CHAPTER V

ANALYSIS

- Preliminary analysis of the scores of different variables
- Analysis of data as per objectives
- Interpretations of the findings
The data was analyzed in two stages. The first stage was used for examining the nature of the distribution of scores for different variables. The second stage was used for answering the questions posed as objectives of the study. The details are presented below:

A. PRELIMINARY ANALYSIS OF THE SCORES OF DIFFERENT VARIABLES

The first part of the analysis was done by

(a) calculating the major statistical indices which will reflect the important properties of the score distributions—the important measures of central tendency, measures of scattering and the index of skewness—indices which will indicate the degree of conformity or deviation of the score distributions from normality as first-level indicators of the representativeness or otherwise of the sample used; and

(b) examining the graphical presentations of the score distributions of different variables for the total sample as well as for the major sub-samples, to confirm the conclusions reached using the calculated statistical indices.
(a) **Statistical summary of the properties of the score distributions for different variables**

The major statistical indices of the score distribution viz., Mean (M), Median (Md), Mode (Mo), Standard Deviation (S.D.), Quartile Deviation¹ (Q.D.), and Coefficient of Skewness² (Sk) are summarised in Table 3.

The statistical indices provide first-level information relating to the nature of the distributions. They need further processing before we can arrive at more dependable conclusions. This has been done in the succeeding sections of the analysis.

(b) **Graphical representation of the score distributions for different variables**

This helped the investigator to obtain a better insight into the adequacy of the sample selection, and the peculiarities, if any, of the distributions before they are subjected to more rigorous statistical analyzes. More dependable and sharper methods are adopted in the formal presentation of the analysis using advanced statistical techniques.

The score distributions for the different variables are presented in figures I to XX
TABLE 3. SUMMARY OF THE STATISTICAL INDICES OF THE DISTRIBUTION
OF DIFFERENT VARIABLES

<table>
<thead>
<tr>
<th>GROUP</th>
<th>VOCATIONAL INFORMATION</th>
<th>INTELLIGENCE</th>
<th>SOCIO-ECONOMIC STATUS</th>
<th>SCIENCE ACHIEVEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>26.23</td>
<td>55.00</td>
<td>31.12</td>
<td>364.07</td>
</tr>
<tr>
<td>Md</td>
<td>26.00</td>
<td>58.00</td>
<td>28.00</td>
<td>365.00</td>
</tr>
<tr>
<td>Mo</td>
<td>26.00</td>
<td>63.00</td>
<td>25.00</td>
<td>405.00</td>
</tr>
<tr>
<td>S.D.</td>
<td>7.38</td>
<td>13.11</td>
<td>12.13</td>
<td>72.81</td>
</tr>
<tr>
<td>Q.D.</td>
<td>5.00</td>
<td>9.50</td>
<td>8.00</td>
<td>52.00</td>
</tr>
<tr>
<td>Sk</td>
<td>+0.093</td>
<td>-0.832</td>
<td>+1.343</td>
<td>-0.370</td>
</tr>
<tr>
<td>M</td>
<td>26.81</td>
<td>55.65</td>
<td>32.44</td>
<td>364.68</td>
</tr>
<tr>
<td>Md</td>
<td>27.00</td>
<td>59.00</td>
<td>30.00</td>
<td>375.00</td>
</tr>
<tr>
<td>Mo</td>
<td>25.00</td>
<td>66.00</td>
<td>25.00</td>
<td>405.00</td>
</tr>
<tr>
<td>S.D.</td>
<td>7.34</td>
<td>12.98</td>
<td>12.57</td>
<td>71.86</td>
</tr>
<tr>
<td>Q.D.</td>
<td>5.00</td>
<td>9.00</td>
<td>7.50</td>
<td>45.00</td>
</tr>
<tr>
<td>Sk</td>
<td>-0.078</td>
<td>-0.887</td>
<td>+1.172</td>
<td>-0.438</td>
</tr>
<tr>
<td>M</td>
<td>25.68</td>
<td>54.39</td>
<td>29.88</td>
<td>363.49</td>
</tr>
<tr>
<td>Md</td>
<td>26.00</td>
<td>57.00</td>
<td>27.00</td>
<td>365.00</td>
</tr>
<tr>
<td>Mo</td>
<td>26.00</td>
<td>63.00</td>
<td>25.00</td>
<td>455.00</td>
</tr>
<tr>
<td>S.D.</td>
<td>7.39</td>
<td>13.21</td>
<td>11.58</td>
<td>73.78</td>
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<td>Q.D.</td>
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<td>60.00</td>
</tr>
<tr>
<td>Sk</td>
<td>-0.130</td>
<td>-0.787</td>
<td>+1.541</td>
<td>-0.312</td>
</tr>
<tr>
<td>M</td>
<td>24.7</td>
<td>52.11</td>
<td>27.98</td>
<td>346.44</td>
</tr>
<tr>
<td>Md</td>
<td>25.00</td>
<td>55.00</td>
<td>25.00</td>
<td>345.00</td>
</tr>
<tr>
<td>Mo</td>
<td>26.00</td>
<td>61.00</td>
<td>25.00</td>
<td>325.00</td>
</tr>
<tr>
<td>S.D.</td>
<td>7.69</td>
<td>12.03</td>
<td>13.25</td>
<td>75.92</td>
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<td>Q.D.</td>
<td>4.50</td>
<td>8.50</td>
<td>5.00</td>
<td>45.00</td>
</tr>
<tr>
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<td>-0.117</td>
<td>-0.890</td>
<td>+1.551</td>
<td>+0.057</td>
</tr>
<tr>
<td>M</td>
<td>27.76</td>
<td>57.89</td>
<td>34.26</td>
<td>381.69</td>
</tr>
<tr>
<td>Md</td>
<td>28.00</td>
<td>61.00</td>
<td>32.00</td>
<td>405.00</td>
</tr>
<tr>
<td>Mo</td>
<td>21.00</td>
<td>63.00</td>
<td>25.00</td>
<td>455.00</td>
</tr>
<tr>
<td>S.D.</td>
<td>6.73</td>
<td>13.51</td>
<td>9.97</td>
<td>65.04</td>
</tr>
<tr>
<td>Q.D.</td>
<td>6.00</td>
<td>9.00</td>
<td>8.00</td>
<td>55.00</td>
</tr>
<tr>
<td>Sk</td>
<td>-0.107</td>
<td>-0.712</td>
<td>+0.101</td>
<td>-0.824</td>
</tr>
</tbody>
</table>

