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Human Intelligence Development: Challenges and Way Forward

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Abstract

What are the challenges in human intelligence development? Inadequate comprehensive theories or the advanced in artificial intelligence? Both have been identified as new challenges in human intelligence development. This paper aims to highlight the challenges in human intelligence development and suggest the way forward. To achieve this goal, existing theories in human intelligence are reviewed and the advancement of artificial intelligence is studied based on secondary data derived from article journals. The data is analyzed using content analysis. The outcome is presented as explanatory to the data gathered at the beginning of this paper and is interpretative in nature in the context of human intelligence development results and discussion. The future research in human intelligence development is the way forward being suggested in this paper.

Keywords: Comprehensive Human Intelligence, Artificial Intelligence Advancement and Human Intelligence Development

Introduction

Human intelligence or intelligence has been generated as unitary or multiple dimensions and, in some theory, as narrow or broad abilities. Nonetheless, intelligence is instead being viewed as product rather than process and has long called for greater attention by theoreticians and clinicians ever since the concepts and theories of intelligence had been established (Lohman, 1989). In recent study, there is still a tendency to view intelligence as product even though the issues of intelligence as a process have been long highlighted. As a result, new terms and constructs are being introduced. Among the new suggestions intelligence as product is ethical intelligence, moral intelligence, mystical intelligence and adaptive intelligence (Quadri, 2021; Sternberg, 2019). However, 'adaptive intelligence' as the word implies argued by Sternberg (2021) to be process rather than another term of product in human intelligence's study. In fact, many issues have been brought to attention for researchers in human intelligence in search for comprehensive understanding of human intelligence. These unresolved issues are also the reason being the development of human intelligence still falls behind if compared to the progress of its rival, artificial intelligence. Therefore, the advancement in the artificial intelligence development also being observed to be ubiquitous issues in human intelligence

development. To study these issues systematically, the next section discusses about the research method on the issues observed.

Research Method

Cambridge Advanced Learner's Dictionary (2003) in defining research as 'a detailed study of a subject, especially to discover (new) information or reach a (new) understanding'. In reference to that definition, this research uses basic qualitative research methodology with content analysis. This method allows more quality information obtained without requires large data sample (Hamzah, 2010). By employing qualitative modes of enquiry, data sample from article journal which discuss about 'comprehensive human intelligence' and 'artificial intelligence advancement' being analyzed using content analysis to produce result of new information in understanding "human intelligence development". Therefore, this study was explanatory and interpretative in nature and contains three important key words 'comprehensive human intelligence, artificial intelligence advancement and human intelligence development. The next two section are explanatory in nature and explains data derived from two key words 'comprehensive human intelligence' and "artificial intelligence advancement".

Comprehensive Human Intelligence

Lohman (1989) in his study of the advanced theory and research of human intelligence has well presented the issues, arguments, controversies, and suggestions in understanding human intelligence. His study provides groundwork in search for comprehensive human intelligence. According to him, ability construct, factor analysis and test are the issues revolve around intelligence where individual differences is a major concern. From factor analysis, many advanced terms emerged as ability construct such as verbal crystallized abilities, fluid reasoning abilities. spatial visualization ability, mental speed. The terms indicate some major shift in the discussion of human intelligence from product to process. Prior to this, popular terms such as emotional intelligence, multiple intelligence and later spiritual intelligence dominated the discussion of human intelligence. At this point of time, some sort of organisation known as quasi hierarchical model¹ and hierarchical model² has been introduced. Around 1980s, the direction of intelligence discussion made it turning point. When cognitive science took over the discussion of the intelligence phenomena, it adds another term known as general intelligence or 'g' factor. Instead of single or multiple abilities, process theories which later developed into hierarchical model combining broad and narrow abilities started gaining influence and clearly emphasized the role of general ability. The most

¹ The quasi-hierarchical model has two deep processing factors (Fluid Ability and Crystallised Ability, three perceptual organization factors (visualisation, clerical, speed, and auditory thinking), three associational processing factors (short term acquisition and retrieval, long term storage and retrieval, correct decision speed) and two sensory reception factors (visual sensory detection and auditory sensory detection) (Lohman, 1989).

