Chapter - 2

THE CONCEPT OF INTELLIGENCE

Definitions

A number of definitions have been put forth by different psychologists to explain the concept of intelligence, but no two of them have agreed upon any. Terman defined intelligence as an ability of abstraction. He said that a man is intelligent in proportion to his ability to carry on abstract thinking. Colvin considered intelligence as a group of innate capacities by virtue of which the individual is capable of learning in a greater or less degree in terms of those innate capacities with which he is endowed. Wechsler defined intelligence as "the aggregate or global capacity of the individual to act purposefully, to think rationally and to deal effectively with his environment." (Patel, L.K., p.30). Wechsler’s definition adds many things in addition to the intellectual factors. Stoddard has also likewise added many non-intellectual factors in his definition of intelligence, viz. "Intelligence is the ability to undertake activities that are characterized by (1) difficulty, (2) complexity, (3) abstractness, (4) economy, (5) adaptiveness to a goal, (6) social value, (7) the emergence of originals, and to maintain such activities under conditions that demand a concentration of energy and a resistance to emotional forces." (Patel, L.K., ibid).

Somebody has even defined intelligence in terms of intelligence tests, saying that intelligence in terms of intelligence tests measure. Thus definitions of
intelligence do not clarify the concept of intelligence, but on the contrary create confusion.

**Connotation of IQ**

Common people consider IQ as a measure of intelligence. They do not distinguish among IQs measured by different intelligence tests. In fact different tests of intelligence have different spreads or SDs. In Cattell’s tests, the SD of the test scores is very big with the result that the IQs of college students would be greater than the genius group as per Stanford-Binet tests. Secondly, common people consider IQ to be constant. If it were so, the graph of intelligence tests scores against ages should be a straight line, but even till 13 or 14 it is not a straight line, but a curved line. Measurement psychologists have found that IQ deteriorates after a certain age. Wechsler has also found that IQ deteriorates after 45 years or so.

In fact tested intelligence should be regarded as a descriptive rather than an explanatory concept. IQ should be considered as the level of ability at a certain point of age. (Anastasi, p.362).

Moreover, intelligence as measured by tests, is not a simple, unitary ability, but a composite of several different abilities, which is evident from types of tests of intelligence. Typical intelligence tests can be regarded as measures of
scholastic aptitude or academic intelligence (Anastasi, p.363). The IQ is both a measure of prior educational achievement and prediction of future educational performance. However, IQ is not a measure of all achievements such as mechanical, motor, musical or artistic aptitudes. IQs have good correlation with academic achievement in common school subjects excluding art or music.

**Hereditary Influences on Intelligence**

How much part heredity plays in intelligence is a controversial subject. Psychologists like Burt and Jenson have laid greater emphasis on the role of heredity in intelligence, while communists like Russians do not ascribe so much importance to heredity. Even in studies involving twins, the inclusion of more or less monozygotic twins, makes a great difference in sampling and consequently in the results. Rise or drop in IQ results from environmental changes in a child's life. Major changes in family structure, rise or drop in family income and adoption in a foster home do produce conspicuous changes in IQ.

Lately, worldwide programmes for the development of intelligence have been witnessed during late '70s and throughout '80s. An international editorial board of the Human Intelligence International Newsletter provides a quarterly report on cognitive research and its educational applications. In Venezuela, a 10-year programme was systematically implemented under government sponsorship for the development of "thinking skills" from infancy to old age (Anastasi,
Planned interventions at infant and pre-school levels yielded significant results. At later years also, several programmes have been effected with encouraging results in many countries. Mentally retarded children and adolescents have also shown significant gains by several investigators. Thus IQ can be improved has been shown positively by many educators at different places of the world.