M=Mean  Md=Median  Mo=Mode  S.D.=Standard Deviation;
Q.D.=Quartile Deviation  Sk= Coefficient of Skewness
Figures I to V present the shape of the score distributions for the main variable viz, ‘vocational information’ for the total sample and the major sub-samples based on the gender of subjects and their locale (rural-urban residence).

**Figure I. Frequency Distribution of Vocational Information Scores**  
(Total Sample)

![Graph of Frequency Distribution of Vocational Information Scores (Total Sample)](image)

**Figure II. Frequency Distribution of Vocational Information Scores**  
(Boys)

![Graph of Frequency Distribution of Vocational Information Scores (Boys)](image)
Figure III. Frequency Distribution of Vocational Information Scores (Girls)

Figure IV. Frequency Distribution of Vocational Information Scores (Rural Subjects)
Figures VI to X present the distribution of 'intelligence scores' for the total sample and the sub-samples defined above.
Figure VII. Frequency Distribution of Intelligence Scores (Boys)

Figure VIII. Frequency Distribution of Intelligence Scores (Girls)
Figure IX. Frequency Distribution of Intelligence Scores
(Rural Subjects)

Figure X. Frequency Distribution of Intelligence Scores
(Urban Subjects)
Figures XI to XV present the distribution of ‘prior science achievement scores’ for the total sample and the different sub-samples.

**Figure XI. Frequency Distribution of Prior Science Achievement Scores**

*Total Sample*

**Figure XII. Frequency Distribution of Prior Science Achievement Scores**

*Boys*
Figure XIII. Frequency Distribution of Prior Science Achievement Scores (Girls)

Figure XIV. Frequency Distribution of Prior Science Achievement Scores (Rural Subjects)
Figures XVI to XX present the distribution of ‘socio-economic scores’ of the total samples and its sub-samples.
Figure XVII. Frequency Distribution of Socio-economic Scores (Boys)

Figure XVIII. Frequency Distribution of Socio-economic Scores (Girls)
Figure XIX. Frequency Distribution of Socio-economic Scores
(Rural Subjects)

Figure XX. Frequency Distribution of Socio-economic Scores
(Urban Subjects)
The graphical presentations when interpreted along with the major statistical indices, lead to the following conclusions:

(i) The ‘vocational information’ scores for the total sample as well as the sub-samples approximate to normality. With one-level of smoothing, the shapes would be converted into a normal distribution. This can be interpreted as showing that ‘vocational information’ like other forms of school achievement (even when vocational information is acquired as an informal outcome of formal education) are normally distributed; this is also an indirect indication of the representative nature of the sample used for study.

The approximation to normality shows that we are dealing with a highly adequate sample, both in size and representativeness.

(ii) The score distribution for ‘intelligence’, as distinct from the distribution of ‘vocational information scores’ shows some visible departures from normality. This is only to be expected since we are dealing with an atypical group of students or a selective group of students with higher levels of intelligence than the general group--those who have been screened at different levels in schools before getting promoted to the higher secondary classes. This group (even when they differ among themselves in their mental ability) belongs to the higher strata of intelligence. This fact is reflected in the score distributions for the total group and the different sub-samples. A majority of students of this sample belong to the relatively higher levels of intelligence. This is reflected in the
shape of the score distributions for the total sample as well as the sub-
samples.

(iii) The scores for ‘prior science achievement’ for the total sample and the four sub-samples exhibit a common property which is to be expected in view of the selection procedures used in the state for admitting students to higher secondary science groups. Only those getting relatively higher scores in science (or science-related areas) at the secondary level gain admission to higher secondary science groups. A vast majority of students in the sample are those who succeed in getting higher scores in secondary school science areas. This is indicated by the shape of the distribution for the total sample. The usual rural-urban differences is also reflected in the relevant sub-sample distributions. That the urban students are one shade better than rural students in their school performance in all areas of the curriculum is borne out by the shape of the distribution of the scores in the area. A vast majority of urban students are ahead of their counterparts in rural institutions in their ‘prior science achievement’. But boys and girls are seen to stand almost at the same level in their prior science achievement, with girls even having a slight advantage over boys. This is possibly because of the known trend that girls in Kerala out perform boys in most school subjects, including science subjects. While boys of all shades of mental ability continue in schools at the higher levels, only relatively superior girls continue their studies beyond the secondary level. Such girls evince higher
degrees of achievement motivation which is reflected as higher science achievement. Normally, only girls with relatively higher scores in science decide to offer science subjects at the higher secondary levels. But men students who get even relatively low scores in science often opt for science optionals at the higher secondary level, and use this as a channel for entering better careers in the science and science-related areas, like engineering, medicine, agriculture, etc. They are willing to join less popular institutions where they can gain admission to science optionals to achieve their aim of pursuing prestigious science-related professions.