² the hierarchical model has three levels. The three-level hierarchy includes a General Reasoning factor, G, at the top. Three broad group factors—Crystallized Abilities, Fluid-Analytic Abilities, and Short- Term Memory—constitute the second level. Three more specific factors make up the third level (Lohman, 1989).

popular theories combining broad and narrow abilities are Structure of Intellect (SOI)³ proposed by Guilford (1985) and Triarchic theory of intelligence⁴ by Sternberg (1985). Sternberg (2019) in his further investigation, link the 'g' factor with his theory of 'adaptive intelligence'. According to him intelligence typically consisting of 'adaptation to the environment' and there is some similarities and differences with general intelligence.

The search for comprehensive human intelligence also can be found in another area of psychological research. In an investigation into psychological dilemma of moral reasoning abilities, Hamzah, Yusoff & Razak (2011) have presented the comprehensive integration of cognition, emotion and spiritual and managed to identify process, dimension and products in their studies of philosophical underpinning of schemata development. They also produced test and measurement of moral reasoning abilities which blend intelligent quotient (IQ), emotional quotient (EQ) and spiritual quotient (SQ). Their work contributes greatly to some understanding of comprehensive human intelligence through Islamic perspective even it lacks in term of structure of hierarchical process. However, the structure of schemata development shows process, major and minor components as well outcome (product) that could be recognised as part of comprehensive human intelligence.

Most significant area that contributes to intelligence is cognitive psychology. Cognitive psychology is an area in psychology which study the internal mental process that deals with perception, thinking, memory, attention, language, problem solving and learning. Its ubiquitous influence on human intelligence's study path the new way to think about what intelligence and other ability tests were really measuring. In fact, it has become the goal in cognitive psychology to understand human intelligence and how it works. Besides that, its influence also paves the way to development of artificial intelligence by stimulating theories of human cognition in computer programmes. The reciprocal relationship of both field computer programming and cognitive psychology contribute significantly to the understanding of the nature of human intelligence and its complexity (Lohman, 1989; Antonov, 2011; Kamar, 2016).

Previous research findings have been consistent and supportive to recognize human intelligence as process first before recognizing it as product. By clearly recognizing it as process, any test measurement developed will measure what it supposes to measure instead measuring limited dimension of human intelligence as product. It not only solves the issues of test and measurement in human intelligence but more importantly it could contribute to the development in human intelligence if comprehensive human intelligence captured clearly. Unfortunately, the research to date has not been able to account of all aspects of human intelligence comprehensively. The lack of certainty in comprehensive human intelligence become major challenge towards its development. Another source of uncertainty is associated with the advancement in artificial intelligence (AI).

³ It is a theory of three- way classification: by the kind of mental process required, by the kind of information processed, and by the mental products generated. The combination of five types of mental processes, four types of content, and six types of products defined the 120 abilities in the structure of the intellect model (Lohman, 1989).

⁴ Triarchic theory of intelligence contains three sub theories: a contextual sub theory, an experiential sub theory, and a componential sub theory (Lohman, 1989).

Artificial Intelligence Advancement

AI started as the computer as brain imitates much more primitive human rational thinking, low level factor and according to Antonov (2011), human poses unconscious super intelligence not fully explored. Antonov (2011) also added the understanding of the degree of advancement of human intelligence is still incomplete. This statement supports the discussion in previous section. This is the first study, to use the term super intelligence as the ability to analyse and solve unclearly defined multi-factor problems which is remains unsolved in AI.

