UNIT-II
INTELLIGENCE AND ITS THEORIES

- Concept of Intelligence & I.Q
- Two factor theory, Group factor and Multi factor theory (Spearman, Thorndike & Thurstone)
- Verbal, Non-verbal and Performance test (Simon-Binet Scale, Cattel’s Culture Fair Test & Bhatia Battery Test).
- Creativity- Concept, Characteristics and its Nourishment
- Multiple Choice questions

CONCEPT OF INTELLIGENCE AND I.Q

Intelligence is defined as general cognitive problem-solving skills. A mental ability involved in reasoning, perceiving relationships and analogies, calculating, learning quickly etc. Intelligence, the dictionary says is the ‘ability to learn or understand or to deal with new or trying situations’. So, intelligence is the mental quality that consists of the abilities to learn from experience, adapt to new situations, understand and handle abstract concepts, and use knowledge to manipulate one’s environment. Some famous definitions of intelligence are as under.

Definitions

1. David Wechsler (1972), “Intelligence is the aggregate or global capacity of the individual to act purposefully, to think rationally and to deal effectively with his environment”.
2. Francis Galton (1884), “Intelligence is the innate general cognitive capacity”.
3. Lewis Terman (1921), “Intelligence is the ability to think abstractly”.
4. E.G. Boring (1923), “Intelligence is what the intelligence tests test”.
5. Jean Piaget (1952), “Intelligence is a particular instance of biological adaptation”.
6. S.B.A. Gul (2013), “Intelligence is the collection of mental abilities”.

So, in short we can conclude the concept of intelligence is very comprehensive. Earlier it was believed that there was one underlying general factor at the intelligence base (the g-factor), but later psychologists maintained that it is more complicated and could not be determined by such a simplistic method. Some psychologists have divided intelligence into subcategories. For example Howard Gardner maintained that it is comprised of seven components: musical, bodily-kinesthetic, logical-mathematical, linguistic, spatial, interpersonal, and intrapersonal. Other definitions are: “Intelligence is what you do when you don’t know what to do.” “Intelligence is a hypothetical idea which we have defined as being reflected by certain types of behaviour.”

How do you measure intelligence?
**Intelligence Quotient (IQ):** This is a mathematical formula that is supposed to be a measure of a person’s intelligence. When it was first created, it was defined as the ratio of mental age (MA) to chronological age (CA) multiplied by 100. For example, if a 20 year old answers the questions like a “typical” or “average” 20 year old would, the person would have an IQ of 100 (20/20 x 100 = 100).

\[
\text{IQ Score} = \frac{\text{MA}}{\text{CA}} \times 100
\]

**Mental age (MA):** the typical intelligence level found for people at a given chronological age.

**Chronological age (CA):** the actual age of the child taking the intelligence test.

- People whose mental age is equal to their chronological age will always have an IQ of 100. If the chronological age exceeds mental age – below-average intelligence (below 100). If the mental age exceed the chronological age – above-average intelligence (above 100).

![Normal Distribution of IQ Scores](image)

The normal distribution: most of the population fall in the middle range of scores between 84 and 116.

- Very Superior Intelligence (gifted) - Above 130
- Superior Intelligence - 120 to 129
- High Average Intelligence - 110 to 119
- Average Intelligence - 90 to 109
- Low Average Intelligence - 80 to 89
- Borderline Intellectual Functioning - 71 to 79
- Mild Mental Retardation - 55 to 70
- Moderate Retardation - 40 to 54
Severe Mental Retardation - 25 to 39