(iv) The distribution of SES scores for the total sample and the four sub-samples indicate the general trend in the state, where a greater number of students in the higher secondary classes are those drawn from the socially deprived groups (mostly from rural areas) who have now access to higher secondary education in their localities. This denied to them about 5-10 years back because of the absence of higher secondary education in many rural areas. The pre-degree stage which originally was run by universities have recently been delinked from the high-profile Arts and Science Colleges (located mostly in urban areas) and have been handed over to several new institutions started in rural and culturally deprived areas of the state. The new generation higher secondary institutions located in culturally disadvantaged areas of the state are willing to admit students with lower levels of achievement in science to higher secondary science groups. Higher Secondary Education (especially in sciences) is currently utilized by more students
drawn from the low SES groups than in the past. Such students want to enter science-based education, along with high SES students to advance their vocational prospects. There is considerable similarity between the SES distributions of boys and girls and those of rural and urban students, which shows that those of almost the same SES levels enter higher secondary education in the rural and urban areas. The SES levels of boys and girls are also almost of the same level because of the new social trend explained earlier.

B. ANALYSIS OF DATA AS PER OBJECTIVES

This part of the analysis presents the analysis in the order of the objectives of the study to throw light on the questions raised as specific objectives and obtain answers to each of the questions stated as objectives. The details are presented below.

1. To assess the adequacy of vocational information acquired by the subject by examining the nature of the score distributions.

This objective attempts to answer the most important question which the study intends to answer: are the higher secondary students in possession of adequate vocational information to make a realistic selection of their future vocations? In the absence of any bench marking for answering this question, the analysis has attempted to answer this question in terms of the shape of the distribution of vocational information scores.

The vocational information test was so constructed as to
provide a profile of essential vocational information absolutely needed by all students if they are to make a scientific selection of their future vocations. The ideal type of score distribution expected is relatively higher vocational information scores for a vast majority of the subjects, especially since this level of education (higher secondary stage of education) is supposed to cater to a specialized group of students different from a general sample of school students, who are aspiring to enter important professions like medicine and engineering. The selection or diversification for the higher vocations and all forms of higher education happen at this level. Rational selection of courses for the higher levels and beyond depends upon the quality of vocational information acquired by the students, informally. The adequacy or otherwise of the 'vocational information' of the subjects was assessed by examining the nature of the score distributions.

Higher levels of vocational information for a majority of the subjects will be indicated by a more dense clustering of higher scores at the right end of the graph (more higher scores to the right end than to the left). The reverse (more lower scores at the left than at the right) would indicate a relatively less satisfactory level of achievement in vocational information of the group, showing that the informal exposure to vocational information fails to develop the desired degree of vocational information.

The departure from the ideal normal distribution has been
used to assess the degree of adequacy of the vocational information available to the group.

The score distribution for vocational information was assessed using appropriate statistical techniques to find out whether the vast majority of the sample (N = 720) are able to achieve higher scores in vocational information or vice versa. A normal or near-normal distribution will have a near-zero coefficient of skewness. This would indicate that the vocational information achieved is incidental and therefore will be normally distributed, with near-equal shapes on either side of the mean or median.

It is interesting to note all the coefficients of skewness for ‘vocational information’ are close to zero. The coefficients for the total sample and sub-samples are + 0.093, - 0.078, - 0.130, - 0.117, and - 0.107. Considering the fact that the total sample is highly representative in terms of size and coverage (N = 720), and the different sub-samples themselves are large enough to represent the respective populations, and the fact that the indices of skewness are all close to zero, needs to be interpreted as evidence of the fact that the distribution of scores is what is to be expected by a system which is not very much concerned with the development of this educational outcome and what is in evidence as vocational information is the result of informal learning by students. The acquired knowledge is based on random acquisition of facts. The existing knowledge has not been acquired as a result of any systematic teaching or through formal instruction provided by the system. The role of the system in the acquisition of vocational information is just
marginal. This is an indictment of the formal system which has ignored the responsibility to develop an important educational outcome, viz, the development of vocational information which is likely to play a significant role in the lives of the students who are to play critical roles in the society of the future.

If active educational intervention had been provided in the late secondary school stage, possibly the nature of the distribution would have been different. The distributions would have reflected a different trend--distributions where a considerable number of students will be getting higher scores and only a small number will be getting low scores. The score distribution in this case would all be negatively skewed (left-skew). This is not in evidence.

It is to be inferred that the present system of education has ignored a basic responsibility which it should have undertaken--educating secondary students about vocations and the background of vocational information in different forms. The present system is not keen on developing the much needed vocational information on the part of the secondary and higher secondary students.

Departure from normality are generally attributed to factors like the following:

(a) selection of a biased sample
(b) poorly made tests where the items of undesirable difficulty levels bias measurement;
(c) when the variable itself is normally distributed; and
(d) errors in test development
We know that none of these conditions would explain fully the empirical evidence available except that the system has ignored the need for educating higher secondary students about the basic information to be used for making proper vocational choice. Instead of leaving students to acquire vocational information on their own through informal and unscientific means, if a concerted and systematic effort was made by the system to develop vocational information in a phased manner, a considerable left-skew (negative skew) would have been in evidence in the different distributions, especially when we note that the sample of students covered by the study are of higher levels of intelligence.

