

Iraqi EFL Intermediate School Students' Crystallized Intelligence

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Abstract:

crystallized intelligence is recognized in many modern intelligence frameworks. Originally conceptualized as capturing acquired skills and declarative knowledge in different content domains, more recent meanings and typical indicators focus on verbal ability. Crystallized Intelligence is dependent on the storage, retrieval, and use of knowledge accumulated from environmental experience. Crystallized Intelligence results from accumulated knowledge, including knowledge of how to reason, language skills and an understanding of technology. This type of intelligence is linked to education, experience and cultural background.

This study aims at finding out Iraqi EFL Intermediate school students' crystallized intelligence level. A sample of (375) students (boys and girls) has been chosen randomly for the academic year 2022/2023. The data is gathered by employing Wechsler's intelligence scale to identify "Iraqi EFL intermediate school students' crystallized intelligence". The results of the statistical manipulation show that Iraqi EFL intermediate students have a moderate level of crystallized intelligence.

Keywords: crystallized intelligence, crystallized intelligence test, Iraqi EFL intermediate school students.

I. Introduction

In a globalized world it is of outmost importance to be able to express oneself in and understand other languages than one's own mother language. English has become the dominant international language in many disciplines and essential in many professional fields (Crystal, 2003). Many scholars believe that intelligence influences language learning, while others argue that there is no link between intelligence and language learning.

Research on the different components of Gc and how they relate to each other is quite extensive. Meanwhile, when it comes to Gc and language learning, only vocabulary size

thoroughly study, while other key components, such as general knowledge, remain largely unexplored (Sitjar&Dunabeitia ,2022). Salthouse (2004) defines Gc as an experience-base knowledge component of intelligence that is acquired through interaction with one's environment. It reflects accumulated knowledge acquired through experience, culture, and prior learning. Gc is the result of accumulated life experiences, and the efficient processing and storage of accumulated information throughout a lifetime.

II. Literature Review

2.1 Crystallized Intelligence

The term “crystallized intelligence” introduce by Cattell (1943) who initially distinguish between two broad factors of intelligence. Cattell (1963,1971) and Horn and Cattell (1966) present a theory of cognitive functioning in the examination of mental abilities, and relationships between ability and school achievement. Cattell's theory of fluid and crystallized mental abilities is based on the differential characteristics of two general types of intelligence: crystallized and fluid. According to Catell (1992), Spearman's “g” really covers two distinct general structures: Gf and Gc intelligence.

Salthouse (2004) defines Gc as an experience-base knowledge component of intelligence that is acquired through interaction with one's environment. It reflects accumulated knowledge acquired through experience, culture, and prior learning. Gc is the result of accumulated life experiences, and the efficient processing and storage of accumulate information throughout a lifetime. The Cambridge Dictionary of Psychology (2009) defines crystallized intelligence as “the form of intelligence associated with previously learn material such as deductive reasoning, vocabulary, general knowledge, reading comprehension, and solving analogies. It increases slowly throughout adulthood until the onset of physical decline in elderly people and is associated most closely with the hippocampus” (p. 260).

This form of intelligence is often measure as knowledge, and appears to link to education, physical health, and general cognitive competence (Sundus A.J. 2022). It is dependent on a range of influences, including motivation, opportunity, and culture (Horn & Cattell, 1967). Gc thus signifies the acquisition and accumulation of practical experience and knowledge gain from a lifetime of practice dealing with vary tasks, situations, and challenges in everyday life (Rowley & Slack, 2009).

Researchers have also argued that Gc relate to components of the ability to view problems from multiple perspectives, accept compromise, and to recognize the limitations of one's own knowledge (Grossmann et al., 2014). Cattell (1992) views Gc as a compose of the primary abilities, such as verbal, numerical, spatial, and mechanical aptitudes.

Horn (1985) interprets Gc as an indication of the extent to which one attains the knowledge of a culture. Gc consists of those cognitive abilities in which skilled judgments are a part of one's history. Gc often involves cognitive functions relate to achievement and includes those abilities influence by formal and informal education (Valencia & Suzuki, 2001).

