ANALYSIS OF THEORIES OF INTELLIGENCE: EMERGING THEMES

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Abstract: Intelligence has profound implications on our life. Even though historical theories have originated in the past they have continued influence on our contemporary world. Each theorist describes and defines human intelligence in different ways. After hundred and twenty years there is no concise definition for intelligence. As theoretical and empirical research on intelligence advances, views about nature of intelligence continue to evolve with them. Even though there is no a single definition, by proper inspection we can see quite similarities between some. And some actually say same thing in different ways. We are trying to analyse different definitions of intelligence proposed so far in literature. Our aim is to sketch briefly, what theorises so far proposed, explain on what intelligence is and does, and how. Qualitative thematic analysis of published articles, books etc. of 14 intelligence theorists were analysed to form 11 emerging themes. Each theme was then discussed in detail.

IndexTerms **- Intelligence , Qualitative thematic analysis, Emerging themes.**

I. INTRODUCTION

Human is the most intelligent being on earth, maybe in the entire solar system. Everyone agrees on this fact, but no one agrees on meaning, nature, and measurement of intelligence. Those who start reading about intelligence will get confused in front of hundreds of theories. More one read about it the more one starts thinking it as immeasurable and measuring immeasurable is making a chaos. But conceptualizing intelligence as immeasurable and denying the concept altogether will be the most idiotic choice we make. We have to search a new way to study intelligence.

What is intelligence? It turns out that the answer depends on whom you ask, and that the answer differs widely across disciplines, time, and places (Sternberg & Kaufman, 2011).Research on intelligence started in 1880's, now its 21st century and still, there is no a standard definition of intelligence. So some started believing intelligence can be described but cannot be fully defined. Analysing every theory defined in the history of 'Intelligence' is an impossible task. Definitions presented here include those which are frequently referenced and cited. By opening the black box of intelligence and through thorough analysis we are trying to work out a way through puzzles of conflicting ideas and theories to enhance knowledge about intelligence.

1.2 AIM

The main research aim was to understand the nature of intelligence. In this study main research questions posed were

- What is intelligence?
- What do theorists so far explain about intelligence?
- Can we derive a concise view of intelligence?

II. METHOD

The qualitative thematic analysis involved processes of condensing each theorist's definition and the concept of intelligence into categories or themes based on valid inference and interpretation. Based on some inclusion criteria certain search terms were defined.14 theorists and their originals works were selected. The qualitative thematic analysis was done and 9 emerging themes were tabulated. Analysis and interpretation of each theme are discussed in detail.

III. RESULT AND DISCUSSION

While analyzing a plethora of intelligence theories to find an answer to the question, 'what is intelligence'- the first idea struck researcher was about the ambiguity of term itself. Most of the articles on intelligence have at least one statement regarding ambiguity, (Hunt & Susanne, 2013; Sternberg 1985; Vernon 1979).This was predicted by Spearman a few centuries ago, *"In truth, intelligence has become a mere vocal sound, a word with so many meanings that finally it has none"* (Spearman, 1927). It is not surprising, as Vernon pointed out; ambiguity is

due to using of intelligence in a different meaning in daily life (Vernon, 1979).

A foundation for the study of human intelligence was laid in late 19th century. Galton suggested the presence of general ability or natural ability. He limited his focus on to experimental study of perceptual and sensory functions (Thurston, 1946), how this functions cause individual difference, individual difference in intellectual power and Eugenics (Burt,1969).The problem of intelligence was then researched by Binet by his studies on school children. His hypothesis was - student's mental power determines how they progress in school. Based on this hypothesis, Binet developed test to identify scholastically backward children. He proposed the term 'intelligence'- an old scholastic word which was used by Spencer (Burt 1969). As we can't discuss in detail all emerging themes in detail we have tried our best to convey what we intended.