The highest and lowest scores obtained for vocational information can also be used to throw some light on the desirability or otherwise of the acquisition of vocational information.

Interpreting test scores using conventional methods (like converting the scores into percentages and interpreting them) are not fully justified since the minimum requirement for vocational choice is a very high score of around 90% - 95%. This is so because every piece of information measured by the test is essential for meaningful vocational selection. The ideal situation expected of every learner is 48 out of the maximum possible score of 48 or scores close to 48. What the learner does not know (even when such items are few) are as important as what the learner knows. When a person gets 60% as his score in vocational information, it also implies the absence of 40% of the essential
knowledge needed for making the right vocational choice.

The highest score for vocational information obtained in the study is 44. Converted into a percentage (out of a maximum possible score of 48), this score is the equivalent of 91.7%. This also means that the subject is ignorant of about 8% of the essential information needed for making a correct vocational choice. The lowest score, is 8. This is the equivalent of 12.5% of the maximum possible. The subject is ignorant of about 82% of the essential information needed for making a correct vocational choice. The average score for the sample is 27.8, which when converted into a percentage, stands for 43.38% of the total. Person getting the average score is ignorant of about 56.62% of the essential information. There are 336 subjects who have scores above 43.38%, which also means that 336 out of the 720 subject lack around 56.62% of the essential information needed for making a scientific selection of their future careers.

It is difficult to start with a benchmarking of the score limit which can be described as ideal/essential for making a correct vocational choice. The ideal situation envisaged is a negatively skewed distribution where a vast majority of the subjects in the sample are getting very high scores or scores close to the maximum possible. The trend indicated by the total sample is carried into the four sub-samples as well.

The analysis of the score distributions for the total sample and the sub-samples confirms the fact that the subjects on the whole are not in possession of the minimum vocational information needed for
making a scientific choice of their vocations. This lacunae is to be attributed to the fact that conventional educational system we practice confines all its attention to teaching the academic subjects, and ignores the need for developing proper vocational information at least as part of formal teaching, especially information relating to specialised science-based professions. Whatever vocational information that is acquired by an average student is what he/she has picked up through informal instruction with people or agencies outside the system.

2. The influence of ‘intelligence’ on ‘vocational information’

The role of intelligence, on all forms of intellectual and educational performance of human beings, is well-accepted. Hence the role of intelligence on the acquisition of vocational information was investigated in some detail in the present study, using two parallel procedures. The first method was a comparison of two contrasted groups (into which the total sample was divided), based on intelligence, viz., high-intelligence (HI) and low-intelligence groups (LI), for their levels of vocational information. The dichotomy of the whole group into HI and LI was done using the mean intelligence score of the whole sample (M = 26.23). Those subjects in the sample getting scores at or above the mean intelligence score were classified as the HI-group while the others in the sample were classified as the LI-group. The means and standard deviations of the vocational information scores of the HI and LI groups and their sample sizes are presented in table 4. This data was used for testing whether the two groups differ in their vocational information.
a) Test of significance of the difference between means of the 'vocational information' of the HI and LI groups.

**TABLE 4**

**STATISTICAL INDICES AND THE RESULTS OF THE TEST OF SIGNIFICANCE FOR DIFFERENCE BETWEEN THE MEAN OF THE VOCATIONAL INFORMATION SCORES FOR THE HI AND LI GROUPS**

<table>
<thead>
<tr>
<th></th>
<th>HI</th>
<th></th>
<th>LI</th>
<th></th>
<th>Critical Ratio (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>M₁</td>
<td>Mean</td>
<td>M₂</td>
<td>Mean</td>
<td></td>
</tr>
<tr>
<td>(M₁)</td>
<td>(M₂)</td>
<td></td>
<td>(M₂)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28.75</td>
<td>6.86</td>
<td>22.72</td>
<td>6.61</td>
<td>301</td>
<td>11.82*</td>
</tr>
<tr>
<td>Sample Size (N₁)</td>
<td>Sample Size (N₂)</td>
<td>Sample Size (N₂)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>419</td>
<td></td>
<td>301</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

* Significant at 0.01 level.

The test indicates that the two groups differ significantly in their vocational information. The critical ratio in this case is 11.82, a value which is very high. It exceeds the limit set for significance for two-tailed tests at 0.01 level, viz, 2.58. This is strong evidence to conclude that the two groups differ significantly in respect of their vocational information. The higher mean value form 'vocational information' of the HI group indicates that this group possesses significantly higher degree of vocational information than the LI group.

The result is consistent with general expectations. It indicates that the higher the level of 'intelligence' of the subjects, the higher will be their level of 'vocational information' and *vice versa*. 
Since this score is composed of three sub-scores (vocational information in three science-related vocational areas viz, medicine, agriculture and engineering) it may be presumed that the difference in vocational information covers all the three forms of vocational information covered by the test. The finding has to be interpreted as showing that, in general, those with higher intelligence, possesses higher levels of vocational information relating to each of the three vocational areas covered by the test of vocational information. As the level of intelligence decreases, one could expect a corresponding decrease in vocational information.

b) Correlation between intelligence and vocational information

The relation between the above two variables viz, ‘intelligence’ and ‘vocational information’ was investigated using a second procedure viz, estimating the product-moment correlation ‘r’ between two variables.