Profound Mental Retardation - Below 25

THEORIES OF INTELLIGENCE

Spearman’s Two-factor Theory of Intelligence

It was developed in 1904 by an English Psychologist, Charles Spearman, who proposed that intellectual abilities were comprised of two factors: one general ability or common ability known as ‘G’ factor and the other a group of specific abilities known as ‘S’ factor. ‘G’ factor is universal inborn ability. Greater ‘G’ in an individual leads to greater success in life. ‘S’ factor is acquired from the environment. It varies from activity to activity in the same individual. In addition to ‘G’, there are so many ‘S’ factors found in a person. Viewed from the practical performance an individual is guided by both ‘G’ and ‘S’. Every activity involves some amount of ‘G’ factor and one of the ‘S’ factors. The mass of ‘S’ is unlimited. Theoretically each individual demonstrates endless types of ‘S’. On the one hand amount of ‘G’ is fixed and permanent in an individual, whereas the strength of ‘S’ factor depends on experience and training of an individual. All actions are determined by both ‘G’ and ‘S’. Amount of ‘G’ varies from individual to individual but it is fixed in each person whereas amount of ‘S’ factor varies within the individual.

In this way, Spearman found high degree of co-relation between ‘G’ and ‘S’ factors but very low degree of co-relation among different ‘S’ factors within the individual.

Characteristics of ‘G’ Factor:
1. ‘G’ factor/General Intelligence is inborn and does not change as a result of training or education.
2. It is a central factor which supplies energy to all the ‘S’ factors.
3. It is constant in the sense that for any individual in respect of all the co-related abilities, it remains the same.
4. The amount of ‘G’ differs from individual to individual.
5. It is used in every life activity, therefore, success or failure of an individual in life is greatly determined by the amount of his ‘G’ factor.

**Characteristics of ‘S’ Factor:**
1. ‘S’ factor is learned and acquired in the environment.
2. The amount of ‘S’ factor can be improved through experience and training.
3. The amount of different ‘S’ factors varies within the individual.
4. ‘S’ factor serves as the base for the aptitude and interest of an individual for a particular kind of work or occupation.
5. ‘S’ factors determines the field of life of an individual.

**Educational Implications:**
Following are the educational implications of two factory theory of intelligence:

1. **Giving Intelligence Test:** In order to know the level of general intelligence of the students, teacher should administer the standardized test of intelligence on the students.
2. **Differential Aptitude Test Battery:** In order to know the strength of ‘S’ factors among different students teacher should administer the Differential Aptitude Test Battery to the students.
3. **Classification of Students:** The students should be classified in different sections on the basis of their level of general intelligence as well as on the basis of ‘S’ factor. In simple words the students having the strong mechanical ability should be kept in one group. Students having good verbal ability should be kept in other group and students having strong numerical ability should be kept in other group.
4. **Diversified Curriculum:** In order to cater to the educational needs of the students having different levels of general intelligence as well as different specific mental abilities, a diversified curriculum should be introduced so that all the students may opt for the subjects and activities as per their abilities.
5. **Psychological Methods of Teaching:** Teacher should apply the psychological methods of teaching keeping in view the level of general intelligence of the students as well as the strength of their ‘S’ factor.
6. **Co-curricular activities:** Various types of co-curricular activities suitable to the children having different levels of general intelligence as well as having different types of specific mental abilities should be organized in the educational institutions.
7. **Admission to various courses**: Admission to various courses should be given to the students on the basis of the level of their general intelligence as well as their specific mental ability or 'S' factor.

8. **Guidance and Counselling**: In order to help the students in making the right selection of the subjects, activities and opportunities at right time as well as for helping them in solving their personal, social and educational problems efficiently.

9. **Provision of Training to the Teachers**: Necessary training should be imparted to the teachers for educating the students having different types of specific mental abilities.

**THORNDIKE’S MULTI-FACTOR THEORY OF INTELLIGENCE**

Thorndike was an associationist and he opposed the theory of General intelligence. He proposed that these are Specific stimuli and Specific response. According to him, Intelligence is nothing more than a convenient name for almost infinite number of actual or potential specific connections between these stimuli and responses. According to this theory intelligence is said to be constituted of multitude of separate factors or elements each being a minute element or ability. A mental act involves a number of these minute elements operating together. If any two tasks are correlated, the degree of correlation is due to the common elements involved in the two tasks. Thorndike distinguished 4 attributes of intelligence. They are: Level, Range, Area, and Speed.