3.1 Term for intelligence as whole

It seems mental ability is the most preferred term when we talk about cognitive functions alone and if we broaden the concept to include all life activities it's better to use the term intelligence. Spearman (1927) used the term 'general intelligence' and 'mental ability' or code letter 'g'. Thurston (1938), Jensen (1969) argued for use of the term 'primary mental abilities' or 'mental abilities'. Gardner (1983) sticks to plural term 'intelligences'. Vernon and Eysenck followed Hebb (1949) and named it as intelligence A, B, C (Vernon,1979). Wechsler (1944) and Cattell & Horn (1972) preferred to use 'capacity' instead of 'ability' and specifically named it as 'general intellectual capacity' and 'cognitive capacity' respectively. Others like Piaget, Boring, Guilford, Das wasn't interested in this term controversy, so followed Alfred Binet and merely used the term 'intelligence'. As years passed research in this area grew, different varieties of tests developed, statistics were improved, empirical studies increased, in some areas conceptual innovation occurred. But the term 'intelligence' prevailed and became publically popular despite all controversies.

3.2 Intelligence as a construct

Here we define construct as a variable which summarizes theoretical observations of each theorist's notion of intelligence into definition and structure. Various intelligence theories to be considered define 'intelligence as a construct' -differently. We classify it as 8 classes: stimulus-response, functions, adaptation, potential, functions/ability, 'g', ability.

3.2.1 Intelligence as stimulus-response connection:

Thorndike was a 'learning' theorist so, viewed intelligence as a stimulus-response connection – and reject possibility of unique mental ability. He proposes three kinds of intelligence; Verbal intelligence, social intelligence, practical intelligence(Wechsler,1944).Thorndike's Practical intelligence-facility in manipulating objects is comparable to Sternberg's(1999) Practical intelligence -the ability to adapt to an environment. But without manipulating objects we can't adapt to our surrounding. Thurston focuses on the action of an individual while Sternberg focuses on the product of that action. Verbal intelligence – facility in the use of symbols can be seen as a part of Sternberg's (1999) Analytical intelligence.

3.2.2 Intelligence as a function:

Almost at the same time when Thorndike defined intelligence as stimulus-response, Spearman had started to define it as function. As a construct Spearman defines intelligence as one fundamental function that is common in all intellectual activity. It is noted that Spearman does not identify his 'g' with general intelligence in a popular sense. It is only one factor present in every operation involving intelligence. Later spearman explains 'g' as one single, universal, fundamental, function and's' as purely specific actions; specific to one ability. Later he identifies 'g' with attention and mental energy (Spearman, 1927).Later hierarchy concept of intelligence was developed based on Spearman's 'g'.

3.2.3 Intelligence as capacity:

After intelligence was 'functionally defined' it was defined as capacity by Boring (1923).Other theorist like Weschler (1944) and Vernon (1950) critics Boring for narrowing intelligence as a testing quantity. But we can see that Wechsler (1944) redefine 'intelligence' for developing his widely and continuously used test of intelligence as "ability to utilize 'g' or energy in contextual situations". But this substantiate Edwin .G. Boring's definition of measurable intelligence that, Intelligence as a 'measurable capacity' is defined as capacity to do well in an intelligence test (Boring,1923).

But unlike 'function', 'capacity' definitions of intelligence prevail to be used in intelligence history. Thurston state intelligence as a capacity to inhibit instinctive behavior and modify behavior by means of imagined stimulus. Most of the other theorist focus on the product of intelligence, but Thurston focus on things that are accomplished by intelligence (since intelligence is not a tangible thing) and doesn't give value to nature of intelligence (Wechsler,1944). He proposes 7 primary mental abilities some of which are comparable to Gardner's multiple intelligences. David Wechsler (1944) view intelligence in terms of capacity i.e. aggregate or global capacity to think, act and deal effectively. It includes the cognitive part (think), realistic action part, the effectiveness of the product part.

3.2.4 Intelligence as adaptation:

Piaget compared intelligence with a biological organization and sees intellectual structures as organs. Intelligence is seen as adaption through accommodation and assimilation. Sternberg's concept of practical intelligence involves adaptation to the environment. Here adaptation is the ability to change environment according to one's need for success. But Piaget's concept of adaptation involves the ability to change the schema for incorporating new schemas. One is external (Sternberg's adaptation) and other is internal (Piaget's adaptation) (Sternberg, 1999, Piaget, 1952). Intelligence as 'adaptation' wasn't popularly accepted.

