Chapter 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Classification of boys into homogeneous group for participation in physical education at the secondary school stage in particular in India was a long felt need. Early decades of the twentieth century recorded some attempts in this direction with respect to Caucasian boys and girls in United States. The classification indices framed were based on factors of age, height and weight, considering their predictability of the motor performance in girls compared to boys. The reason for this phenomenon was also not properly understood. As a consequence, attempts evolving satisfactory classification indices with respect to boys appear to have been given up. In India, however, there has not been any evidence of effort to evolve a classification method applicable to boys of secondary school in particular though some classificatory formulae are reported to be in use in some parts of this country.

Since the boys in the secondary schools are exposed to wide varieties of physical activities any classificatory formula should necessarily be based on a combination of easily assessable.
factors of age, height and weight, that would have the bet predictive power with respect to their general motor ability. Any classificatory method evolved should be on a regional basis to be a satisfactory one.

Hence the purpose of the study was to evolve and suggest a method for classification of homogeneous groups for boys based on statistical evaluation of $R^2$ coefficients of the factors of age, height and weight considered individually and in various combinations with respect to the motor ability and selecting the best correlate therefrom.

Five hundred and twenty four normal healthy boys without any physical deformity selected at random from twenty secondary schools of Amravati served as subjects.

The performance of subjects on the Scott Motor Ability Test Battery (Basket Ball Throw; Four Seconds Dash; Wall Pass and Standing Broad Jump) converted to percentile scores on the Hull Scale was considered as the criterion of the general motor ability. Age was taken in months, height in centimeters and weight in kilograms. Dates of birth as entered in the school records were taken to determine the age, height and weight of the subjects were measured in accordance with the standard procedures. All the data in respect of the subjects was collected at the
Institutions of their study.

In determining the predictive power of the factors of age, height and weight on performance, the performance criterion was considered as a dependent variable and the factors of age, height and weight individually or in combinations were considered as independent variables.

The Independent Variables were grouped into six categories for purposes of computing the coefficient of determination ($R^2$) as follows.

**Category 1**— Age, height and weight individually (as single factor variables) in relation to performance.

**Category 2**— Body build indices based on height and weight, in relation to performance.

(a) Weight – Height Ratio $(\frac{w}{h})$

(b) Quetelet’s Index $\frac{w}{h^2}$

(c) Inverse Ponderal Index $(\frac{h}{\sqrt[3]{w}})$

(d) Tuxford Index $\left(\frac{w}{h} \times \frac{308 - m}{235}\right)$

Where $w = \text{weight (kg)}$, $h = \text{height (cms)}$, $m = \text{age (months)}$.

**Category 3**— Body build indices multiplied by age in relation to performance.
(a) Age $\times \frac{w}{h}$

(b) Age $\times \frac{w}{h^2}$

(c) Age $\times \frac{h}{\sqrt{w}}$

(d) Age $\times \frac{\sqrt[3]{w}}{h}$

**Category 4** – Several two factor combinations of age, height and weight (other than the body build indices) as variables in relation to performance.

(a) Age $\times$ Height

(b) Age $\times$ Weight

(c) Height $\times$ Weight

(d) $1.5 \text{ Height } \div \text{ Weight}$

(e) $\frac{\text{Height}}{\text{Age}}$

(f) $\frac{\text{Weight}}{\text{Age}}$

**Category 5** – Three factor combinations involving age, height and weight as variables in relation to performance.

(a) Age $\times$ Height $\times$ Weight

(b) Age $\div$ Height $\div$ Weight

(c) Age $(1.5 \text{ Height } \div \text{ Weight})$

(d) Age $\times 1.5 \text{ Height } \times \text{ Weight}$

(e) $\frac{\text{Weight}}{\text{Height } \times \text{ Age}}$
Category 6 – Contributions of Age, Height and Weight severally in the following combinations in relation to performance.

(a) Age ÷ Weight ÷ Height (Trivariate Regression)

(b) Weight ÷ Height (Bivariate Regression)

In respect of the Independent Variables as stated under categories 1 to 5, the coefficients of determination were computed by using the linear regression mode. Under multiple regression mode, the coefficient of determination \( (R^2) \) of the factors of age, height and weight as a trivariate and bivariate (height and weight) combinations (Category-6) was arrived at by the Matrix Inversion Method.

The trivariate and the birvariate combinations which registered highest coefficients of determination were selected to suggest classification formulae.

CONCLUSIONS

The analysis of the data led to the following conclusion.