From computer as brain, advance computer programme has developed from serial processing to parallel processing and interest in advance computer programme has made major shift into displaying AI. In fact, cognitive science provides groundwork for the interaction between computer science, cognitive psychology, linguistic, neuropsychology, philosophy, and instructional psychology. Under the umbrella of cognitive science, the new discovery from those field are predicted to further the advancement in computer programming displaying AI (Lohman, 1989).

Thus far, the advancement in AI seems to dominate some process in human activities and abilities. Table 1 projected the ratio of Human-Machine working hours for period 2018-2022. The projection shows the increasing number of the machine abilities over human abilities or in other word, computer displaying AI over human intelligence.

Table 1. Ratio of Human – Machine working hours, 2018 vs 2022 (projected)

Abilities	2018		2022	
	Human	Machine	Human	Machine
Reasoning & decision making		19%		28%
Coordination, developing, managing & advising		19%		29%
Communicating & interacting		23%		31%
Administering		28%		44%
Performing physical & manual activities		31%		44%
Identifying & evaluating job relevant information		29%		46%
Performing complex and technical activities		34%		46%
Looking for & receiving job related information		36%		55%
Information & data processing		47%		62%

Notes: Taken from Future of Jobs Survey 2018, World Economic Forum

Above is the reflection on the abilities of computer as machine in displaying AI over human abilities in some specific area of human intelligence. The abilities identified have been made comparison base on working hours between computer displaying AI as machine and human from 2018 to 2022 period of projection. If in 2018, the machine working hours is only 19% in reasoning, decision making, coordination, developing, managing and advising, the working hours of machine will increase to 28-29% in 2022. The rest abilities also show the increasing working hours of the machine which looking for and receiving job related information as well information and data processing show more than half percentage of working hours by the machine.

Even it seems a big challenge to human, Miller (1981) once argued that computational theories completely no account for human cognition since human brain is itself a computer. Therefore, computer that models an intelligent brain is expected to be a brain (Miller, 1981). Most likely Miller argument had been underestimating the abilities of computer displaying AI abilities. Furthermore, the advancement of AI nowadays might be able to include intuition, intention, desire and belief in its computational logic structure as research in abductive logic programming (ALP) and belief-desire-intention (BDI) model in progress (Srivastav, 2019) and these far exceed the computer-brain analogy.

Up to this point, the present study has shed a contemporary light on the contentious issues in cognitive psychology and in computer science and summarizes much of what is known about the organization of human abilities. The following is a brief report on a synthesis and evaluation of comprehensive human intelligence and AI advancement.

Result

In fact, a model of ability organisation within developmental and information processing has been proposed since 1985. The model combines the hierarchical model of intelligence and the quasi-hierarchical model of intelligence. This model provides foundation to the development of comprehensive human intelligence. It also completes some puzzle in human intelligence development.

Further research in these two hierarchical models seems to provide a more comprehensive scheme considering the 'g' factor as in Structure of intellect (SOI) and Triarchic theory. However, critics have been made in their inadequacy of certain elements such as SOI has been criticized of not including auditory elements and Triarchic theory is only concept idea that difficult to make assessment in practical. Recent finding on the element of practise seems to be missing in both theories. This element has been made importance in human intelligence development. The finding of joint influence between intelligence and practise in expertise development showed the moveable benefit more from the same amount of learning style. From this finding, it is noticeable that human intelligence is ill defined by limiting general reasoning abilities as hallmark of intelligence (Vaci et al., 2019).

Process theories of abilities is important to be highlighted here because human intelligence development is not just about the identification of construct but more importantly the identification of the process involved. The best illustration of the process theories abilities comes from the simulation of computer programming displaying AI as being discussed in previous discussion and also from psychological dilemma in moral reasoning abilities

(Antonov, 2011; Hamzah et al., 2011). However, the former best referring to the process taking place in brain and the later lack in hierarchical structure as being discovered in previous research in human intelligence. A reasonable approach to tackle this issue could be a focused research in human intelligence development.

This section has explained the incoming challenge in human intelligence development from comprehensive human intelligence and artificial intelligence advancement's perspective. The next section will interpret the finding as a way forward in human intelligence development.