- **Level**
  This refers to the difficulty of a task that can be solved. If we think of all test items arranged in a sequential order of increasing difficulty, then the height that we can ascend on this ladder of difficulty determines our level of intelligence.

- **Range**
  This refers to the number of tasks at any given degree of difficulty that we can solve. Theoretically an individual possessing a given level of intelligence should be able to solve the whole range of task at that level. Range is determined not only by Level but also by the breadth of experience and by opportunity to learn. In intelligence tests range is represented by items of equal difficulty.

- **Area**
  It refers to the total number of situations at each level to which the individual is able to respond. Area is the summation of all the ranges at each level of intelligence processed by an individual.

- **Speed**
  This is the rapidity with which an individual can respond to items. Speed and altitude are positively related. Speed is much closely bound up with altitude than are the other attributes. We should not therefore emphasis speed too much in our intelligence test.
Author of the theory assumed that intelligence involves three mutually independent abilities:

- **Abstract intelligence**: the ability to verbal and symbolic thinking.
- **Mechanical intelligence**: the ability to effectively control your body and manipulate objects
- **Social intelligence**: the ability to communicate with people, understand and perform in social relations

Thorndike came up with his model in 1920, when psychology was dominated by the concept of intelligence as a universal factor. As one of the first realized significant limitations of this approach and proposed a model consisting of three mutually independent components.

**Use of the Thorndike’s Intelligence Theory in practice**: In human resource management it is used in job creation and staffing - in job analysis. The individual components are relatively independent of each other. During various work tasks and activities, different forms of intelligence apply in different degrees.

**Thurstone’s Group factor theory or Primary Mental Ability Theory of Intelligence**

An eminent American Psychologist ‘L.L. Thurstone’ advanced a theory of intelligence called Primary Mental Ability Theory of Intelligence in 1938. Thurstone was of the opinion that intelligence is neither the combination of ‘G’ and ‘S’ factors as propounded by Spearman nor a haphazard collection of several mental abilities as advanced by Thorndike.

Thurstone gave this theory after using 56 different tests ranging from 2 to 20 minutes in duration of 240 students of Chicago University. On the basis of factorial analysis, he found that intelligence is comprised of seven primary mental abilities. Thurstone concludes that certain mental operations have a common primary factor that gives them psychological and functional unity and also differentiates them from other mental operations. These mental operations constitute a group. A second group of mental operations has its own unifying primary factor.
and so on. In all there are seven such groups which cover the entire range of mental abilities. Each of these primary factors is independent of others.

**Description of Primary Mental Abilities:**

According to Thurstone, these seven primary mental abilities are:

1. **Verbal Comprehension:** It is the ability to understand and use verbal relations, words and ideas. In other words, it is the ability to use words in planning, thinking and communication.
2. **Numerical Ability:** It is the ability to do calculations quickly and accurately.
3. **Word Fluency:** It includes the use of vocabulary and communication skills.
4. **Memorising Ability:** It is the ability to retain the learnt material in the mind for long time and recall it spontaneously.
5. **Spatial Ability:** It is the ability to visualise objects in space.
6. **Perceptual Ability:** It is the ability to perceive objects accurately
7. **Reasoning Ability:** It is the ability to understand or judge the things with the help of signs and symbols. It may be inductive or deductive.
   a) Inductive Reasoning Ability - It is the ability to proceed from specific to general.
   b) Deductive Reasoning Ability - It is the ability to proceed from general to specific.

**Educational Implications:**

In the light of Thurstone’s Primary Mental Ability Theory of Intelligence following steps should be taken in Education -

1. **Giving the Intelligence Tests:** In order to see the strength of different primary mental abilities in the students’, teacher should administer the standardized intelligence test on the students.
2. **Classification of the Students:** The students should be classified in different categories/sections on the basis of their primary mental abilities.
3. **Diversified Curriculum**: In order to help the students to opt for the subjects and activities according to their primary mental abilities, a diversified curriculum should be introduced in the educational institution.

4. **Co-curricular activities**: In order to develop the different primary mental abilities among the students, various types of co-curricular activities should be organized in the educational institutions.

