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Role of Executive Functioning and Literary Reapproach for Measures of Intelligence

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ABSTRACT: *Over the years, Intelligence has been a crucial part in Psychological practices. Basic operational definition behind construct of Intelligence proposed by Wechsler (1944), was to act purposefully (Plan and control behaviors) and thinking rationally (organize and direct behavior). This operational definition was afterwards incorporated in measures for intelligence but as these measures were first aligned with academics, a major part of basic definition got overlooked. Previously Intelligence was divided in two major components that are Crystalized and Fluid Intelligence but resent Literary Reaproach was intended to enlighten the basic purpose of Intelligence measures and to highlight the overlooked components of Intelligence. These components are then further aligned with behavioral interpretations of Executive functions. It is proposed that alliance of Fluid Intelligence with Executive Functioning can bring pronounced change in clinical practices and change the bookish views of Intelligence into a functional approach.*

Keywords: *Executive Functioning; Intelligence; IQ; Measures*

I. INTRODUCTION

Since the dawn of time, Psychologists are known as professionals who evaluate behaviors and mental processes by using appropriate and psychometrically valid testing instruments. Testing and constructing measures have been most persistent and widely utilized inventions of this field and standardized intelligence tests are till date known as the most significant of these inventions (Roid, 2003).

The construct of intelligence was originated from a concept stating the high level of intelligence will indicate high level of purposeful and rational behaviors. In other words, people with high Intelligence Quotient will efficiently utilize this construct in daily life affairs and will be well functioning (Terman, & Merrill, 1960). However, the concept didn't actually demonstrate the foreseen path of analyzing a person's intelligence. The present research paper is intended to explain how measures of intelligence being used these days are not providing complete information, how this is affecting the clinical practices of third world countries and the role of executive functioning as an interesting assessment method.

Intelligence and Third World Countries

In 1963, learning disability originated as a concept worth studying through IQ measures (Bender, 2004). It evaluated a person's ability to learn and comprehend on the basis of Intelligence tests. This concept seemed to work in west where literacy level was quite high (Brown, & Campione, 1986) whereas in third world countries the literacy level has never been on the rise and number of people fail to complete early years of school life but still because intelligence has implicitly denoted as the basis of all clinical challenges, intelligence measures are being utilized as clinically effective measures (Grantham-McGregor, Cheung, Cueto, Glewwe, & Strupp, 2007). If such practice keeps on happening, soon half the world will come under diagnosis of learning disabled. The reason is that the measures of intelligence are highly concentrated on bookish views of intelligence. Moreover, it evaluates a person's exposure to the world based on crystallized intelligence and discounts the value of other functional purposes of intelligence (Duan, Wei, Wang, & Shi, 2010).

IQ and Practical Challenges

It has been an established concept that relationship of scores on measures of IQ are directly proportional to academic performance (Duckworth, Quinn, & Tsukayama, 2012). On the contrary, real life experiences illustrate a different phenomenon where a number of students who score high in academic life, fail to meet the worldly tasks afterward and fail to produce remarkable occupational records (Brouwers, & van de Vijver, 2015). Additionally, professionals report that most of their learning was acquired after they were done with an academic period (Sternberg, & Grigorenko, 2014). If one can compare a person's academic performance and then relate it with pursuits of the real world, he can find the truth behind these observations. Thus, intellectual demands of schooling are mere subset of demands in real world and IQ tests have only been describing a sub-set of what a person's abilities are.

An important point that might compare IQ measures and theories of intelligence in practical life is regarding trait and state of the intelligence (Mahmood, 1991). The fact that sub-set of intellectual functioning are highly sensitive to non-intellectual factors is already established but still while using these measures the point of fluctuation in performance gets overlooked. As performance is subject to fluctuation, this fluctuation (non-intellectual factors: emotional kind) can highly affect the results of test and if we overlook this point than the only thing that is being measured is the state of intelligence. Therefore, to reach the trait of intelligence, one would have to eliminate the non-intellectual factors. According to Chandrasekaran (2013) possibility to assess the trait and eliminating possible error of non-intellectual factors is by determining the ease a person experiences in acquiring new knowledge, reformulating it, and adapting it in other situations.

This concept can be further elaborated by an experiment conducted by Sternberg, Conway, Ketron & Bernstein (1981). Participants were asked to describe the characteristics of ideally intelligent, academically intelligent and everyday intelligent person. Results of factor analysis provided three factors named as Practical Problem solving, Adaptive Behavior and Social Competence. Researchers agreed with this concept and further proposed that intelligence is a construct that not only accounts for cognitive processes used in academics but also for practical performances (Gard et al., 2014).