The value of ‘r’ in this case (N = 720) was 0.477. For a sample of size 720, the value is highly significant. It could be described verbally as ‘substantial’ or ‘marked’ relationship once we adopt the scheme proposed by Garrett¹. The positive value of the index shows that for any positive change or increase in the value of intelligence will be followed by a corresponding change in the value of vocational information. The common percentage variance of the two variables or the percentage overlap of the two variables can be expressed from the value of ‘r’. This can be done by converting $r^2$ into a percentage. The common or shared variance in this case is 22.75. This
shows that 22.75% of the variance of vocational information scores is accounted for by variation in intelligence.

The estimated sample value of \( r \) obtained viz, 0.477 is likely to change for different investigations using differing samples. We can fix the two limits within which the real \( r \) or the population \( r \) would lie, once we work out the two confidence limits—the confidence intervals at the 0.01 level. The two limits will be given by the formula

\[
 r \pm 2.58 \times \frac{1-r^2}{\sqrt{N}}.
\]

Substituting the value \( r = 0.48 \) and \( N = 720 \) in the above, we find that the two limits are \( 0.48 \pm 0.0748 \), which is the same as 0.5548 and 0.4052 respectively.

The limits are to be interpreted as showing that the real population value of \( r \) could be expected to lie between these two limits (viz, between 0.4052 and 0.5548) at the 0.01 level of confidence. This would mean that if 100 experimenters replicate the same study, 99 experimenters will get correlations which fall within these two limits while the probability of it falling outside these limits is only one out of 100.

The noticed correlation between ‘intelligence’ and ‘vocational information’ confirms the finding obtained in the earlier sections of the present analysis using the t-test. Both the methods support each other, and point to the existence of a relatively strong dependence of ‘vocational information’ scores on ‘intelligence’ scores. As per existing conventions, intelligence is to be treated as the independent variable and vocational information is to be treated as the dependent variable. The analysis confirms the considerable role that intelligence plays in determining the level of vocational information of higher secondary
students. More intelligent students acquire more useful vocational information through informal learning, even when this is not an expected formal outcome of the system.

The fact that vocational information is not included as a part of a school curriculum does not stand in the way of intelligent children from acquiring the essential vocational information on their own.

3. The influence of ‘prior science achievement’ of subjects on their ‘vocational information’

This section of the analysis explored the possibility of how another independent variable selected for study, viz, ‘prior science achievement’ of higher secondary students influences their ‘vocational information’. The science achievement of higher secondary students at the end of their secondary schooling was treated as the independent variable for the purpose. This obviously was based on the assumption that science learning, in general, would contribute directly or indirectly to the acquisition of science-related vocational information of students.

The influence of ‘prior science achievement’ on vocational information was assessed in two ways, as in the previous analysis. The first method used was to divide the total sample into two contrasted groups based on their prior science achievement—high-science achievers (HSA) and low-science achievers (LSA)—and compare the vocational information of the two groups using the conventional t-test. The means of the vocational information scores of the two groups were compared in the t-test. The second method used for the purpose was the estimation of product-moment ‘r’ between science achievement and vocational
information. This was used as a supporting evidence to what was revealed by the t-test. The details relating to the two procedures are reported below.

a) **Test of significance for difference between the mean vocational information scores of contrasted groups based on prior science achievement (HSA and LSA)**

The whole sample (N = 720) was divided into two contrasted groups based on their prior science achievement based on the percentage marks obtained by the subjects in the common state level secondary school examinations for the four science subjects, viz. physics, chemistry, biology and mathematics, totalled with equal weightage given to the four measures. The dichotomy into high-science-achievers and low-science-achievers was effected by dividing the total sample using the mean science achievement score of the total group as the cut-off point.

The dichotomy yielded two contrasted groups of science achievers—the High Science Achievers (HSA) and Low Science Achievers (LSA). Subjects getting scores at or above the mean prior science achievement score (M = 26.23) were classified as HSA's while others were classified as LSA's.

The mean and standard deviation of the 'vocational information' scores of the two groups (HSA and LSA), together with the two sample sizes are reported in Table 5.
TABLE 5

STATISTICAL INDICES AND THE RESULTS OF THE TEST OF SIGNIFICANCE
FOR DIFFERENCE IN VOCATIONAL INFORMATION OF THE HSA AND THE LSA

<table>
<thead>
<tr>
<th>Groups</th>
<th>HSA</th>
<th>LSA</th>
<th>Critical Ratio (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ($M_1$)</td>
<td>Standard Deviation ($\sigma_1$)</td>
<td>Sample Size ($N_1$)</td>
</tr>
<tr>
<td></td>
<td>28.38</td>
<td>7.08</td>
<td>390</td>
</tr>
</tbody>
</table>

* Significant at 0.01 level

The critical ratio was calculated using the standard formula for test of significance of difference between means of large independent samples. Details are presented in the same table. The critical ratio in this case is 8.95. This is much higher than 2.58, the limit set for significance at 0.01 level. We may therefore strongly conclude that there is significant difference between the ‘vocational information’ levels of the two contrasted groups. The higher mean value of the ‘vocational information’ of the HSA, as compared to the LSA, indicates that the HSA group possesses significantly higher degree of vocational information than the LSA. This is also evidence of the fact that those who show higher performance in science subjects also pick up more useful vocational information, from all available sources—from both outside the curriculum or from within the curricular areas. Those with
higher science achievement are seen to possess higher levels of vocational information in respect of the three vocational areas viz, medicine, agriculture and engineering.

b) Correlation between prior science achievement and vocational information.

The validity of the finding reported above, using the test of significance was further examined using another supporting statistical technique -- the coefficient of correlation.

The two variables (viz, 'vocational information' and 'prior science achievement') were correlated to find out the degree to which 'prior science achievement' influences the acquisition of vocational information.