2.2 Theories of Fluid and Crystallized Intelligence

Crystallized intelligence is a well-recognized broad ability factor in the major theories of intelligence including Cattell-Horn-Carroll (CHC) theory, Gf-Gc theory, and the three-stratum theory.

2.2.1 Cattell-Horn-Carroll Theory

Cattell-Horn-Carroll (CHC) theory of cognitive abilities is the most comprehensive and empirically support psychometric theory of the structure of cognitive abilities to date. It represents the integrated works of Raymond Cattell, John Horn, and John Carroll (Schneider & McGrew, 2012). Both Cattell-Horn and Carroll models essentially start from the same point Spearman's (1904) g-factor theory; though they take different paths, they end up with remarkably consistent conclusions about the spectrum of broad cognitive abilities. Cattell built upon Spearman's g to posit two kinds of g: Gf, the ability to solve novel problems by using reasoning believed and Gc, a knowledge-based ability that is highly dependent on education and acculturation (Horn & Cattell, 1966). Horn (1968) identify four additional abilities; these included visualization, short-term memory, long-term retrieval, and processing speed. (Horn & Noll, 1997)

2.2.2 Cattell's Theory of Fluid and Crystallized Intelligence

Cattell (1943) posits a theoretical model, derived from Hebb's theory of intelligence, in which intelligence was largely explain by the interactions between two broad abilities Gf and Gc. Whereas Gf describe as the ability to reason and solve problems independent of prior knowledge, Gc dependent on the storage, retrieval, and use of knowledge accumulated from environmental experience. Gc consists of discriminatory habits long established in a particular field, originally through the operation of Gf (Brown, 2016).

In a substantive review of Gf-Gc theory, Blankson (2012) suggests that the accumulated evidence indicates that human abilities can be organized within a higher-order structure in which approximately 80 first-order primary mental abilities are explained by eight second-order abilities. The consensus second-order abilities include: Gc, Gf, Short-Term Apprehension and Retrieval, Fluency of Retrieval from Long-Term Storage, Processing Speed, Visual Processing, Auditory Processing, and Quantitative Knowledge. Cattell's "Theory of Fluid and Crystallized Intelligence" extend several times in terms of factors and abilities. The theory somewhat modifies to include visualization,

gv, fluency, and speed, gs as primary factors, visualization correlated highest with Gf, Gc (Cattell & Horn, 1978).

2.2.3 Carroll's Three-Stratum Theory

Carroll differentiated factors or abilities into three strata that varied according to the "relative variety and diversity of variables" (Carroll, 1997, p. 124) include at each level. The various G abilities are the most prominent and recognized abilities of the model as broad or stratum II abilities and include abilities such as Gf and Gc, the two original factors. Carroll (1997) broad abilities represent basic constitutional and long standing characteristics of individuals that can govern or influence a great variety of behaviors in a given domain and they vary in their emphasis on process, content, and manner of response. Broad abilities, like Gf and Gc, subsume a large number of narrow or stratum I abilities of which approximately 70 have been identified. Narrow abilities represent greater specializations of abilities, often in quite specific ways that reflect the effects of experience and learning, or the adoption of particular strategies of performance (Carroll, 1993).

The broadest or most general level of ability in the Gf-Gc model represent by stratum III, located at the apex of Carroll's (1993) hierarchy. This single cognitive ability, which subsumes both broad (stratum II) and narrow (stratum I) abilities, is interpreted as representing a general factor (g) that involve in complex higher-order cognitive processes (McGrew & Woodcock, 2001).

2.3 Crystallized Intelligence and Knowledge

Cattell (1957) emphasizes the breadth of Gc, indicating that Gc includes both broad cultural knowledge and more narrow sources of knowledge, few investigators attempt to develop assessments of knowledge that tap the diverse domains of knowledge that persons presumably develop and maintain over the adult life-span (Ackerman & Rolfhus, 1999).