Human Intelligence Development: A Way Forward

Overall, this study outlines a critical role for searching a comprehensive framework of human intelligence, the need for collaborating human intelligence and AI as well the need for reviewing educational objective and strategies.

The data reported here appear to support the assumption that attempt in defining the universe of intelligent behaviours, cognitive function or tasks has become central issues in human intelligence. This proves the inadequacy of the comprehensiveness of the study of human intelligence, and it has been proven that the existing intelligence test only pay attention to certain selected task only. Lohman (1989) has clarified this by stating comprehensive framework must establish first before administering intelligence test. "The comprehensive framework of human intelligence can then be used to construct test of different facets of intelligence" (Lohman, 1989). Further studies should attempt to identify this 'comprehensive framework of human intelligence and as a way forward in developing human intelligence.

Comprehensive framework here then can be established by recognising other than cognition aspect. Kants and Wechsler were the scholars considering the affective dimension. Besides affective, Kant also emphasized the importance of intention. Surprisingly, in reviewing the literature, no comprehensive concepts, or theories of human intelligence able to integrate it in a structure of hierarchical process. More research is required in treating comprehensive framework of human intelligence consisting cognitive, affective, intention as well outcome in a structure of hierarchical process. The underpinning factors is the existence of boundaries to treat intelligence, learning and development as three distinct field in psychology. However, these boundaries can be diminished, and more integrated approach can be achieved. In fact, advancement in AI showed how the other dimensions of human intelligence can be integrated in some sort of process (Srivastav, 2019).

AI and its growing abilities to mimic human intelligence should not be viewed as opponent to human intelligence. In some instance, AI helps improve human intelligence development (Lohman, 1989); Srivastav, 2019). Indeed, it gave way to a growing respect for human intelligence and its operation. The finding of this study suggest that human intelligence development and AI development are at similar importance and promising area of collaboration (Blog, 2020; Srivastav, 2019; Kamar, 2016). The attitude towards AI can also be confirmed to facilitate rather than alternate human intelligence or in other words it is to support super intelligent multi factor system. Kamar (2016) even suggested the term hybrid intelligence to manifest this new phenomenon. Those who would be able to master this system would be able to achieve the best in their life.

The advancement of AI also according to (Antonov, 2011), give some insight to what developed in human. According to him, objective of education must be the development of human intellectual resources, and this provide another important discovery in human intelligence development. However, it has been reported, these human intellectual resources seem to be not clearly defined and identified comprehensively. Antonov (2011) further argued, for intellectual development of people, the system of comprehensive education must be rebuilt and aimed first. Comprehensive education with objective to develop human intellectual resources means might means here to integrate cognition, emotion and spiritual components to form human thinking in shaping individuals moral reasoning. (Hamzah et al., 2011). The product of this kind of education could be in the form of moral intelligence, ethical intelligence, and mystical intelligence (Quadri, 2021).

Initial observations suggest that there may be a link between human intelligence development and Muslim moral structure and belief system as proposed by Hamzah et al., (2011) in their research on moral structure and moral development. The 'philosophical underpinning of schemata development' which serves as working framework of their research could be considered groundbreaking for further research in human intelligence development in Islam. The philosophical framework either need further reviewed or reorganized in the context of human intelligence development.

This section has interpreted and discussed the finding which emerged from the content analysis presented in the previous section. Three major themes emerge from the studies discussed so far, hence provide important insight into the human intelligence development and its way forward.

Conclusion

The search for comprehensive understanding of the nature, construct, major components, and hierarchical structure is vital for human intelligence development way forward. With recent AI development in computer science, the development for comprehensive organization of human abilities will be a growing interest and respect. The impact of both certainly has direct influence in education system. The education system must identify the need for comprehensive human intelligence development which integrate AI development into its system to prepare its future generation. The finding from this study contribute to the current literature in the context of human intelligence, especially on its development.

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