

Measurement of Human Intelligence

Ranjith Engu¹, Sairam Vakkalanka²

^{1,2} *Blekinge Tekniska Högskola, Karlskrona, Sweden-37179.*

Abstract—*This paper describes about the need for measuring the human intelligence, definitions and sub attributes of intelligence, different measures and measuring scales of human intelligence.*

Keywords—*Measurement, Intelligence, human intelligence, scales of measurement.*

I. INTRODUCTION

Intelligence is derived from mixture of inherited characteristic such as development or social characteristics. Usually, it is a combination of the acquired characteristics and environmental factors [1]. Intelligence is unique in every human being it differs according to the activities, exercise (to brain like problem solving) and many other things. To differentiate the mental ability of the human beings, we need to measure the key attributes of the human beings persist, one such attribute is human intelligence. There are several theories related to the measurement of human intelligence which help in understanding what intelligence actually does mean such as cognitive, contextual, and psychometric theories [1]. Each of these portrays the term intelligence from a different point of vantage. The following sections portray important discussions identified from these theories also suggesting the need to measure intelligence and how one could measure the human intelligence.

II. INTELLIGENCE IS....

Intelligence is defined in many ways and in different perspectives; by prominent psychologists and authors. Some of those definitions are mentioned below.

- Boodoo et.al [1] states that intelligence is “A very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience. It is not merely book learning, a narrow academic skill, or test-taking smarts. Rather, it reflects a broader and deeper capability for comprehending our surroundings—“catching on,” “making sense” of things, or “figuring out” what to do”.
- Alfred Binet [2] suggests that intelligence is “Judgment, otherwise called “good sense,” “practical sense,” “initiative,” the faculty of adapting one’s self to circumstances” and states that “Intelligence is the capacity to reason, to plan, to solve problems, to think abstractly, to comprehend ideas, to use language, and to learn”.
- According to David Wechsler [3], Intelligence is “The aggregate or global capacity of the individual to act purposefully, to think rationally, and to deal effectively with his environment”.
- H. Gardner [5] describes intelligence as “the ability to solve problems, or to create products, that are valued within one or more cultural settings.”
- Cyril Burt [4] defines that Intelligence is “Innate general cognitive ability”.
- Woodrow [6] depicts intelligence as “The capacity to acquire capacity”.

From the above definitions, one can say that intelligence is a multi-factorial entity or a multi dimensional entity which includes learning, sheltering, manufacturing and migration, in order to adapt to a new environment.

III. WHY MEASURE HUMAN INTELLIGENCE???

We live in world where we chase precision, want standardization, and try to manage and control. So, in this world measuring things plays a prominent role. Measurement is critical, it helps one to evolve and understand problems. To know the functionality and capability of an object we need to test or measure the attributes of the object. In the same way to know what a person is capable of, we need to measure some of his/her attributes which varies from person to person. Every human being is capable of doing something, the thing here is “how to differentiate persons with different capabilities”, it might be either doing daily activities, mathematics, subjects, maintaining relations anything. Every activity that is done by us needs some knowledge, the ability to perform the activity with correct use of knowledge is important which can be termed as intelligence.

- 1) We measure intelligence in order to identify ones strengths and weaknesses in a particular domain.
- 2) It helps in the order of classification of individuals.
- 3) It helps in assigning tasks and solving problems, as it helps in recognizing people who are fit to solve or perform the task.

But measuring intelligence is no ordinary process like the measurement of heights, depths, breadth width etc. It is a multi- dimensional attribute and involves many factors for assessment.

IV. FACTORS FOR ASSESSING INTELLIGENCE

Human intelligence is a multi dimensional attribute unlike the measurement of other entities such as breadth, width, height etc. The attributes of intelligence can be classified into a hierarchy of attributes such as Logical reasoning, Reading and writing skills, Memorizing capability, visual processing, auditory processing etc [7]. These are supplied with sub attributes such as the age, gender, environment, experience etc.

1. Characteristics of Intelligence

- 1) Logical reasoning: It is ability to analyze and synthesize numerical and be able to use them in order to solve real world problems [7].
- 2) Reading and writing skills: The ability to write and read usually, these are thought at school [7].
- 3) Memorizing capability: This is the ability to hold and store information for some span of time .This can be again divided into short term memorization and long term memorization [7].
- 4) Visual processing: This is the ability to synthesize process and analyze the visual patterns [7]. It deals with the perception of visual patterns.
- 5) Auditory processing: This is the ability to understand, use and reproduce the language of sound signals [7].
- 6) Speed of processing: This is the speed at which one can perform a given task [7]. Example, when an individual is subjected to extreme conditions, such as extreme temperatures, no food, etc. The speed at which he works in such an environment is taken into consideration.
- 7) Response time: The reaction time to stimulus is calculated [7]. It is generally considered for a short span of time say some three or four seconds, unlike the speed of processing which is considered for hour or days.