5. **Providing Freedom**: In order to give full expressions to the innate potentialities, talents and abilities, maximum freedom should be given to the students.

6. **Introduction of creative activities**: Some creative activities like art and craft, drawing, painting, music, singing, dancing, dramatics, clay modelling and such other activities should be introduced in the curriculum for developing different primary mental abilities of the students.

7. **Admission to various courses**: Admission to various courses should be given on the basis of the strength of the primary mental ability of the students.

**INTELLIGENCE TESTS**

**Verbal and Non-verbal tests of Intelligence (Simon-Binet Scale, Cattel’s Culture Fair Test & Bhatia Battery Test)**

Intelligence is measured through a complicated process. It involves a comparison and establishment of relationship between C.A (Chronological Age) and M.A. (Mental Age). This relation is expressed by I.Q. (Intelligence Quotient). When the mental age is divided by the chronological age and the quotient is multiplied by 100, the result is I.Q.

\[ I.Q. = \frac{M.A}{C.A} \times 100 \]

So, to measure the mental age and chronological age we are having intelligence tests. Intelligence tests are classified according to the activities prescribed in them. These are as follows:

1. **Verbal Tests**: Verbal intelligence tests include items that can be expressed in language forms. In this test, you are given a large no of questions which you have to solve in a very short period of time.

2. **Non-Verbal Tests**: Non-verbal intelligence tests are expressed by means of objects, materials, for instance, lines, drawing, pictures, etc. The same procedure is followed in this test too, you are given a no of questions which you have to solve in mean time.

As the name itself suggests, verbal tests make use of language whereas non-verbal tests include such activities which do not necessitate the use of language. Both these types are suitable for the individual as well as the group. Consequently, verbal and non-verbal tests are capable of further sub-division into two classes - individual and group. Thus finally there are four groups of intelligence test:
The first successful test of intelligence was developed by French psychologist Alfred Binet in response to a request by French public school officials for a test that could identify school children at risk of falling behind their peers in academic achievement. The result was the Binet-Simon intelligence test.

The Binet-Simon test consists of a variety of items intended to reflect knowledge and skills which the average French school child of a given age would have. These items are graded in difficulty according to age, so that, for example, items the average twelve-year-old would be able to answer, a younger child would tend to miss. The test is administered individually, one-on-one, by a person trained to do so, and requires about two hours to complete.

The scoring of the test produces a number called the child's mental age. The mental age reflects the level at which the child performed the test — if the child performed at the level of the average ten-year-old, for example, then the child would be assigned a mental age of ten, regardless of the child's chronological age (physical age). One compares the child's mental age to his or her chronological age. If the mental age is the same as the chronological age, then the child is average. If the mental age is higher than the chronological age, then the child is mentally “advanced” or gifted. If the mental age is lower than the chronological age, then the child is mentally “retarded,” or behind his or her peers in intellectual development.

The Binet-Simon test and its successors measure intelligence by assessing intellectual skills and knowledge. They assume that the individual has had the opportunity to learn these skills and knowledge; if the person had the opportunity to learn them and did not perform well, then this is assumed to reflect a deficit in intelligence. On the other hand, if the person has not had the exposure needed to learn these things, the failure to demonstrate knowledge of them says nothing about the person's intelligence. Ignoring this truth has led to some unwarranted conclusions being drawn based on test results.

Cattell's Culture Fair Test of Intelligence

The Culture Fair Intelligence Test (CFIT) was conceived by Raymond B. Cattell in 1920s. It is a nonverbal instrument to measure your analytical and reasoning ability in the abstract and novel situations. The test includes mazes, classifications, conditions and series. Such problems
are believed to be common with all cultures. That’s the reason that the testing industry claims it free from all cultural influences.

The culture fair is a high speed IQ test. The full scale is to be resolved in less than one hour. When you ignore the speed factor, your results can be misleading and even dangerous to your career efforts.

The culture fair intelligence test has gone through many revisions since its inception. The latest revision was made in 1961 and since then very smart and minor changes have been introduced. Currently you can find three scales of the culture fair IQ test.