Recently, Ackerman (2000) finds that knowledge of sciences, humanities, and technology preserve in adult samples generally concordant with the hypotheses of Cattell (1957) and Hebb (1942).

However, Ackerman (2000) also concludes that knowledge is something more than Gc as typically assessed. Specifically, only about 50% of the variance in various knowledge scales accounted for by measures of Gc. Thus, knowledge represents an important component of adult intellect that is separable from traditional measures of Gc. Among major intelligence theories, those of Cattell (1943) and Hebb (1942) emphasize that the Gc factor of intelligence is well-maintained in adulthood (with positive correlations often found in cross-sectional samples of adults of widely differing ages). The age pattern for Gc increases with age is often contrasted with factors of abstract reasoning, math abilities,

and spatial abilities which tend to show decreases in adult performance as age increases after the early 20s (Cattell, 1971, 1987; Horn & Cattell, 1967).

Verbal ability and Gc often conflate, when in reality some verbal tasks can have a significant fluid component. For instance, a common verbal task presents a sentence with a blank space such as “long is to short what tight is to” and requires the participant to fill in the gap with the appropriate word among an array of options e.g., wide, narrow and large. While the participant must know the meaning of the response option words in order to pick the correct one which requires Gc, they must also be able to deduct the relationship between the initial pair of words and pick an option that follows the same pattern which requires reasoning ability. Students can be taught how to make these decisions, (R. K. Elaf, 2022).

Similarly, (Ackerman1998) Gc is not just limit to vocabulary knowledge; rather, it extends way beyond, to all possible types of acquired knowledge. This means that exclusively using vocabulary or verbal tasks as a measure of Gc fails to include a significant portion of a person’s knowledge, and hence a significant portion of Gc.

2.4 Improving Crystallized Intelligence

The efficacy of memory training in improving acquired skills, such as Gc and academic attainment, do not establish. Furthermore, evidence of transfer effects from gains made in the train tasks is sparse. (Healy& Bourne,2006). Studies indicate that gains in intelligence are due to improvements in test-taking. (Bors& Vigneau,2003).

Considering the fundamental importance of Gc in acquiring and using knowledge and its predictive power for a large variety of intellectual tasks, these findings may be highly relevant to improving educational outcomes in those who are struggling. Gc reflects acquired skills and knowledge. Language proficiency is obligatory in translation practice (Krebt, 2022).

Accordingly, different neural substrates are associated with Gc: it is more closely linked to brain regions that involve the storage and usage of long-term memories, such as the hippocampus (Geary,2005).

Crystallized intelligence is acquired through knowledge and experience and is related to verbal ability, language development and academic success. The most important presumption is that the student and the teacher would take care of the structure spontaneously (Krebt, 2017). Gc, together with Gf, are constructs of general intelligence (Cattell,1971). Gc involves learning, knowledge and skills, while Gf refers to our ability in tests of problem-solving, pattern matching, and reasoning. Growth of attention on learning in classrooms becomes the vogue now as it proves its striking effect on students’ progress in learning foreign languages (Alsaadi & Shahad Hatim,

2016). Although there is evidence that Gf can be improved through memory training in adults. (Jaeggi, 2008)

III. Methodology

3.1 Population and Sampling

The population in this study is Iraqi EFL intermediate school students consists of (15000) students during the academic year 2022/2023. five intermediate schools are randomly selected from the directorate of education in Al-Qadisiyah governorate to extract the sample from. The total number of the sample is 375 students.

3.2 Instrument

The instrument in the present study is a Gc test which is adopted from (Wechsler, 2003). The form of test consists of (380) items, the researcher adopted (30) items according to the suggestion of jury member to be suited to the second intermediate level and Iraqi environment.

3.3 Reliability

A sample of (40) students are randomly selected from the 2nd intermediate school (Um-kulthum intermediate school for girl) from the Educational Directorate of Al-Qadisiyah to conducting the pilot administration of the two tests. The pilot study is conducted on 4 December 2022, this procedure is used to find out:

1. The clarity of items and instructions in the tests.
2. The amount of time participants set aside to complete answering the tests.