**Motivation and Intelligence**

Cognitive skills like intelligence and aptitudes are affected by several personality traits like motivation. A person’s performance on an intelligence test like his performance in school, on the job, etc. is affected by his achievement drive, persistence, value system, emotional thwarting and other personality factors. The individual’s performance on any type of test is influenced by his interests, attitudes, self-concept and attention given to the teacher. One of the ways of how the motivation and other affective variables contribute to the development of intelligence is through the amount of time, the individual spends on a particular activity relative to other activities requiring the individual’s attention. Atkinson and his colleagues formulated - Comprehensive scheme representing the inter-relationships of abilities, motivation and environmental variables. One of the important concepts in this scheme is time devoted by the person to studying or carrying out a job-oriented function. Motivation affects both the efficiency with which a task is performed and the time spent on it in relation to other activities.
Another important component of Atkinson’s scheme is the lasting cumulative effect of task performance on the individual's cognitive and motivational development. It represents a feedback to the individual's cognitive and personality traits. Control of attention given to a particular task serves to intensify the effect of time devoted to relevant activities which increases development of his intelligence. In a way, all abilities and personality traits constitute a spiral in which both influence each other. Studies of the environmental mastery in the infancy reveal some promising relations to subsequent measures of intellectual competence.

Research studies on infancy lead towards a rapprochement between the study of affective and cognitive developments. It helps to bring about a more integrated utilization of affective and cognitive data in the interpretation of test results at different age levels.

While various definitions of intelligence were put forth by different psychologists and while the stability of IQ was being challenged, several theories of explaining intelligence were being initiated by some psychologists. The chief among these theories was Spearman’s Two Factor Theory.

**Spearman's Two Factor Theory**

In a number of researches based on intelligence tests, Charles Spearman, a British psychologist, could see the following pattern of diagonal correlations.
TABLE - 1
Matrix of Inter-Correlations of Four Hypothetical Tests

<table>
<thead>
<tr>
<th>Tests</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-</td>
<td>$r_{12}$</td>
<td>$r_{13}$</td>
<td>$r_{14}$</td>
</tr>
<tr>
<td>2</td>
<td>$r_{21}$</td>
<td>-</td>
<td>$r_{23}$</td>
<td>$r_{24}$</td>
</tr>
<tr>
<td>3</td>
<td>$r_{31}$</td>
<td>$r_{32}$</td>
<td>-</td>
<td>$r_{34}$</td>
</tr>
<tr>
<td>4</td>
<td>$r_{41}$</td>
<td>$r_{42}$</td>
<td>$r_{43}$</td>
<td>-</td>
</tr>
</tbody>
</table>

It was observed in such tables of correlations that the subtraction of the products of the two diagonal ends tend to be zero.

\[(\gamma_{12} \times \gamma_{34}) - (\gamma_{14} \times \gamma_{32}) = 0 \text{ and so on}\]

or

\[\frac{\gamma_{12}}{\gamma_{14}} = \frac{\gamma_{32}}{\gamma_{34}}\]

This is called a tetrad equation in which the differences of the products of all diagonal ends vanish. Spearman showed that this happen because in those tests, there is one general factor $G$, and the remaining is a specification, a factor that is specific to that activity or test. $G$ is not equivalent to intelligence, but common people consider it a general intellectual factor. In Spearman's own words, "All branches of intellectual activity have in common one fundamental function (or group of functions), whereas the remaining or specific elements of the activity seem in every case to be wholly different from that in all others." (Desai, p.24).

Schematically it can be represented thus -

![Diagram]
He believed that this general factor common to all intellectual activities is innate or inborn or hereditary and the remaining portion of each activity is due to different specific factors, $S_1$, $S_2$, $S_3$, $S_4$ and $S_5$. Being innate, $G$ does not change during the life time of the individual and $S$ factors are educable.

The main criticism against Spearman’s two factor theory was that the tetrad equations in actual practice do not vanish nor have small magnitude, but many times, they show a appreciable magnitude. So some other theories were put forth to account for this phenomenon.

Even then some modern day psychologists like Cattell and J.C. Raven profess themselves to be Spearmanite.

