – 11	9.5	21	-2	-42	84
12 – 15	13.5	30	-1	-30	30
16 – 19	17.5	36	0	0	0
20 – 23	21.5	28	1	28	28
24 – 27	25.5	13	2	26	52
28 – 31	29.5	4	3	12	36
32 – 35	33.5	2	4	8	32
36 – 39	37.5	1	5	5	25
40 – 43	41.5	1	6	6	36
44 – 47	45.5	1	7	7	49
		145		92-96 = -4	444

$N = 145$ $\qquad c = \dfrac{-4}{145} = -.028$ $\qquad ci = -.028 \times 4 = -.112$

$$(c)^2 = (-.028)^2 = .000784$$

Assumed Mean $=$ 17.5
$\qquad$ Mean $=$ 17.5 - .112
$\qquad\qquad =$ 17.388 $=$ 17.4

Standard Deviation (S.D.) $= \sqrt{\dfrac{\Sigma fx'^2}{N} - c^2} \times i$

$\qquad\qquad\qquad = \sqrt{\dfrac{444}{145} - .000784} \times 4$

$\qquad\qquad\qquad =$ 1.7498 $\times$ 4 $=$ 6.9992 $=$ 7.0

$\sigma_m = \dfrac{S.D.}{\sqrt{N}} = \dfrac{7.0}{\sqrt{145}} = \dfrac{7}{12.042} = .581$

$$(\sigma_m)^2 = (.58)^2 = .3364$$

TABLE XXI

Mean Score and S.D. on the Modified New
Draw-a-man Scale according to the Grades

GRADE III

Step Intervals	Mid point	f	x'	fx'	fx'^{2}
8 - 11	9.5	6	-3	-18	54
12 - 15	13.5	20	-2	-40	80
16 - 19	17.5	28	-1	-28	28
20 - 23	21.5	32	0	0	0
24 - 27	25.5	21	1	21	21
28 - 31	29.5	10	2	20	40
32 - 35	33.5	5	3	15	45
36 - 39	37.5	3	4	12	48
40 - 43	41.5	0	5	0	0
44 - 47	45.5	2	6	12	72
		127		80 - 76 = 4	388

$N = 127$ $c = \frac{4}{127} = .0315$ $ci = .0315 \times 4 = .126$

$$(c)^2 = (.0315)^2 = .099225$$

Assumed Mean $= 21.5$
$= 21.5 + .126$
$= 21.626$

Standard Deviation (S.D.) $= \sqrt{\frac{\Sigma fx'^2}{N} - c^2} \times i$

$= \sqrt{\frac{388}{127} \times .0099225 \times 4}$

$= 6.88$

$\sigma m = \frac{S.D.}{\sqrt{N}} = \frac{6.88}{\sqrt{127}} = \frac{6.88}{11.269} = .61$

$$(\sigma m)^2 = (.61)^2 = .3721$$

TABLE XXII

Mean Score and S.D. on the Modified New
Draw-a-man Scale according to the Grades

GRADE IV

Step Intervals	Mid point	f	x'	fx'	fx'^{2}
8 - 11	9.5	5	-3	-15	45
12 - 15	13.5	12	-2	-24	48
16 - 19	17.5	25	-1	-25	25
20 - 23	21.5	33	0	0	0
24 - 27	25.5	22	1	22	22
28 - 31	29.5	11	2	22	44
32 - 35	33.5	13	3	39	117
36 - 39	37.5	4	4	16	64
40 - 43	41.5	5	5	25	125
44 - 47	45.5	3	6	18	108
48 - 51	49.5	2	7	14	98
		135		156-64 = 92	696

$N = 135$ $\qquad c = \dfrac{92}{135} = .681 \qquad ci = .681 \times 4 = 2.724$

$$(c)^2 = (.681)^2 = .463761$$

Assumed Mean $= 21.5$

Mean $= 21.5 + 2.72$

$\qquad\quad = 24.22$

Standard Deviation (S.D.) $= \sqrt{\dfrac{\Sigma fx'^2}{N} - c^2} \times i$

$\qquad\qquad\qquad\qquad\qquad = \sqrt{\dfrac{696}{135} - .463761} \times 4 = 2.17 \times 4$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad = 8.68$

$\sigma m = \dfrac{S.D.}{\sqrt{N}} = \dfrac{8.68}{\sqrt{135}} = \dfrac{8.68}{11.617} = .747 = .75$

$$(\sigma m)^2 = (.75)^2 = .5625$$

TABLE XXIII

C.R. for Differences in the Mean Scores
of the Grade Groups : I, II, III and IV

Grade I & Grade II

Mean Scores

Grade I -- 13.5 (m_1)

Grade II -- 17.4 (m_2)

$\sigma D = \sqrt{(\sigma m_1)^2 + (\sigma m_2)^2}$

$= \sqrt{.2601 + .3364}$

$= \sqrt{.5965}$

$= .77$

$D = 17.4 - 13.5 = 3.9$

Critical Ratio (C.R.)

$= \dfrac{D}{\sigma D}$

$= \dfrac{3.9}{.77}$

$= 5.06$

Grade II & Grade III

Mean Scores

Grade II -- 17.4 (m_1)

Grade III -- 21.6 (m_2)

$\sigma D = \sqrt{(\sigma m_1)^2 \ (\sigma m_2)^2}$

$= \sqrt{.3364 \ .3721}$

$= \sqrt{.7085}$

$= .84$

$D = 21.6 - 17.4 = 4.2$

Critical Ratio (C.R.)

$= \dfrac{D}{\sigma D}$

$= \dfrac{4.2}{.84}$

$= 5$

Grade III & Grade IV

Mean Scores

Grade III -- 21.6 (m_1)

Grade IV -- 24.2 (m_2)

$\sigma D = \sqrt{(\sigma m_1)^2 + (\sigma m_2)^2}$

$= \sqrt{.3721 + .5625}$

$= \sqrt{.9346}$

$= .97$

$D = 24.2 - 21.6 = 2.6$

Critical Ratio (C.R.)

$= \dfrac{D}{\sigma D}$

$= \dfrac{2.6}{.97}$

$= 2.68$