3.2.5 Intelligence as potential:

Vernon (1950) accepts Hebb's (1949) definition of 'intelligence A' as the basic potentiality of the organism. Other theories also discuss intelligence A, B, C but don't explicitly state or name it as such. Spearman (1927) view 'g' as a common factor which is present in all test of mental ability and defined it as ability needed for all tasks. So spearman's 'g' can be identified with intelligence B. Horn present evidence for genetic determiners determining in which direction intelligence develops and named it fluid intelligence following Cattell (Cattel & Horn, 1972). So Fluid intelligence can be equated to intelligence A. Boring define intelligence as a measurable quantity. So his intelligence can be included in intelligence C (Boring, 1923).Gardner (1983) defines intelligence as a bio-psychological potential to processes information. Gardner maintains 7 or more independent domains/mental faculties/intelligences- in which Spatial intelligence is comparable to Thurston's spatial visualization and perceptual speed.
Intrapersonal intelligence and interpersonal intelligence are comparable to Thorndike's social intelligence. Logical-mathematical intelligence is comparable to Thurston's number facilities and reasoning. Linguistic intelligence is comparable to Thurston's word fluency, verbal comprehension.

3.2.6 Intelligence as Function/Ability:

Guilford's (1968) structure of intellect model present intelligence as a collection of both ability and function needed for processing of information. The cubical model represents 5 operations, 4 content and 6 products. All intellectual ability has a unique combination of operation, content, and product. Anastasi (1992) also viewed intelligence as a combination of abilities or composite of several functions needed for survival in a culture. She couldn't specify if the abilities or function occur as a thought processes or as an external behaviour.

3.2.7 Intelligence as 'g':

From his factor analytic studies, it was Spearman (1927) who proposed the concept of 'g'. But he defined intelligence in terms of a fundamental function and later introduced this one letter code. Wechsler (1944) agrees with Spearman and define 'g' as psycho- mathematical quantity which measures the minds capacity to do intellectual work. He regards 'g' theory of intelligence as a universally accepted concept of intelligence. Grottfredson (1998) agrees with this concept and believes in the existence of 'g' at top of the hierarchy of mental abilities. Vernon (1950) also suggest the existence of 'g' at top of hierarchy below which there are several major, minor, specific factors. But the degree of specificity of spearman's specific abilities and Vernon's specific factors can't be distinguished (Gardner & Robertson, 2004). But it was Jensen who defined it as such, "g factor of mental tests". 'g' is an open-ended category that includes all processes of cognition (Jensen, 1969 &1980).

3.2.8 Intelligence as an ability:

After 'Capacity definition' of intelligence, Intelligence defined as 'ability' became more popular. Vernon (1950), Das (2009), Grottfredson (1998), Sternberg (1999), was the prominent psychologist who defined intelligence in terms of 'ability to do something' and then that something was defined. For Grottfredson it was an

ability to deal with complex cognition but Das specified it more clearly as an ability to plan and structure behavior. Vernon also defined it in terms of behavior; intelligence B-ability showed through behavior. For Sternberg, it was simply an ability to succeed.

3.3 Independency v/s dependency

Spearman, Thurston, Guilford, Gardner, and Das, view intelligence as independent. But on what this independence occurs is different for everyone. For Spearman (1927) 'g' and's' is independent. Thurston (1938) present factors as independent vectors. Guilford's (1968) numerous factors (abilities) are relatively independent in a population but have common involvement in an intellectual activity, because all intellectual ability involves a unique combination of one kind of content, operation, and product. One of Gardner's (1998 &1992) major claims is, 7 intelligences are relatively independent. Das main focus is on independent cognitive functions which work interdependently (Naglieri, Das, 2002).

Wechsler, Jensen, Grottfredson demonstrate flexible stand of interdependency. According to Wechsler, (1944) abilities are not entirely independent but are qualitatively differentiable. Jensen (1969) states that level I and level II types of mental processes are functionally dependent but genotypically independent. In Grottfredson's (1998) view all abilities are interrelated and not independent because all these abilities have more or less correlation with g.

One of the prominent theorists who view intelligence as dependent is Sternberg. For him, all three kinds of abilities are ultimately the result of the interactions of three kinds of information-processing components: meta-components, performance components, and knowledge-acquisition components. Here interaction occurs between information processing components so abilities seen as dependent. Dependency to particular problem and situation is also emphasized (Sternberg, 2003).

3.4Culture and intelligence

Influence of culture is one of the prominent controversies that are going on in literature related to intelligence and its assessment. Anastasi, Gardner, and Sternberg strongly argue for cultural influence. As three of them define intelligence differently, 'how' and 'on what' culture will influence also varies greatly. Thus for Anastasi, it is on survival abilities, for Gardner, it's on intelligences, and Sternberg it's on effective information processing components.