The value of 'r' in this case (N = 720) was 0.420. The obtained value of 'r' is significant at 0.01 level. The value could be described using the classification suggested by Garrett. This coefficient can be described as a 'substantial' or 'marked' relationship between the variables.

The positive value indicates that for any positive change in the independent variable (prior science achievement), we can expect a commensurate positive change in the dependent variable, viz, vocational information. The overlap of the two scores (overlap of 'vocational information' with 'prior science achievement') is nearly 17.64 percent in terms of shared variance. This has to be interpreted as showing that nearly 18 percent of the scores of 'vocational information'
is accounted for in terms of variance in ‘prior science achievement’.

The sample value of correlation \((r = 0.420)\) will help us to work out the 0.01 level confidence intervals within which the real (population) value of ‘\(r\)’ would lie. The 0.01 confidence levels (calculated using the formula used in the case of intelligence) are 0.4999 and 0.3400. We may assign 0.01 level of confidence (99 out of 100) when we draw the conclusion that the population value will lie between the above two limits. This is consistent with expectations. It will be logical to assume that learning of science would expose the learner to certain forms extra information relating to professions connected with science areas.

A knowledge of bio-sciences, for example, would expose one certain aspect of vocations in areas like agriculture or medicine. A sound background of physics will help the learner to understand more of electrical or mechanical engineering, etc. Expressed differently, formal science learning in terms of the conventional curriculum will help learners to acquire certain forms of vocational information relating to science-based professions. The suggestions provided in the formal curriculum is likely to be used by interested learners to search for additional information relating to these professions from other sources. This form learning is acquired as a by-product of, formal learning of conventional science subjects.

Both the methods presented above (t-test and correlation) lead to the same result. Both the approaches help to draw the identical conclusion that ‘prior achievement in science’ of the
subjects has a determining influence on the level of ‘vocational information’ acquired by higher secondary science students.

4. The influence of ‘socio-economic status’ of subjects on their ‘vocational information’

Another important independent variable selected for study was ‘socio-economic status’ of subjects. The influence of this variable on the ‘vocational information’ of the subjects was explored, first using the test of significance and again using the size and direction of correlation, as was done for the two previous independent variables. The findings are presented below.

The two contrasted groups based on socio-economic status were formed by dividing the total sample into two--classifying those getting socio-economic scores (SES) at or above mean for the total sample ($M = 26.23$) as the high socio-economic group (H-SES) and the others in the total sample as the low socio-economic group (L-SES). The means and standard deviations of the two groups in ‘vocational information’ were calculated and used for the test of significance. Also, the correlation between the ‘SES’ scores and the ‘votional information’ scores for the whole group was worked out (product-moment ‘r’) and the results were simultaneously interpreted.

a) Test of significance of the difference between means of vocational information of H-SES and L-SES groups

Statistical indices and the results of the test of significance are summarised in Table 6
### Table 6

**Statistical Indices and the Results of the Test of Significance for Mean Difference in the Vocational Information of H-SES and L-SES Groups**

<table>
<thead>
<tr>
<th>Groups</th>
<th>H-SES</th>
<th>L-SES</th>
<th>Critical Ratio (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean $(M_1)$</td>
<td>Standard Deviation $(\sigma_1)$</td>
<td>Sample Size $(N_1)$</td>
<td>Mean $(M_2)$</td>
</tr>
<tr>
<td>28.06</td>
<td>7.26</td>
<td>271</td>
<td>25.12</td>
</tr>
</tbody>
</table>

* Significant at 0.01 level.

The test shows that there is significant difference between the two groups in their vocational information. The ‘t’ value is 5.27, which is far higher than the limit set for significance at the 0.01 level viz, 2.58. Higher mean value in vocational information is seen to be associated with the higher SES group and vice versa. The difference noticed could be interpreted as showing a dependence of ‘vocational information’ on the ‘socio-economic status’ of the subjects. The higher mean value in ‘vocational information’ of the H-SES, as compared with the mean scores of the L-SES, shows that higher one’s SES, higher will be one’s ‘vocational information’ and vice versa. This has been further confirmed by calculating the correlation between the two variables.
b) Correlation between ‘socio-economic status’ and ‘vocational information’

This has been examined, as in the case of the previous variables, using the supporting statistical technique -- coefficient of correlation ‘r’. The value of ‘r’ (between socio-economic status and vocational information) was worked out. This was found to be 0.233 (N = 720). The value of the correlation is not as high as in the case of the two previous independent variables, viz, intelligence and prior science achievement. But the relationship, even when it is low is positive and significant. The relationship could be described as ‘low’, ‘present, but slight’ as per Garrett’s classification. The positive value shows clearly that positive changes in the independent variable (SES) will be followed by positive changes in the dependent variable (vocational information). This would mean that the higher one’s socio-economic status, higher will be his vocational information with the reverse being true -- the lower ones SES, lower will be their vocational information. The overlap between the two variables (in terms of shared variance) is 5.42 percent, confirming the fact that the two variables are somewhat interdependent, though not to extent they overlap with intelligence and prior science achievement. The confidence interval for ‘r’ in this case are 0.3203 and 0.1397. This is to be interpreted as showing that the population value of ‘r’ will lie between these two intervals at the 0.01 level of probability.

The findings, on the whole, support the earlier finding
obtained using the t-test for comparing the vocational information of two contrasted SES groups for vocational information.