As a results, no ambiguity is found in the test items. The time required for the students to answer the two test is between (40-45) minutes.

IV. Results

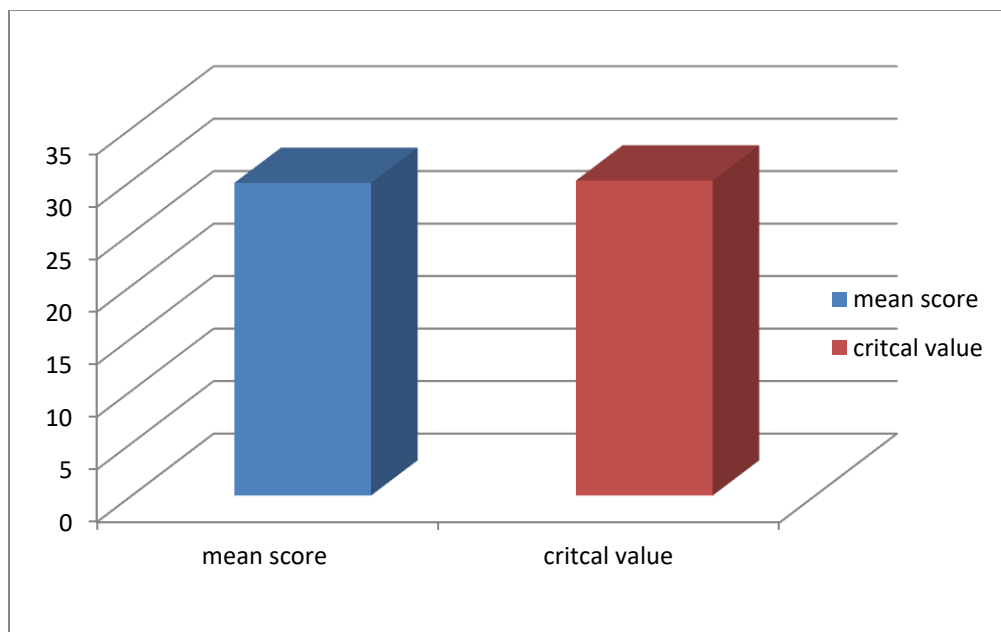
The aim of this study is (Finding out Iraqi EFL intermediate school students' crystallized intelligence level). In order to achieve this aim, Gc test has been applied on a sample consists on (375) students (boys and girls). The results have been showed that arithmetic mean scores of this sample is (29.776) and standard deviations is (6.225), for the purpose of knowing the significance of differences between mean score and hypothetical mean is (30) score, the study has been used T-value for one sample, and it showed that the differences at the level of (0.05). T-value reached (0.697) score and this score is lower than T-value (1.96) at the freedom degree (374), it is indicated that Iraqi intermediate students have a moderate level of Gc, as shown in table (4-1) and figure (4-1).

Table 4.1

The Arithmetic Mean, The Standard Deviation, and the T-Value for Gc test

Variable	N	Arithmetic Mean	Standard Deviation	Theoretical Mean	T-value		Significance (٠,٠٥)
					Calculated	Critical	
Crystallized Intelligence	٣٧٥	٢٩,٧٧٦	٦,٢٢٥	٣٠	٠,٦٩٧	١,٩٦	Significant

Figure 4.1

The Arithmetic and Theoretical Means for Gc test

V. Discussion of Results

This study reveals that Iraqi EFL intermediate students have a moderate level of Gc, this finding is attributed to the different levels of students and the individual differences in interpreting the items of the test. The moderate level of students' Gc can be justified by the fact that the participants do not have enough expertise and knowledge that can help in the full development of Gc. It is worth mentioning that the accumulation of skills and knowledge during different stages of life is considered the important basis for the evolution of Gc. On the other hand, Gc depends on the ability to retrieve information and previously learned problem solving schemas from long-term memory. Long term retrieval involves the ability to store and retrieve symbol names over a period of time, holding the

information in memory while attending to new information. Gc involves the ability to apply previously learned information to new material. Students with a deficit in this area are likely to have reduced vocabularies and limited background knowledge. Low Gc may hamper an individual's ability to comprehend written text due to lack of vocabulary knowledge, basic concepts, and general life experiences that are needed to understand the text (AL-Bakri and Salman,2020).

