CHAPTER VI

Results and Discussions

The statistical treatment of the relevant data has already been indicated in the previous chapter. We are now presenting a discussion of our findings in the following paragraphs to show how far they actually corroborate with those of other investigators.

In regard to the first issue (indicated in Chapter II) concerning the relation between the mental ability and achievement in science I would like to point out that the co-efficient of correlation is significantly high. The correlation is determined school wise which shows that the degree of correlation varies from 0.54 to 0.89. When the entire sample was taken into consideration the correlation of coefficient was found to be i.e. 0.71. There is every reason to believe that mental ability i.e., intelligence plays a highly significant role in scholastic performance with special relation to performance in science. This finding has been corroborated by numerous investigators. 'Super (48:86-92) after summarizing a number of studies, concludes that there is a relationship between intelligence and educational achievement as revealed by the levels of intelligence in different curricular areas of studies'.

1. Willy and Andrew- Modern methods & Technique in Guidance P - 206.
correlation between intelligence tests and grades is not especially high, ranging from 0.30 to 0.80. Another investigation aimed at studying the relationship between intelligence and achievement in science of high school students by K.G. Rastogi (1964). Intelligence was measured by the Jalota's test of mental ability and achievement test was measured by taking marks obtained in the U.P. Board Examinations. Results revealed that the relationship between intelligence and achievement in science were found to be significantly positive.

Hence nearly all studies show a fairly high correlation between intelligence scores and scholastic grades in high school and college. High scores in mental tests are usually associated with high scholastic grades while low scores are usually associated with low grades. This is well shown by the Brown University Studies. So, we know that the person who does badly on mental tests is likely to do badly in school. Clear differences are shown in ability and accomplishment between the very low I.Q. and the very high I.Q. The relation of mental ability to occupational level has been recognised since the first use of Army Alpha. Every comparison shows higher mental test scores among men in more prestigious, more demanding occupations. Intelligence tests have also frequently been used to predict occupational capacity. Direct studies of the predictive validity of mental tests for occupational selection frequently give encouraging results though the results depend on the occupation and on the criterion. On the
whole, tests have excellent validity for predicting grades at the end of training. A version of the Army general classification test had correlation above 0.60 with grades in occupations as diverse as airconditioning and printing (AGCT manual, 1960). Therefore correlations with measures of job performance averaged only 0.23 (Ghiselli, 1966, P-121). The coefficients for any job title range from very high to negligible, depending upon the range of ability in the group tested and the demands of the specific job. According to Ghiselli, average validities for group mental tests against job proficiency fall in the following ranges:

- Low (0.25 and below) service occupations, machinising workers, packers & wrappers, repairmen, record clerks, assembler.
- High (above 0.25) Managerial & professional, computational work etc.

Somewhat similar results are reported by the U.S. Correlations for general mental ability are above 0.40 for success of accounts, electronics foremen, mechanical inspectors and bindary workers, for example (GATB manual, 1967). J. Anderson (1939) contended that children with high mental ages do not gain more from year to year than duller children - they finish higher, but they also started higher. Woodrow found negligible correlations between mental tests and gains in laboratory learning. Therefore the pupils high in mental age learn more than those low in mental age. Hence MA does represent one kind of ability to learn. That is why the confusion regarding the overlap of achievement tests and general ability tests developed.
A combination of high school grades with a group mental test commonly predicts college grade averages with validity 0.60-0.70 in colleges that are not especially selective. The coefficient for the test alone is usually around 0.50; long tests with educational loadings may predict with validity 0.60 by themselves (Munday, 1967).

We may be fairly sure that if a boy attains an intelligence scores much below the median of a certain occupation, the probability of his success in that occupation would be remote and it might be wiser for him to choose another unless he shows clearly other outstanding qualifications. The boy who makes a high intelligence score should, possibly, consider first those occupations that rank high in intelligence scores rather than those ranking low, but a high score, in itself, is not a valid ground for avoiding any occupation. In the light of Thorndike's findings, even this graded statement may be too strong. In the ten-year follow up of individuals, he found the prediction of vocational careers and vocational success based upon intelligence tests little better than a chance guess. Intelligence scores are undoubtedly much more valuable as indicating desirable occupational choices, at certain levels, than are the data regarding intelligence levels of occupations. This is true because these scores have a high value in predicting success in school, and school success is a necessary element in the preparation for all higher occupations. If an occupation requires a certain amount of school
work as a prerequisite to entrance or to success and if, as we have seen, scores made in intelligence tests have real predictive value for school success, these scores are very useful in indicating occupational choice even though they do this indirectly. V. Jha (1970), has found that there was a significant positive relationship between achievement in science and general intelligence.