5. **The influence of ‘gender of subjects’ on the ‘vocational information’ of higher secondary students**

Gender differences are in evidence in most of the educational outcomes of learners. Vocational information being a variable which is related to educational performance, it was presumed that this is also likely to be influenced by the gender of the subjects. The influence of the gender differences was examined as a possible factor which is likely to influence the acquisition of the needed vocational information. This was done using the conventional method of dividing the total sample into two groups--boys and girls, and comparing their vocational information using a ‘t’ test.

Statistical indices and the result of the test of significance for the two gender groups -- boys and girls -- are presented in the Table 7.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean (M)</th>
<th>Standard Deviation (σ)</th>
<th>Sample Size</th>
<th>Mean (M)</th>
<th>Standard Deviation (σ)</th>
<th>Sample Size</th>
<th>Critical Ratio (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>26.81</td>
<td>7.34</td>
<td>349</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Girls</td>
<td>25.68</td>
<td>7.39</td>
<td>371</td>
<td></td>
<td></td>
<td></td>
<td>2.05*</td>
</tr>
</tbody>
</table>

* Significant at 0.05 level
The mean and standard deviation of the scores in ‘vocational information’ of boys and girls were separately worked out and subjected to the t-test. The t-value (critical ratio) obtained in this case is 2.05 which is less than 2.58, the 0.01 limit set for significance. But this value exceeds 1.96, the limit set for significance at 0.05 level. We may conclude that the two groups differ significantly in their ‘vocational information’ at 0.05 level.

The higher mean score of boys shows that their vocational information is significantly higher than that of girls. This is consistent with expectations.

The above finding indicates that gender is a significant factor which determines the vocational information of higher secondary science students.

6. The influence of rural-urban differences on vocational information of higher secondary students.

Rural-urban differences are widely in evidence in most of the school-related outcomes, especially the cognitive performance of students. The present study also presumed that this difference will be present in the matter of vocational information as well, because this is an outcome very much close to different forms of educational outcomes.

The influence of rural-urban differences on vocational information was examined by classifying the total sample into two groups (rural and urban groups) and comparing them for their mean vocational information score.
Statistical indices and result of the test of significance are presented in Table 8

**TABLE 8**

**STATISTICAL INDICES AND THE RESULTS OF THE TEST OF SIGNIFICANCE FOR DIFFERENCE IN VOCATIONAL INFORMATION OF RURAL AND URBAN SUBJECTS**

<table>
<thead>
<tr>
<th></th>
<th>Urban</th>
<th>Rural</th>
<th>Critical Ratio (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Groups</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mean</strong> (M₁)</td>
<td>27.76</td>
<td>24.70</td>
<td>5.68*</td>
</tr>
<tr>
<td><strong>Standard Deviation</strong> (σ₁)</td>
<td>7.69</td>
<td>6.73</td>
<td></td>
</tr>
<tr>
<td><strong>Sample Size</strong> (N₁)</td>
<td>360</td>
<td>360</td>
<td></td>
</tr>
</tbody>
</table>

* Significant at 0.01 level

The critical ratio is very high, viz., 5.68. This far exceeds 2.58, the limit set for significance at 0.01 level, showing that there is significant difference between the urban and rural groups of higher secondary students in respect of their vocational information. The higher mean value of the urban group in vocational information is much higher than that of the rural group. This has to be interpreted as showing that the level of vocational information of the urban group is significantly higher than that of rural subjects covered by the study. This is consistent with what is to be expected on the basis of earlier studies which show that urban students have an advantage over rural students in all their
education-related outcomes. This is true of vocational Information as well.

**Interpretation of the findings**

The study shows that all the five independent variables selected for study viz, intelligence, prior science achievement, socio-economic status, gender of subjects and rural-urban residence of subjects, all influence the acquisition of vocational information, of higher secondary students. The five independent variables selected for study all exert a significant influence on the dependent variable viz, vocational information.

It is of interest to note that even when the degree of dependence varies from one independent variable to another, there is general agreement that all of these significantly influence the acquisition of vocational information of higher secondary students.

The independent variable which influences the acquisition of vocational information most, as indicated by coefficient of correlation is, intelligence, followed by, ‘prior science achievement’, and ‘socio-economic status’, in that order. As per tests of significance, the highest t-value is for ‘intelligence’ (t = 11.82) followed by ‘prior science achievement’ (t = 8.95), ‘socio-economic status’ (t = 5.27), ‘gender of subject’ (t = 2.05) and ‘rural-urban residence’(t = 5.68). In respect of the first three measured variables (intelligence, prior science achievement and socio-economic status) higher means in vocational information are
also associated with the groups associated with the higher levels of these variables. With respect to gender differences, higher vocational information is for boys. The rural-urban difference in vocational information is visible as higher scores associated with urban subjects.

There is broad agreement in the findings obtained for the three measured variables in respect of the t-tests and the product-moment coefficients of correlation. The critical ratios in all the three cases are $t = 11.82$, $t = 8.95$, $t = 5.27$. The values of $r$ are also significant in all cases ($r = 0.477$ for intelligence, $r = 0.420$ for prior science achievement, and $r = 0.233$ for socio-economic status). The first two could be described as ‘substantial’ or ‘marked’ while the corresponding value for socio-economic status is to be described as ‘low’ or ‘slight’.