1. Among the factors of age, height and weight in secondary school age is found to bear the lowest correlation with motor ability \( (r = .24) \) with the coefficient of determination also least \( (R^2 = .058) \) compared to the factors of height and weight. Height has the highest coefficient of determination \( (R^2 = .186) \) and correlation \( (r = .43) \) with weight occurring next in
order, the $R^2$ and $r$ value of weight being .150 and .39 respectively.

2. The body build indices – Height Weight Ratio ($\frac{w}{h}$), Quetelet’s Index ($\frac{w}{h^2}$), Tuxford Index ($\frac{w}{h} \times \frac{308-m}{235}$) registered significant but very low correlation and coefficient of determination with motor ability when compared to other height – weight combinations. The $R^2$ values ranged from .0001 to .094 and the $r$ values ranged from .01 to .31. The $R^2$ and $r$ values of Inverse Ponderal Index were found to be not only the lowest among the body build indices but also not statistically significant.

The values of coefficients of determination and correlation did not improve when the various body build indices multiplied by age factor, were considered.

Hence, none of the body build indices can be considered for purposes of suggesting a classification formula in secondary school boys.

3. $1\frac{1}{2}$ Height ÷ Weight bears the highest coefficient of determination ($R^2 = .209$) and correlation ($r = .46$) with motor ability among the various two factor combinations (Age and Height; Age and Weight; Height and Weight). The combination multiplied by a regression constant .37 could be considered as providing a formula for a classification index in secondary school.
4. The bivariate combination of height and weight yielded almost the same $R^2 = .209$ and $R = .46$ as the combination of $1\frac{1}{2}$ Height ÷ Weight suggesting that the bivariate combination also can be considered in providing a classification formula. The bivariate combination with weightages provided for height and weight separately would yield the following classification formula:

Classification Index = .55 Height (cm) + .38 Weight (kg)

The above formula is preferred to the earlier stated formula "=.37 (1.5 Height ÷ Weight)" for reasons of ease of computation.

5. The trivariate combination of Age ÷ Height ÷ Weight, in relation to motor ability has the highest coefficient of determination ($R^2$) being .228, and highest coefficient of multiple correlation $R$ being .478, among the various combinations tried, suggestive of its highest predictive power and its consideration as the first choice for computing a classification formula for of the secondary schools. With appropriate regression loadings for the three factors, the index of the first choice is as follows:

Classification Index = .13 Age (months) ÷ .53 Height (Cm)

(First Choice) + .33 Weight (kg).
The group classification norms for the above index are as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Scores</th>
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<th>Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seniors</td>
<td>Above 122</td>
<td>A</td>
<td>Above 128</td>
</tr>
<tr>
<td>Intermediates</td>
<td>1.8-122</td>
<td>B</td>
<td>120-128</td>
</tr>
<tr>
<td>Juniors</td>
<td>Below 108</td>
<td>C</td>
<td>111-119</td>
</tr>
<tr>
<td></td>
<td></td>
<td>D</td>
<td>102-110</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E</td>
<td>Below 102</td>
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</tbody>
</table>

6. Since the contribution of age in the classification formula of the first choice is very small, the classification formula of the second choice form among the two factor combinations with appropriate regression Loadings happens to be,

Classification Index = 55 Height (cm) $\div .38$ Weight (kg)

(Second choice)

The group classificatory norms for the index of the second choice would be as follow:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Scores</th>
<th>Grade</th>
<th>Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seniors</td>
<td>Above 105</td>
<td>A</td>
<td>Above 111</td>
</tr>
<tr>
<td>Intermediates</td>
<td>90-105</td>
<td>B</td>
<td>103-111</td>
</tr>
<tr>
<td>Juniors</td>
<td>Below 90</td>
<td>C</td>
<td>94-102</td>
</tr>
<tr>
<td></td>
<td></td>
<td>D</td>
<td>85-93</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E</td>
<td>Below 85</td>
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</tbody>
</table>
When Index of the second choice is preferred, ready reckoner charts for placing the girls in grades provided on pages 65 and 66 may be used.

**RECOMMENDATIONS**

1. Since any classification index cannot be universally applied, regionwise replications of investigations in other parts of the country on the lines of the present study may provide useful formulae applicable to each reason for classification of homogeneous group of secondary school level boys.

2. Such investigations may be conducted with respect to higher primary school level boys.

3. There is no evidence of any scientific investigation to evolve classificatory formulae for the boys of higher primary and secondary schools of this country. Hence, such investigations as the present one with respect to different level of boys are also recommended.