All the above characteristics points to only one attribute: it is the ability of a person having a happy life fulfilled with his own definitions of success which can also be termed as intelligence.

The above characteristics can also be considered as the attributes of intelligence because these characteristics are important to perform different activities.

2. Components of Intelligence

In the “theory of intelligence” Sternberg has proposed that intelligence is made of three components, they are

1. Internal world
2. The relationships to the external world
3. Experiences which interrelates the internal and external worlds.

The above three components are interdependent. The best example to show that the above three components are interrelated is a software development team assigned with a project. The internal world refers to the project planning, requirements phase, Analysis phase. The relationship to the external world refers to the project execution and maintaining phases. The third one is the experience gained by the team after and before completing the project which is helpful for developing the future projects.

V. MEASUREMENT – METRICS, SCALES & INSTRUMENTS

As discussed earlier there are few ways to measure the intelligence, one of the ways is performing the IQ tests. This IQ tests are carried out differently based on the requirements. Now a day’s many MNC’s conduct an aptitude test while recruiting employees to the company. This aptitude test serves as an instrument or a measuring tool to the company to measure the aptitude skills in the individual and scores of every person who takes the aptitude test are reported, based on the scores the individuals are ranked and prioritized and will be recruited by the company. These IQ tests and tests related to IQ test serves as an instrument to measure the human intelligence.

- IQ tests
- Binet- Simon Intelligence Scale
- Stanford-Binet Intelligence Scale.
- Wechsler Intelligence Scale for Children.
- Wechsler Adult Intelligence Scale.
- The Army Alpha and Beta Tests.
- The Comprehensive Test of Nonverbal Intelligence
- Slosson Intelligence Test-Revised (SIT-R)

1. IQ Tests:

IQ (intelligent quotient) tests measures the ability of the person in answering a series of questions related to problem solving, analytical skills and spatial activities. This IQ test provides a IQ test score through which the persons abilities can be differentiated in different areas of knowledge.

2. Binet-Simon Intelligence Scale:

This is the first intelligence test developed by the French psychologist Alfred Binet. Alfred Binet along with theodore Simon were commissioned to develop a test devise that would differentiate the children having low ability of learning to that of children having high ability of learning, this created a first intelligence test in the year 1905. Assessing memory, knowledge, reasoning skills are the part of the first intelligence test. The difficulty of this intelligence test was carried out according to the age group of the children. After carrying out this intelligence test many times some changes

were made to this test and were named as Binet-Simon intelligence scale. This scale is used to measure the intelligence of an individual aged between 2 years to 90 years.

Pros:

- A Child's mental age is calculated and according to that the child intelligence can be graded as poor, average, advanced or gifted.
- By this grade a child's intelligence and mental ability can be increased by special observation at his/her activities.

Cons:

- Assumes that the individual has an opportunity to learn certain skills and knowledge, but if the individual does not learn it reflects as deficit knowledge.
- If the individual does not have exposure to certain things and fails to demonstrate knowledge, this test does not give any response regarding the person's intelligence.

3. Stanford Binet Intelligence Scale:

Lewis Terman has translated the Binet-Simon intelligence test scale into English and adapted it in the culture of the American schools which helped them to know the intelligent Quotient of the children. The Binet-Simon test has undergone periodic revisions, Lewis has used the latest revised test and named it as Stanford Binet Intelligence test.

In this Stanford binet intelligence test the ratio of mental age to the chronological age of a child is calculated, which results in the new metric called IQ (Intelligent Quotient).

$IQ = (\text{Mental age} / \text{Chronological age}) * 100$

By the above formula an individual's IQ can be calculated. This test is also known as "ratio method".

4. Wechsler Scales:

David Wechsler a clinical psychologist has designed the intelligence tests which are helpful to find the cognitive strengths and weaknesses in an individual. These tests are mostly based on his definitions of the intelligence- "the aggregate or global capacity of the individual to act purposefully, to think rationally, and to deal effectively with his environment" [8] Wechsler intelligence scale is similar to the Stanford Binet scale, Unlike the Stanford Binet scale, Wechsler scales are divided into six verbal and five performance subtests. These are included with some performance tasks which do not require much emphasis on verbal ability. This intelligence test results three separate IQ's

- Verbal IQ
- Performance IQ
- Composite full scale IQ

The Composite full scale IQ is the resultant of the average of the verbal IQ and the performance IQ. The test takes around 60-90 minutes to administer the complete test. Comparing the performance and the verbal IQ may result in some problems when giving a single result. For example if the performance IQ is higher than the verbal IQ the result will be given as the person is having poor verbal abilities. In order to overcome this problem Wechsler has designed two scales.