The first scale of the culture fair test is used for children (4-8 years) and those who are mental retarded. This scale is not important for your career building efforts. However, the scale number 2 and 3 are used for screening purposes at job and college admission situations. So, the remaining part of this page shall focus upon the common features of these two scales of the culture fair intelligence test.

**Two Forms of the Culture Fair Intelligence Test**

The scale 2 and 3 contain two equivalent forms as A and B with the following features.

- Each form can be administered individually or with combination of the other form. When it is administered individually, it is called short intelligence test. However, when both forms of a scale are combined, it is called a full scale test.

- Each form is comprised of four sub-tests: series, classifications, matrices and conditions. Each sub-test is preceded by several practice questions. You are offered a booklet of eight-pages of multiple choice questionnaires.

**Bhatia Battery of Performance Test of Intelligence**

Bhatia's Battery of Performance Test of Intelligence was constructed by C. M. Bhatia in 1955. This test was developed to test the Intelligence of Indian Population. This is a performance test of intelligence and consists of a battery of 5 sub-tests, namely: Koh’s Block Design Test, Pass-along Test, Pattern Drawing Test, Immediate Memory, and Picture Construction Test.
1. **Koh’s Block Design Test**: This battery includes 10 designs from the original 17 designs from the Koh’s test. The time for first five designs is 2 minutes and for the remaining five, the time is 3 minutes. The cards with a variety of coloured designs are shown to the test taker and he is asked to reproduce them using a set of coloured blocks. Performance is based not just on the accuracy of the drawings but also on the examiner's observation of behaviour during the test, including such factors as attention level, self-criticism and adaptive behaviour (such as self-help, communication, and social skills).

2. **Alexander Pass-along Test**: All the designs of the original test are included in this battery. The first four of these have to be completed in two minutes and the rest of the four have to be completed in 3 minutes.

3. **Pattern Drawing Test**: This test is constructed by Bhatia. This test includes eight cards. Every card has a pattern and the subject is required to draw these patterns in one go without lifting the pencil. The time for the first four cards in 2 minutes and for the rest of the four cards it is 3 minutes.

4. **Immediate Memory**: This test has two parts: digit span forward and digit span backward. The test taker is required to repeat the numbers the examiner says. The number of digit is increased on every trail. The test is continued till the subject repeats it successfully in the same order. This is digit span forward. In the backward recall, the numbers are repeated in the backward position, from the last to the first. This recall is also continued till the subject successfully repeats the sequence.

5. **Picture Construction Test**: This test requires the subject to construct a picture that is given in parts. The parts are to be meaningfully combined to construct the picture. The time for first two pictures is 2 minutes and the rest of the three pictures it is 3 minutes.

Individual administration of this test takes less than one hour. Maximum 95 marks can be obtained in the complete test. Maximum marks for the 1st, 2nd, 3rd, 4th, and 5th test are 25, 20, 20, 15, 15 respectively. The main objective of the test is to measure the intelligence of children and less educated or illiterate Indians. The norms for the test have been obtained for the boys of 11 and 16 years. Later, the norms for girls have also been obtained.
CREATIVIVY: CONCEPT, CHARACTERISTICS AND ITS NOURISHMENT

Creativity was believed to be a gift of God bestowed on highly talented people and geniuses. Therefore, the view that the very intelligent or very superior people would also be creative was held. Creativity was regarded as a rare quality of distinguished individuals. A creative person has an inborn talent. The relationship between creativity and intelligence is neither linear nor curvilinear. For a long time creativity was considered to be associated with artistic individuals who have been distinguished in various fields as painters, sculptors or writers. Creativity is distinguished by novelty, originality and is unusually inventive. Creativity is the power of the mind to form new ideas and thoughts. It helps you imagine something new and special. For example drawing, painting, writing, comes from being able to wonder, appreciate and think about things and be inspired by them. For example if you draw well and you see a beautiful painting, you begin to wonder at its beauty. You ask yourself why you should not paint something as beautiful as the picture you have seen. Next day, you begin to draw or paint something of your own which is more beautiful than that you have seen. This is your creativity. So creativity brings out something special in you. Now, you must be clear about the concept of creativity.