Anastasi sees intelligence as a combination of abilities required for survival and advancement within a particular culture. In different historical times even in the same culture, the qualification for survival and achievement differ. So there is no need to tell about different cultures. In short, abilities vary with time and place (Anastasi, 1992).Gardner (1998) reasoned that culture determines which of the 7 intelligences in what combinations are highly valued in a given society. Sternberg's theory of Successful intelligence is defined as an ability to succeed in life within one's socio-cultural context. The componential aspect of intelligence is same for all culture. i.e Information Processing components are universal. But which information processing components are more effective, is culturally determinant and culture-specific .i.e contextual aspect of intelligence is relative. Thus culture determines which intelligence effectively facilitates environmental adaptation (Messick, 1992).

Grottfredson (1996) strongly argues against cultural influence on intelligence. She strongly disagrees the influence of culture on 'g'. She says "culture doesn't construct 'g' or cultures construct same 'g'". Guilford (1968) gives more emphasis to experience than culture. He concludes that intellectual ability of a person is generalized skill developed through experience within a certain culture.

3.5 Nature v/s nurture

Under this theme, we try to understand long-standing debate going on in psychology, particularly in intelligence research. By nature, we meant those theories which view environment determine intelligence, by nurture, we mean gene determine intelligence.

Thurston's (1946) study of identical and fraternal twins agree with previous research that inheritance plays an important part in determining mental performance. He also assures that mental abilities are trainable but the outcome performance depends on native ability. Anastasi argues intelligence is not heritable. She emphasized the role of experience, i.e. Antecedent experiences not only affect intellectual development as a whole but every category identified as an ability (Anastasi, 1972 & 1992).

Majority of theorists take a flexible position – both nature and nurture determine intelligence. Of those, Sternberg was prominent theorist who argued for interactionism view. Sternberg view intelligence is a result of

genes X environment interaction. (Sternberg, 2003).

3.6 Individual difference

By this theme, we infer how each theory discusses individual difference and the reason behind Galton's quest 'why an individual is different'. Earlier theories reason that individual difference is due to genetic variation (Jensen, 1969; Thorndike, 1925; Thurston, 1938). Later on, after the spreading of cognitive psychology, theories consider individual difference was due to the difference in cognitive processing (Das, 2009; Gardner, 1998; Guilford, 1968).

3.7 Assessment

Here we try to identify what each theorist criticise about traditional intelligence test. Traditional test measure only abstract abilities, analytical abilities or scholastic aptitude (Anastasi, 1992; Guilford, 1968; Thorndike, 1925; Spearman, 1927; Sternberg, 2003).They also propose tests which complement their proposed theory of intelligence. Thurston (1938) argue for inclusion of primary mental abilities, Wechsler (1944) for non - intellective factor, Piaget (1952) gave importance to 'why a child responded in a given way', Sternberg (2003) for the inclusion of practical and creative abilities.

3.8 Age

Theorists (Boring, 1923; Piaget 1952; Thurston, 1938; Wechsler, 1944) agree with the notion intelligence mature at adolescence. But Thurston has the opinion some abilities mature more early and Wechsler specify it by saying some abilities mature by age 12 and some by age 15.

3.9 Methodology

In methodology, we analyze what method each theorist used for their study of intelligence. It varies from experiments with animals (Thorndike, 1901), factor analysis (Spearman,1927), developmental psychology (Piaget,1952), Psychobiology (Thurston,1938; Jenson,1969), interdisciplinary approach (Moran & Gardner, 2006) cognitive psychology and psychometric analysis (Anastasi,1992; Grottfredson,1998; Sternberg,1985) to Luria's Neuro-imaging studies and clinical study of brain lesion (Das, 2002).

IV. CONCLUSION

Each and every theory contributes to our understanding of nature of intelligence. It seems intelligence can be defined either in term of ability /capacity or in term of cognitive functions or product of such functions. The analysis reveals that genetic variation and difference in cognitive processing leads to individual difference. This work also strengthens the idea that culture an important role in determining what intelligence is. Also, it substantiates the fact that interdisciplinary approach or method of converging operation is the best method for studying intelligence.

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