Executive Functioning and Practical Intelligence

Psychologists diverted their attention towards executive functioning based on its utility in self-regulated learning (Schunk & Ertmer, 2000). The goal of self-regulated learning was to serve in setting appropriate goals in tasks, concentrating, effectively organizing data by using different strategies, memorizing, monitoring the performance, coding and actively managing time for tasks (Duckworth, Akerman, MacGregor, Salter, & Vorhaus, 2009). This self-regulatory learning is performed through executive functions. In cognitive psychology, executive functions (EF) are defined as functions that are involved in shifting between tasks, updating working memory representations and inhibiting the responses when necessary (Perrotin, Tournelle, & Isingrini, 2008; Willcutt, Doyle, Nigg, Faraone, & Pennington, 2005). These functions have been related to some crucial cognitive functions like planning, metacognition, decision making and self-regulation (Dawson & Guare, 2004; Garner, 2009). Based on these structural components of executive functioning, some of the researchers have aligned the role of executive functioning with cognitive abilities of high order called Intelligence (Friedman, Miyake, Corley, Young, DeFries, & Hewitt, 2006).

The functions of suppressing habitual responses of an individual and regulation of thoughts or actions are conducted by Executive Functioning. A theoretical explanation for relation between executive functions and intelligence was proposed by Friedman, Miyake, Corley, Young, DeFries and Hewitt (2006). It was proposed that hallmarks of intelligence are aligned with executive functions (Sternberg, 1988) like planning and regulating daily behaviors. Sternberg (1998) justified the fact that any damage to the frontal lobe of the brain suggests low performance of executive functions and simultaneously suggest challenged Intelligence because Intelligence also provides extent of functioning in similar domains (Damasio, 1994; Friedman, Miyake, Corley, Young, DeFries and Hewitt, 2006).

Measures of Intelligence and Executive Functions

First IQ assessment measure Stanford-Binet Intelligence Scale was based on theoretical assumption that Intelligence will be defined on the basis of person's ability for perceiving the world, logging the perception in memory and ability to rework them (Binet, & Simon, 1916). This assumption was in alliance with definitions of updating, shifting and inhibiting that are functions of EF.

There are only few studies that compared the association of executive functions with intelligence measures. Welsh, Pennington and Groisser (1991) compared executive functions task with IQ and found insignificant results. The tasks used as executive functional representations were Visual Search (Teuber, Battersby, & Bender, 1955), Motor Planning, Wisconsin Card Sorting Test (Heaton, 1981), Tower of Hanoi (Simon, 1975), Matching Familial Figures Test (Kagan, 1964) and Verbal Fluency (McCarthy, 1972). Another research by Ardila, Galeano, and Rosselli (1998) conducted the study with 300 college students and compared the verbal fluency tests with Intellectual measure called WAIS's verbal subtest. Results showed significant but low relationship between them.

Ardila, Pineda and Rosselli (2000) conducted a detailed study to compare executive functions with Intelligence measures. Wisconsin Card Sorting Test [WCST], Trial Making Test [TMT] and Verbal Fluency Test were used as executive functioning measures whereas Wechsler Intelligence Scale for Children- Revised [WISC-R] was used as an Intelligence measure. Results showed significant relation between Verbal Fluency and WISC-R's verbal sub-tests except for the arithmetic tests. These correlations were significant but rather low in relation. Findings suggested that WCST measured the ability of executive formation or concept formation but it is not generally included in intelligence batteries, which is a drawback for these batteries. Further Performance IQ was only correlated with TMT but still a low correlation was seen. No other relation was found between Intelligence and Executive functioning measures.

A similar study of this kind was done by Arffa (2007). In this study relationship of Intelligence was observed with WCST, Stroop Color-Word Test, Design Fluency Test, Oral Word Fluency Test and Trail Making Test, Rey Complex Figure Test, Rey Auditory Verbal Learning Test, Wide Range Achievement Test and Underlining Test among average, gifted and above average children through WISC-III. Results showed that IQ on Full-scale scores were significantly related to WCST's Preservative and Non-preservative errors, Color-Word condition, Stroop-Color Word Test, Design Fluency and Color-Word condition but not with Auditory Verbal Learning Tests.

Among all, executive function which has been mostly related to Intelligence was working memory updating (Ackerman, Beier, & Boyle 2005; Engle, Tuholski, Laughlin, & Conway, 1999). In terms of the function of inhibition, researches have compared it with intelligence in adult phase of life and called it significant indication of intelligence (Salthouse et al., 2003; Dempster, 1991) whereas the function of shifting showed weak relation with intelligence which either be caused by differences in measure of assessment and participants (Miyake et al., 2000; Rockstroh & Schweizer, 2001).

II. DISCUSSION

It is now clear that IQ measures have not been showing relationship with measures of EF but how to conclude that EF is the main phenomenon that can make the assessment of Intelligence complete? This question will be answered in following discussion.