5. Wechsler Intelligence Scale for Children

The intelligence of the children aged between 6-16 years is measured. This test is divided into two phases, namely Verbal section: it tests the children how well they express themselves in words. Performance section: It tests the children how well they understand while communicating with others.

6. Wechsler Adult Intelligence Scale

The intelligence of the adults aged between 16-89 years is measured. This test was revised in the year 1994 and named as WAIS-R which tests the adults in the age group between 16-74 years.

This Wechsler scale is being widely used these days.

Pros:

- These tests are administered by a trained test administrator individually.
- It measures different areas of intelligence such as verbal, performance, perceptual reasoning which results in the overall measurement of the intelligence.

Cons:

- This test cannot give the accurate results after the testing process.

7. Army Alpha and Beta Tests

These tests were developed by the psychologists Lewis Terman, Robert Yerkes, and others to know what type of advanced training is needed for the recruited U.S army for the World War I. Alpha Test emphasized on the verbal abilities where as beta test was emphasized on the non-verbal abilities. After conducting the Alpha test it is known that the army has a mental age of 13 and it is concluded that the army is feeble minded by Robert Yerkes. The drawback here is that the score is based on either of test which does not predict the person's actual mental ability.

8. The Comprehensive Test of Nonverbal Intelligence

This test is designed to assess student's visual learning skills. This test is especially helpful in assessing students without speech or who have minimum language skills and for those who are physically retarded (like deaf). This test measures several types of non verbal reasoning skills like solving problems using analogies, through pictures and pointing responses, by classifying things and by logical sequences. This test item measures the abstract and concrete concepts.

9. Short Intelligence test

It is also called as Slosson Intelligence Test-Revised (SIT-R). This test contains the items similar to the Wechsler scale. This test can be conducted from infancy through age 27.

Pros:

- There is no need to administer the test by a trained administrator.

Cons:

- The testing process results in the interpretive and statistical limitations on the data .

10. The Comprehensive Test of Nonverbal Intelligence

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VI. DISCUSSION

Intelligence is the important attribute for the human being, to be differentiated from one another there is a need to measure this attribute. Not only by following these scales discussed , one can attain a higher level of intelligence by exercising brain by brain training games, developing the ability to think by oneself, and getting adapted to the surrounding environments.

VII. CONCLUSIONS

Measurement though may not solve problems, certainly helps in providing scope for improvement. Human intelligence can be measured using various theories and models, also by conducting tests. We have tried to bring into light many theories and tests which are used for measuring the human intelligence. Though every test has its own drawbacks or weakness there are plenty of uses as well.

REFERENCES

- [1]. Boodoo, G., Bouchard, T. J. , J., Boykin, A. W., Brody, N., Ceci, S. J., Halpern, D. F., Loehlin, J. C., Neisser, U., *Intelligence: Knowns and unknowns*, American Psychologist, pp. 51-77,(1996).
- [2]. Boodoo, G., Bouchard, T. J. , J., Boykin, A. W., Brody, N., Ceci, S. J., Halpern, D. F., Loehlin, J. C., Neisser, U., Perloff, R., Sternberg, R.J., *Intelligence: Knowns and unknowns*, Annual Progress in Child Psychiatry and Child Development (1997).
- [3]. Binet, A., *New methods for the diagnosis of the intellectual level of subnormals*. The development of intelligence in children: The Binet-Simon Scale. E.S. Kite (Trans.). Baltimore: Williams & Wilkins. pp. 37-90. Retrieved 10(July 2010).
- [4]. Burt, C., *The Differentiation Of Intellectual Ability*. The British Journal of Educational Psychology.
- [5]. Gottfredson, L., *The General Intelligence Factor*. *Scientific American Presents* 9(4), pp. 24-29., 18(may 2008).
- [6]. Wechsler, D., *The measurement of adult intelligence*. Baltimore: Williams & Wilkins.
- [7]. Alan S. Kaufman, *IQ Testing 101*, Springer Publishing Company, 2009
- [8]. [ISBN 0-8261-0629-3](#) [ISBN 978-0-8261-0629-2](#)
- [9]. Thorndike, E. L., et al. *Intelligence and its measurement*, A symposium. Journal of educational Psychology, pp.123-147.