Definitions of Creativity
Drevdhal, J. E: “Creativity is the capacity of a person to produce compositions, products or ideas which are essentially new or novel and previously unknown to the producer.”
Mc Kinnon: “Creative is a process extended in time and characterized by original adaptiveness and realization.”
Taylor: “A process is creative when it results in a novel work that is accepted as tenable, useful or satisfying by a group at a point in time.”
Torrance: “Creativity is a process sensing gaps or disturbing missing elements, forming ideas or hypotheses communicating the result, possibly modifying and re-testing hypotheses.”

Characteristics of Creativity
1. In order to be creative, a person should be very well aware of the problems in his surroundings. A creative person is aware of the problems present in his surroundings and makes every effort to find out new solutions to these problems.
2. Dynamic Thinking- A creative person not only thinks creatively, but he will be having dynamic thinking. He has more capacity of adjustment.
3. The most important characteristic of creativity is divergent thinking. Divergent thinking involve continuity, flexibility, and originality. These qualities can be observed in the works of great scientists, philosophers and literary thinkers.
4. Besides being divergent, creativity leads to useful results. It is certain that a new idea gives immense pleasure to the thinker as creativity impresses every one. According to Bruner, a creative product must be impressive.
5. An important trait of creative thinking is flexibility of thinking and behaviour. The creative person is always prepared to adapt to new attitudes, ideas or behaviour.

6. Originality is an essential feature of creative thinking. A creative person is not confined to ideas or experiences. He uses new ideas, new attitudes and new methods.

7. In order to achieve the above mentioned traits of creative thinking, the creative person should have sufficient curiosity. It is due to curiosity that a person is anxious to know new things in any field. It is due to curiosity again that he seeks to utilize new methods.

8. An ordinary person is generally confined to his immediate environment and circumstances and hence cannot rise above it. A creative person on the other hand, has the ability to go beyond the immediate environment and show novelty in thinking and behaviour.

9. In order to find out new solutions, it is necessary that the problem should be looked from a new point of view. The object of thinking should be novel and valuable. Thinking should be divergent, highly motivated and constant.

**NOURISHMENT OF CREATIVITY**

Creativity is difficult for a lot of people to quantify; it’s a broad term, but an important skill. Creativity is what drives us as designers. Creativity and expertise is what makes the difference between an amateur and a professional. Creativity is usually a personal talent. And, the good news is: anyone can learn to be more creative in their work and life.

‘You can't wait for inspiration, you have to go after it with a club’

– Jack London

Education breeds knowledge, knowledge makes way for imagination and imagination takes on the path to creativity. A young mind is a power house as it strives to showcase what it has been carrying inside itself. When a person starts to comprehend the fact that the limitations set on the mind are nothing but illusions of fear, they unravel the mysteries of the mind and focus on finding their true self.

It is an era of self-development and self-awareness. Every single day, thousands of new ideas come into existence just because a few brilliantly wild yet disciplined students had the courage to think out of the box and look far beyond the normal course of things. They were not taught what to think rather they had the capability to analyze how to think about things. Education and training aims to provide the students with all the tools and resources that they need in order to disrupt the ordinary pattern of life and think of ideas that aspire to change the world and make it a better place. It’s a fact that when a fire is ignited in the mind to achieve something that seems impossible to achieve, that fire turns the mind into a golden sword that slashes away those self-doubts and turns you into a warrior who will fight and finish the battle.
Challenge is the mother of creativity. The more uncomfortable you get, the more imaginative your mind gets. As the students become part of the institute, their sense of innovation and the craft of creativity take a great jump towards the higher end of the spectrum. We should walk with our students to every possible extent and support their initiatives like a parent supporting the family. To believe that everyone on this planet has a creative thinker inside them and that’s how we can change the world; by believing that we are unique in our ideas yet connected in that uniqueness.