It has been witnessed that some people with damage in frontal lobes and consequent deficit in executive functions, seem to show normal IQ scores on IQ measures (Friedman, Miyake, Corley, Young, DeFries and Hewitt, 2006). This inconsistent observation provided a contrary theory that either Executive Functions or Frontal Lobe may not be related to Intelligence. This inconsistent finding called for Cattell's explanation of Intelligence. According to which intelligence is measured in two domains called Fluid Intelligence and Crystallized Intelligence. Fluid Intelligence is referred to higher abilities of mental functions like reasoning and Crystallized Intelligence is referred to acquired knowledge from higher mental functions (Fluid Intelligence) based on experiences of different kinds (Carroll, 1993).

Duncan, Emslie, Williams, Johnson, and Freer (1996) studied patients with frontal lobe damage through Raven Progressive Matrices. The Raven Progressive Matrices was proposed to be related with the functions of Fluid Intelligence and results showed that the deficit in functions of fluid intelligence was significantly high in patients with frontal lobe damage. According to this research, Fluid Intelligence is functionally similar to cognitive functions of EF and as frontal lobe patients show deficits in fluid intelligence but hardly on crystallized intelligence therefore it can be assumed that psychometric tests like WAIS are not sensitive to fluid intelligence.

Some researchers have suggested overall Intelligence (Crystallized and Fluid) to be related with Executive functioning (Carpenter, Just, & Shell, 1990; Engle, Tuholski, Laughlin, & Conway, 1999; Miyake, Friedman, Rettinger, Shah, & Hegarty, 2001; Salthouse, Atkinson, & Berish, 2003; Salthouse, Fristoe, McGuthry, & Hambrick, 1998) but differences in what type of executive function determined the intellectual functioning better, was still yet to be found. This difference was studied by Friedman, Miyake, Corley, Young, DeFries and Hewitt (2006). They compared three executive functions (inhibiting, shifting and updating) with fluid and crystallized intelligence separately. Results showed that among executive functions, updating function was highly related with scores on Intelligence measures whereas shifting and inhibiting functions were not significantly measured by these measures. Based on these findings it is apparent that present intelligence measures are neither fully accurate at assessing executive functional abilities nor fluid intelligence of a person which has been the core intention behind constructing IQ measures in the first place.

On behalf of this debate, it can now be said that if a person's intelligence is assessed based on same definition by founders of intelligence, the researchers must find significant relationship between executive functioning tasks and intelligence measure. A number of researchers have studied the relation of executive functional tasks with intelligence measures and found inconsistent results (Welsh, Pennington & Grossier 1991; Golden, 1981; Boone, Ghaffarian, Lesser, Hill-Gutierrez, & Berman, 1993; Ardila, Pineda, & Rosselli, 2000). Therefore, it can be said that either EF should not be included as intelligent behaviors or the psychometric measures are not sufficient for providing thorough assessment of Intelligence.

As mentioned earlier, there were few studies that did find consistent relationship between executive functions and Intelligence measures. However, such results might be found by inclusion of the population with frontal lobe challenges such as aged fellows and clinically challenged population (Sathouse et al., 1998; 2003). Another justification behind such results can be that among aged participants frontal lobe functions get compromised and as a result the executive functions get compromised. Consequently the assessment of executive functions and Intelligence showed higher correlation (Rabbitt, Lowe, & Shilling, 2001). Rest of the studies which were conducted with normal population and showed significant relation between intelligence measures and executive functioning, did not focus on executive functions individually and overall result was overpowered by just one of the executive function that is "working memory updating".

It has been seen that Intelligence measures have been providing us with half the information. According to basic definition of intelligence, the points that are missing in current measures of intelligence are related to executive functions, which is apparently part of fluid intelligence or adaptation of crystallized intelligence in daily functioning. Therefore it is posited that instead of concentrating on half the knowledge and making judgements about a person's intelligence, measures of executive functions should be constructed to fill the gap of knowledge. Benefit of focusing on executive functions will be for all, regardless of age and literacy level because executive functions are representations of adaptation of intelligence in real life.

III. CONCLUSION

Present paper is based on inappropriate traditional tests and missing information related to executive functions. The tests of intelligence currently being used in researches and clinical fields do not include the major element of Intelligence proposed by Wechsler, (1944) that is to act purposefully (Plan and control behaviors) and thinking rationally (organize and direct behavior). Moreover, Intelligence measures are developed on the norms of developed countries where literacy level is quite high in comparison to developing countries but for developing countries measuring intelligence on the basis of executive functions and behavioral adaptations of intelligence will be a rather easy way of reaching the root cause of different clinical problems and constructing intervention plans.

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