VI. Conclusions

In accordance with preceding survey and discussion related to the finding, aim, and question of this research, the conclusion has been drawn that Iraqi EFL intermediate school students have moderate level of reading comprehension.

References

- Ackerman, P. L. (1996). A theory of adult intellectual development: Process, personality, interests, and knowledge. *Intelligence*, 22(2), 227–257. [https://doi.org/10.1016/S0160-2896\(96\)90016-1](https://doi.org/10.1016/S0160-2896(96)90016-1)
- Ackerman, P. L., & Cianciolo, A. T. (2000). Cognitive, perceptual-speed, and psychomotor determinants of individual differences during skill acquisition.
- Ackerman, P. L., & Rolfhus, E. L. (1999). The locus of adult intelligence: Knowledge, abilities, and nonability traits. *Psychology and Aging*, 14(2), 314–330. <https://doi.org/10.1037/0882-7974.14.2.314>
- Al-Bakri, S. & Salman, A. (2020). Fluid, crystallized intelligence and language proficiency a correlational study: *Journal of Global Scientific Research*,9, 2523-9376.
- Bors, D.A., Vigneau, F., & Lalande, F. (2006). Measuring the need for cognition: Item polarity, dimensionality, and the relation with ability. *Personality and Individual Differences*, 40, 819-828.
- Brown, R. E. (2016). Hebb and Cattell: The genesis of the theory of fluid and crystallized intelligence. *Frontiers in Human Neuroscience*, 10, Article 606. <https://doi.org/10.3389/fnhum.2016.00606>
- Carroll, J. B. (1993). Human cognitive abilities: A survey of factor-analytic studies. Cambridge University Press. <https://doi.org/10.1017/CBO9780511571312>
- Carroll, J. B. (1997). The three-stratum theory of cognitive abilities. In D. P. Flanagan, J. L. Genshaft, & P. L. Harrison (Eds.), *Contemporary intellectual assessment: Theories, tests, and issues* (pp. 122–130). The Guilford Press.
- Cattell, R. B. (1943). The description of personality: basic traits resolved into clusters. *The Journal of Abnormal and Social Psychology*, 38(4), 476–506. <https://doi.org/10.1037/h0054116>

- Cattell, R. B. (1957). *Personality and Motivation Structure and Measurement*. New York: World Book.
- Cattell, R. B. (1963). Theory of fluid and crystallized intelligence: A critical experiment. *Journal of Educational Psychology*, 54(1), 1–22. <https://doi.org/10.1037/h0046743>
- Cattell, R. B. (1971). *Abilities: their structure, growth, and action*. Houghton Mifflin.
- Cattell, R. B. (1987). *Intelligence: Its Structure, Growth and Action*. New York: North-Holland.
- Cattell, R. B. (1992). Human motivation objectively, experimentally analysed. *British Journal of Medical Psychology*, 65, 237–243.
- Cattell, R. B., & Horn, J. L. (1978). A check on the theory of fluid and crystallized intelligence with description of new subtest designs. *Journal of Educational Measurement*, 15(3), 139–164. <https://doi.org/10.1111/j.1745-3984.1978.tb00065.x>
- Cattell, R.B. (Ed.). (1966). *Handbook of multivariate experimental psychology*. Rand McNally: Chicago.
- Crystal, D. (2003). *English as a global language* (2nd ed.). Cambridge: Cambridge University Press. doi:10.1017/CBO9780511486999
- Dhea Mizhir Krebt, (2022). Cognition Construction of First Language of Translator Education in Iraq: A Correlation Study. *Alustath Journal for Human & Social Sciences*. Volume (61), Issue (1), 2022, 639-650.
- Geary, D. C. (2005). The origin of mind: Evolution of brain, cognition, and general intelligence. American Psychological Association. <https://doi.org/10.1037/10871-000>
- Grossmann, I., & Na, J. (2014). Research in culture and psychology: Past lessons and future challenges. *Wiley Interdisciplinary Reviews: Cognitive Science*, 5(1), 1–14. <https://doi.org/10.1002/wcs.1267>
- Healy, A. F., Wohldmann, E. L., Sutton, E. M., & Bourne, L. E., Jr. (2006). Specificity effects in training and transfer of speeded responses. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 32(3), 534–546. <https://doi.org/10.1037/0278-7393.32.3.534>
- Hebb, D. O. (1942). The effect of early and late brain injury upon test scores, and the nature of adult intelligence. *Proceedings of the American Philosophical Society*, 85, 275–292.