The common conclusion which is to be drawn is that all the selected independent variables selected for study influence the acquisition of vocational information of students significantly. The influence is considerable, except for one variable, namely, socio-economic status where the influence is one shade lower than for the other variables; but all relationships are significant. A detailed interpretation of the findings is attempted below:

(a) The noticed association between ‘intelligence’ and vocational information is in conformity with general expectations based on earlier researches. Intelligence is known to be the most important single determinant of different forms of cognitive performance, including school learning or education-related cognitive performances. Vocational information is not a curriculum-based educational outcome,
since there is no provision to systematically introduce vocational information in Kerala schools. Whatever information is acquired by the subjects is what they have acquired incidentally or informally. May be the most intelligent students understand the need to acquire vocational information as a method of securing their entry into worthwhile professions, without any formal initiation into the area. When motivated, they collect and retain such information informally and process this to serve as a basis for making a rational vocational choice.

The more intelligent a student, greater will be his/her ability to select appropriate information and retain it in mind for future use. Other factors remaining the same, more intelligent students will have greater motivation for acquiring all forms of learning which are likely to be useful for his/her future life. Such students are likely to identify the crucial nature of vocational information in different forms (as indicated by the items of the inventory). The opposite is also true—those with lesser intelligence are unlikely to understand fully the implications of vocational information for their professional choice and career advancement. They would generally sideline the need to acquire such information or operate with the inadequate information which they acquire incidentally. The positive correlation and significant ‘t’ values are indications of the above possibilities.

(b) The noticed association between ‘prior science achievement’ and ‘vocational information’ is also what one would expect although for the same and or for different reasons. High
achievers are normally those of high intelligence. As such, all the arguments presented above for the high intelligence groups are valid for the high achievers as well. Another possible causal factor which links 'prior science achievement' with 'vocational information' is that proper science learning will expose students to the vocational dimensions related to the curricular areas.

Thus, a student of human physiology will obviously be exposed to certain ideas and certain practices relating to the medical profession. The interest stimulated will be followed up by making informal studies about the nature of the medical profession, educational qualifications needed to enter into this profession, aptitudes to be developed for the purpose, educational preparation and finances required for joining medical education, etc. The same is true of students who learn about electromagnetic induction and the working of dynamos and electric motors in physics. They will get attracted and exposed to certain aspects of the profession of electrical engineering informally. Thus science achievement in itself could also act as a motivating and contributing factor for acquiring select forms of vocational information. A good science curriculum will also contain information relating to science-related vocations.

(c) The relation between 'socio-economic status' and 'vocational information' is to be interpreted in terms of the established relation between SES and different forms of 'cognitive achievements'. All important studies about the role of socio-economic status of learners and their educational or education-related performance provide
convincing proof of the role that SES plays on all forms of human performance. The positive influence of SES on different forms of cognitive performance could be explained in terms of different positive factors (achievement-boosting factors) implicit in the concept of SES. Other things being equal, we find that those who get higher SES scores are those who have better heredity. Often a number of economic advantages go along with higher SES -- like a better environment for the development and utilization of one's innate learning potential, higher motivation for learning, access to superior educational institutions etc. Higher SES automatically ensures a number of supportive factors which lead to superior educational performance--higher self-concept, less of academic anxiety, higher social adjustment etc. Even better learning facilities like exposure to quality learning materials, powerful reinforcements for learning from family, special coaching etc, are automatically available for children from higher SES. All these are likely to cater to the development of better vocational information, which is to be treated as an informal learning outcome.

(d) The significant influence of 'gender differences' on 'vocational information' indicated by the study is also one which is in conformity with general expectations. Almost all studies relating to gender differences show that males and females differ in their levels of mental performance and in the quality of mental performance, especially in different areas of school achievement and their aptitudinal dispositions. The fact that girls in general excel boys in language development and communication abilities as against boys who are known
to excel girls in mathematical-spatial abilities and in abstract thinking, is well documented. These basic abilities are reflected in differing levels of school performance of the two groups.

Vocational information is one which is acquired more through informal learning, even when we admit that they exhibit some kind of overlapping with school learning. But the disposition to gain more information about vocations (more information relating to relevant aspects of different vocations) is, to a certain degree, decided by the gender-group to which one belongs. Preference for vocations is culturally determined in most cases. In the cultural context of the country, boys are assigned the role of wage earners and as such are subjected to an increasing social pressure to aspire for entry into a well-defined group of higher professions. This together with a number of gender-related genetic factors are responsible for a slightly better performance of boys in the test of vocational information. The explanations have to be sought in hereditary and social-environmental factors in operation.

(e) The significant influences of 'locale' (rural-urban residence) on the 'vocational information' of higher secondary students is also consistent with general expectations. A vast majority of studies relating to the educational performance of students from rural and urban areas show a consistent trend in favour of urban children. Even in a rural-urban culture like that of Kerala, the influence of the greater rural environment/urban environment becomes visible. This is
evident in the case of 'vocational information', as well. Rural-urban differences affect all forms of cognitive performance. Vocational information is one such. This outcome is very close to the educational performance in different conventional curricular areas. The usual trend, in favour of urban students, is visible here as well. Very few exceptions have been noticed.

The reason for such differentiation based on rural-urban residence is to be attributed to a large number of factors. One such is the tendency for the higher-intelligence groups to migrate to the urban areas in search of better opportunities. Another is the availability of better learning facilities and higher social motivation for those who are reared in an urban environment. This is a general urban culture which children pick up from the social environment. The higher degree of competition for acquiring better learning present in the urban group is generally carried into all forms of formal and informal learning. It is not uncommon for urban children to take up courses for better communication, life-skills, personality development, and special coaching for excelling in national competitive examinations. Both formal and informal self-learning methods are used for the purpose. Such advantages are carried into the domain of vocational information as well. It is this superiority of urban children which is reflected as an advantage among the urban children over their rural counterparts.
References:


2. ibid., 116.