**Group Factor Theory**

When all tetrads were not found vanishing, some psychologists like E.L. Thorndike and Godfrey Thomson put forth a group factor theory, saying that some specific factors cover broader ground and so they may be termed group factors. V-verbal factor, n-numerical factor, K-space factor were thus found common to many tests and so they were called group factors. Some psychologists even found among those group factors, some major group factors and some minor group factors. Philip Vernon summarised them as follows (Vernon, 1951):
Godfrey Thomson postulated that the G-factor is not always to be assumed, but that the human mind is capable of holding many small abilities. When a certain act is to be performed, a sample of these abilities are called into play and when another activity is to be performed another sample of abilities is called into play. Thus the abilities required for one activity and those for another activity may have some in common or it is possible to assume two widely different activities having in common no ability. In the first case, there will be some correlation between those two activities, whereas in the second situation, there will be no correlation. Thus it is not necessary to assume the existence of G-factor at all; only group factors could explain the phenomenon. Schematically, the sampling theory can be shown like this.

**Ability Factors**

<table>
<thead>
<tr>
<th>G</th>
<th>Major group factors</th>
<th>Minor group factors</th>
<th>Specific factors</th>
</tr>
</thead>
</table>

**Sampling Theory**
Activities A and B call into play a sample of many small abilities which have some common. Activity C does not have any abilities common with activity A or activity B. Godfrey Thomson demonstrated this with the creation of a number of tests, some of which covered common ground and some nothing in common.

**Multiple Factor Theory**

L.L. Thurstone in the U.S.A. demonstrated with his tests of primary mental abilities, the absence of any general factor. In his work he found out some group factors which he termed as "Multiple" factors which did not have anything
Guilford's Revised Mo. 1 of the Structure of Intellect
in common. In the primary mental abilities he could separate V-Verbal, P-Perceptual Speed, I-Inductive Reasoning, N-Number, M-Ro[fc] Memory, D-Deductive Reasoning, W-Word Fluency and K-Space or Visualization. Later on he found out Second Order Factors of which, as he said, G may be one. He described primary factors as 'facilities' in the mind or 'media of expression' and second order factors as more central (Vernon, pp.20-21).

The Structure of Intellect (SOI) Theory

J.P. Guilford postulated entirely a different theory of abilities which he called the structure of intellect model. It was a three dimensional model with three components - (i) Contents, (ii) Products, and (iii) Operations. In the beginning he assumed 4 aspects of contents, 6 of products and 5 of operations - in all 120 abilities, but later on he revised it to have $5 \times 6 \times 6 = 180$ abilities (see diagram).

Guilford's theory has not been universally accepted, although many of his followers have tried to apply it to formulate tests of different abilities. Some people claim to have prepared about 80 to 100 tests of abilities Guilford has enunciated.

Cattell's Assumption of Two G's

Cattell was an ardent believer in Spearman's theory. But he has conceived two different types of G, viz. $G_e$ and $G_f$. $G_e$ is the general factor found with
concrete tasks. Performance tests need this ability. $G_r$ is fluid intelligence which is abstract. Tests which need abstraction of ideas need $G_r$ more than $G_c$.

**Jensen's Controversial Hypothesis**

A. R. Jensen, a psychologist teaching in the university of California wrote an article in Harvard's Journal in 1972 which raised a big controversy in many parts of the world. He hypothesized that those people who have recently seen the present culture are as good as those who have a long history of culture, in $G_r$, but they may be deficient in $G_r$ compared to those with long period of culture. He found that black students of America whose background is hardly of 300 years of culture lag behind the white students whose ancestors had a long period of culture in tests needing $G_r$ or fluid intelligence, although both were found nearly equal in tests of $G_c$ or performance tests. This hypothesis lays emphasis on the role of heredity which many psychologists have disputed. This controversy still goes on and has not been resolved yet.

**Brand's Book**

Recently a news item has appeared in the newspapers that a Professor of Psychology in the University of Edinburgh, Christopher Brand made some provocative comments on race differences in IQ, resulted in a demand for his dismissal from the university and his book, titled *The G-Factor* which was to be published by John Wiley has been withdrawn from publication by the publisher.
on the eve of its publication. The university, however, has supported the professor for his academic freedom.

University of Edinburgh is now contemplating to close down its Centre for Human Ecology wherein Professor Brand works, of course, for some other reasons (Times of India, Ahmedabad Edition, 26-5-96, p. 8).