- Horn, J. L., & Cattell, R. B. (1966). Refinement and test of the theory of fluid and crystallized general intelligences. *Journal of Educational Psychology*, 57(5), 253–270. <https://doi.org/10.1037/h0023816>
- Horn, J. L., & Cattell, R. B. (1967). Age differences in fluid and crystallized intelligence. *Acta Psychologica*, 26(2), 107–129. [https://doi.org/10.1016/0001-6918\(67\)90011-X](https://doi.org/10.1016/0001-6918(67)90011-X)
- Horn, J. L., & Noll, J. (1997). Human cognitive capabilities: Gf-Gc theory. In D. P. Flanagan, J. L. Genshaft, & P. L. Harrison (Eds.), *Contemporary intellectual assessment: Theories, tests, and issues* (pp. 53–91). The Guilford Press.
- Horn, J.L. (1968). Organization of abilities and the development of intelligence. *Psychological Review*, 75(3), 242–259. <https://doi.org/10.1037/h0025662>
- Jaeggi SM, et al. (2007) On how high performers keep cool brains in situations of cognitive overload. *Cognit Affect Behav Neurosci* 7:75–89
- Krebt, D.M. (2017). The Effectiveness of Role Play Techniques in Teaching Speaking for EFL College Students. *Journal of Language Teaching and Research* 8(5):863. DOI:10.17507/jltr.0805.04. University of Baghdad.
- R. K., Elaf (2022). “The Effect of Cognitive Strategies on Iraqi EFL College Students’ Writing Anxiety”. *Journal of the College of Education for Women, University of Baghdad*, vol. 33, no. 4, Dec. 2022, pp. 27-39, doi:10.36231/coedw.v33i4.1633.
- Rowley, J. and Slack, F. (2004) Conducting a Literature Review. *Management Research News*, 27, 31-39. <https://doi.org/10.1108/01409170410784185>
- Salthouse, T. A. (2004). What and When of Cognitive Aging. *Current Directions in Psychological Science*, 13(4), 140–144. <https://doi.org/10.1111/j.0963-7214.2004.00293.x>
- Schneider, W. J., & McGrew, K. S. (2012). The Cattell-Horn-Carroll model of intelligence. In D. P. Flanagan & P. L. Harrison (Eds.), *Contemporary intellectual assessment: Theories, tests, and issues* (pp. 99–144). The Guilford Press.
- Sitjar, F. and Dunabeitia, J. (2022). *Intelligence subcomponents and their relationship to general knowledge*. <https://doi.org/10.1007/s41809-022-00113-z>
- Spearman, C. (1904). 'General intelligence,' objectively determined and measured. *The American Journal of Psychology* 15(2), 201–293. <https://doi.org/10.2307/1412107>
- Sundus A.J. Kamil, (2022). Investigating Strategies Developed by University Students in Learning English Vocabulary. *AL-USTATH JOURNAL FOR HUMAN & SOCIAL SCIENCES FOR HUMAN & SOCIAL SCIENCES* Volume, 61, Issue. 4, pages, 101–119.
- Valencia, R. R., & Suzuki, L. A. (2001). *Intelligence testing and minority students*. Thousand Oaks, CA: Sage.