However it is pertinent to discuss here, as I have studied, the relation between mental ability and achievement in the physical science, is highly significant (i.e. 0.71) which corroborates the result of super, Rastogi and other investigators. Of course I administered my tests upon 207 students of 12 Higher Secondary Schools. If the correlations between intelligence and educational achievement are determined school wise it shows that the degree varies from 0.50 to 0.89. From this it is presumed that mental ability is highly responsible for the improvement of scholastic efficiency. If the number of students are increased the results might be more valid. It is also determined in recent times in the guidance programme that either on educational or on vocational prediction intelligence plays a very important part which no one can afford to minimise.

Secondly in connection with the issue concerning the relation between the interest and achievement in science I would point out that the coefficient of correlation is not only positive but
it is significant at both the levels. The correlation is determined schoolwise which shows that the degree of correlation varies from 0.19 to 0.86. When the entire sample was taken into consideration the coefficient of correlation was found to be positive and significant (i.e. 0.49). There is a popular belief that interest plays a significant role in scholastic performance as well as in vocational prediction. This has been corroborated by several investigators. Most recent developments suggest that interest does indeed play a part in achievement even though not in as direct a way as had been expected. K.G. Rastogi (Raj. Uni., 1964) studied the relation between intelligence, interest and achievement of the high school students. Results revealed that the relationship between interest and achievement in science (r = 0.37) was not found to be so high that interest could be said to be the major predictor of achievement. A.K. Bardhan (Cal. Uni., 1965) studied the development of interests among the boys in secondary schools in Calcutta with reference to science, humanities, technology and commerce courses in multilateral schools. The investigation intended to find out the interest patterns that would correspond to particular streams of study in the diversified secondary schools in India, and thereby to develop a tool for measuring interests useful in prediction and guidance. The most important outcome, according to the investigator was the re-establishment of the fact that interest measurement was an effective way of educational guidance. The point biserial correlation coefficient between the interests of Class VIII boys and their
higher secondary examination results was found to be 0.657.
L. Singh (Agra, Uni., 1967) studied the patterns of educational
and vocational interests of adolescent boys and girls from rural
and urban areas. The findings revealed that educational and
vocational interests of adolescents were not in agreement and thus
educational courses of subjects for study and vocational interests
were not directly related. Significant differences in vocational
interests of male students for literary, scientific, commercial,
constructive, aesthetic, agricultural, social service and house-
hold vocations existed; interest in persuasive vocations was
equal. Female urban students were most interested in scientific
education while rural female students were most interested in
literary education. Urban males were most interested in literary
and rural males in aesthetic vocations. "It has been found that
the coefficients of correlation between educational and vocational
interests, between educational courses of subjects offered and
groups liked most, between groups offered and vocational likings
for them were -0.089, -0.10 and -0.60 respectively". 2

"Correlations of interests with grades in related fields are
generally below 0.30, so interest tests add only a small amount to
academic prediction". 3

Studies reviewed elsewhere (J.G. Darley and T. Hagenah - vocational interest measurement P. 56-58; E.K. Strong - vocational interests of men and women, Ch-20) have led to the conclusion that interest has a very low relationship to achievement in school or college, with such coefficients for inventories such as the Strong and the Kuder rarely being as high as 0.30. But the size of the relationship depends on the ranges of interest and ability in the persons in the sample, and on the conditions under which the students study. A few selected investigators will illustrate the point.

Interests as measured by the Kuder and the Strong were correlated with five-year grades in Engineering by L. Long and J.D. Perry ('Academic Achievement in Engineering related to Selection procedure and interests' J. Applied Psycho, 37:468-71; 1953), the mechanical and scientific keys on the former having r's of 0.16 and 0.17 (significant at the 5 percent level) with grades and the Strong engineering scale yielding a relationship of 0.03.

"S.D. Melville and N.O. Frederiksen (Achievement of Freshmen Engineering students and the Strong vocational Interest Blank - Applied Psycho, 36:169-73; 1952) correlated strong scores with average freshman engineering grades and with adjusted average grades (Freshman average minus the average predicted from intelligence and high-scale achievement) controlling intelligence made little difference. The engineering interest scale correlated 0.11
and 0.12 with two criteria, while the scale for mathematical and chemical interests correlated 0.22 and .24, 0.26 and 0.29. However, including high-school achievement in the correlation for intelligence may confuse the picture. A final type of complex analysis of the interest achievement relationship was made by Frederiksen and Melville, who hypothesized that compulsive students do well in all courses, while noncompulsive students do better in courses in which they are interested. For compulsives the correlation between engineering interest and freshman grades was -0.01 using one criterion of compulsiveness, -0.04 using the other; for non compulsiveness the correlations were 0.25 and 0.29. For the two groups combined, the correlation was only 0.10. It is clear that interest has predictive value, when other factors such as competitiveness, compulsiveness, and values do not outweigh it. The Kuder yielded several significant correlations ranging from 0.20 to 0.33; less than a third of them being of a type one might have hypothesized; for example, computational interests correlated 0.20 with research competence, but social service interests correlated -0.20 with supervisory competence. The Strong psychologist scale correlated 0.33 with academic performance and 0.43 with research competence. Strong regards interest as what he calls an 'indeterminate' indicator of success. That is to say, interest tends to be associated with success, but not directly, since both are

affected by many other factors. However, Carter (1944) points out in his summary of ten years of work in this field, the criteria of success in any vocation are not adequate, and this makes the validation of scales and tests for the measurement of interest and the detection of interest patterns difficult in terms of success.

Lewis and McGehee (q.v. P-598) have shown that there are significant differences in interest as between bright and dull children. The comparative interest patterns of these two groups are shown here:

Percentages of superior and retarded boys and girls designated as interested in various hobbies:

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<tr>
<th></th>
<th>Boys</th>
<th>Girls</th>
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<tr>
<td></td>
<td>Superior</td>
<td>Retarded</td>
</tr>
<tr>
<td>Reading novels</td>
<td>50</td>
<td>23</td>
</tr>
<tr>
<td>Reading history &amp; science</td>
<td>31</td>
<td>9</td>
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<tr>
<td>Active games &amp; sports</td>
<td>67</td>
<td>54</td>
</tr>
<tr>
<td>Playing musical instruments</td>
<td>22</td>
<td>10</td>
</tr>
<tr>
<td>Sewing &amp; knitting</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>House work</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Studying</td>
<td>9</td>
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It will be seen from the above comparative interest patterns of these two groups that the high differentiations occur with reading, sports and games, playing musical instruments, dramatics and collecting, and that others are definitely significant, and also that the superior subjects had many more hobbies than the retarded.

However interests help a student choose between broadlines of training, but in that training and subsequent experience he will modify his interests and make further career decisions. The shaping of a career is never finished. Certain doors are closed if a person does not get the right training at the right time, but whatever training he does get leaves many options. Sometimes students are asked to report the strength of their various interests. The average correlation between estimated interest and measured interest was 0.52 (Crosby & Winsor, 1941). In another investigation (Haganah, 1953; cited in Darley & Haganah, 1955, P. 67), roughly two-thirds of those who claimed interest in business detail, business contact, or a technical field had similar measured interests; but the test supported only a third of those who claimed dominant scientific, social service, and verbal-linguistic interests (Super & Crites, 1962, P. 437-441).

The counsellor must not assume that inventory scores are more valid than expressed interests. When claimed and inventoried interests disagree, the counsellor will want to make sure that the
expressed interest is based on mature consideration, but he would be unwise to dismiss it as 'wrong'. On the whole, the interest inventory is used almost entirely in academic and vocational counselling.

From the above discussion, it seems justifiable to infer that when other factors are held constant, when the congeniality of the activity affects industriousness and when appropriate criteria are used, interest is moderately related to educational and vocational success. In this context I have studied the relation between interest and achievement in physical science of 207 students of 12 Higher secondary schools. I found the coefficient of correlation in general i.e. 0.49, which is positive and significant and it corroborates the results of investigators such as K.G. Rastogi, A.K. Bardhan, E.K. Strong, Kuder, Frederiksen and Melville. The coefficient of correlations between interest and educational achievement are also determined schoolwise. It shows that the degree of correlation varies from 0.19 to 0.86. From this picture it is clear that interest is obviously a necessary factor in counselling a subject either in vocational or educational guidance. Of course it does not play a vital role in the guidance programme but it cannot be avoided.

Thirdly, with regard to the issue concerning the relation between the mental ability and the interest the coefficient of correlation is not only positive but significant at both the levels.
The correlation is determined schoolwise which shows that the degree of correlation varies from 0.33 to 0.83. But when the entire sample was taken into consideration the coefficient of correlation was found to be high (i.e. 0.58). However, interest and mental abilities are not same thing. Interests never become entirely fixed. It helps a student choose lines of training, but in that training and subsequent experience he will modify his interests and make further career decisions. Therefore, 'a person with interests and abilities suitable for an occupation can and will do well in it, a person with suitable abilities but unsuitable interests can do well but may not, and a person with low aptitude will do badly'. On the whole, the findings of the coefficient of correlation between mental ability and interest have been corroborated by several investigators. K.G. Rastogi (Raj. Uni. 1964) studied the relation between intelligence, interest and achievement in English and Science of high school students. Results revealed that the relationship between intelligence and interest was found to be significantly positive. Secondly a combination of intelligence and interest was a better predictor of achievement in English and in Science than either interest or intelligence alone.

However, it is important not to confuse measures of interest and ability. 'Interest measures tells us nothing directly about

Differential ability tests are used for institutional decisions and for individual decisions (Cronbach & Gleser, 1965). Such decisions (Career guidance, for example) make far less use of statistical rules and far more of psychological interpretation. As a person goes through school and into his first jobs, he has many occasions to narrow his field of concentration or even to transfer to a new one. In high-school courses and introductory college courses he develops new aptitude and interests. Workers change position or change responsibilities within the same establishment. The engineer in a technical firm, for example, may become a manager, a salesman, a creative designer or an expert on specifications. Wise choice requires self understanding. Kelly's (E. Kelly in Gee & Cowles, 1957, PP. 185-196) data illustrate that interest scores shed some light on the role the person is likely to perform within his profession. Strong scores were used as predictors of these criteria. The highest correlations with the rating on service orientation were carpenter, 0.44, and sales manager, -0.42. Other scales having positive correlations between 0.30 and 0.39 were Industrial Arts Teacher, Math-Science Teacher, Physicist and Dentists; Advertising man, CPA, and the Strong keys for sales occupations had negative correlations. Helson (1966) studied college senior girls known to the faculty for creative achievements in art, science etc. So Strong was the relation (r = 0.58) that Helson made all her further comparisons within the group reporting such childhood interests. Similar
findings come from a retrospective study of male engineers well into their careers (S. Klein & Owens, 1965). The criterion was predicted with validities 0.25 to 0.30 by test of mechanical ingenuity given to the men in college ten years before.

The determination of aptitude for any job would require tests of specific abilities, personality, general mental ability, observations by skilled observers, mental and physical records. Emphasis should be given not to weaknesses and to lack of abilities so much as to strengths and to presence of abilities. Aptitude tests that are reasonably valid for workers on the job may not be valid for guidance into an occupation; aptitudes cannot adequately be determined on the basis of success in or aptitude for success in the training programme.

Significant symptoms of aptitude may be found in what a person says about his interests. These expressions do not always correctly represent his actual interests, nor do his real vocational interests always correspond with his capacity to perform. It is the fact that achievement is the resultant of aptitude and interest.

From the above discussion it is clear that for the school or college guidance counsellor, aptitude tests are useful in so far as they permit him to forecast the general field of work for which a student will be able to complete training and in which he will
It has also been found that both aptitude and interest of an individual are best determining factors in educational and vocational field rather than interest alone. I have studied the relation between the aptitude and interest in Physical science of 207 students and the result revealed that it was positively significant (i.e. 0.58), which also corroborated the result of Carrol, Sapon, Kelly, Strong and other investigators. I also studied the correlation between aptitude and interest schoolwise, it shows that the degree of correlation varies from 0.36 to 0.79. From this it is realised that in between the aptitude and interest, the former is indispensable or highly responsible for the improvement of educational and vocational efficiency. Of course aptitude and interest both in a combined way show high predictive value.

Finally, in regard to the issue concerning the relative importance of ability, interest and aptitude in predicting academic success with special reference to physical science I would like to discuss here the coefficient of multiple correlation between achievement test in physical science and ability, interest and aptitude, which is not only positive but significantly high (i.e. 0.58). But when the multiple correlation is separately studied it is revealed that the coefficient of correlation between achievement in physical science and combined ability & interest, ability & aptitude, aptitude & interest are 0.72, 0.74 and 0.64 respectively.
The above findings are corroborated by other investigators such as K.G. Rastogi (1964), who found that the relation between intelligence and interest in English was significantly positive. He also found that intelligence and interest were related more with achievement than between each other. Lastly it is revealed by Rastogi that 'a combination of intelligence and interest was a better predictor of achievement in English and in science than either interest or intelligence alone'. The study was conducted by M.A. Syed (Phy. Amu, 1967) on a sample of doctors, engineers, lawyers & teachers and the result revealed that subjective consideration of suitability, interest and ability were the basis of occupational choice. A. Kaur (Raj. Uni., 1970) also studied and constructed a battery of tests to collect information about students' abilities, aptitudes and interests in order to suggest suitable procedure which would help teachers and counsellors for giving guidance to students. Liddle (1965) & Parikh (1964) prepared a scholastic aptitude test for admission to preparatory science course. The test consisted of three subtests on English, numerical ability and abstract reasoning. The reliability coefficients for each subtest as well as the total test ranged between 0.83 and 0.89. The concurrent validity coefficients against scholastic achievement in terms of total scores ranges from 0.464 to 0.766.

From the above discussion it can be inferred that ability, aptitude and interest are to be taken into consideration before counselling a student. I studied more than two hundred students of higher secondary schools and made out the result of scientific aptitude, ability and interest tests, and their correlations with the achievement test in physical science. I also found the results of the coefficient of multiple of correlation between those tests and achievement test in physical science. The obtained results are not only positive but highly significant at the same time.