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# Development and standardization of cognitive ability test for children

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**Abstract**
The present study investigated, developed & standardized Cognitive Ability Test for children, Age group (7-16). The main objective of the study was to develop test items through Bloom's taxonomy, Leslie Wilson theory, determining the difficulty, Discrimination Index & Reliability. The purpose of this research project is the identification, measurement and analysis of core cognitive ability factors that determine success in education and occupation. The study was significant because it shall provide standardized ways of comparing the child performance with that other children observed in the same situation in terms of their cognitive ability (Anastasi, 1950). The study was delimited to forty children of age 9-11 years.

**Keywords:** Cognitive Ability, Bloom's taxonomy, Leslie Wilson theory

## Introduction
This study aims to construct & standardize a cognitive ability test for children of age group 7-16 years. It will provide a base for measurement & identification of cognitive abilities at primary / secondary school level. This test will help us in developing a universal scale or matrix to numerically measure cognitive ability factors (like Focus, Decision Making Ability, Creativity, Dynamic IQ) termed as natural ingredients for success in life in general. The numerical measurement of these factors will also help us in identifying the gaps between current level of cognitive development & desired level of cognitive development, on a prescribed scale. It will also help in designing educational solutions that can elevate the cognitive ability of children to desired levels to drastically increase their learning process. In the process Authors have also arrived to the conclusion that Intelligence is a very generic term. Instead it should be termed as cognitive ability and be broken into factors that are independent in nature. Factors like focus, decision making ability & creativity has a direct impact on an individual's life & common belief put these factors under the category of wisdom or general intelligence. It was found that no convincing test or comprehensive analysis was available to measure these factors in numerical values. The problem in psychological advancement is the dearth of reliable and universal measurement tools. Like to measure current we have a universal unit ampere, for weight it is kilograms, for temperature it is Celsius, power is measure in watts, there is no universal unit to measure cognitive ability. The benefit of using universal standards is that the future research cannot deviate from its goal, as all researchers have an agreed platform to start with. Research will become more meaningful, goal oriented and unidirectional. From hypothetical theories it will move to scientific evidence based research which will lead future researchers to carry on the work where previous generations stop. Through this work Authors found out that a universal measurement matrix & methodology can help us serve better in understanding human cognition & to reorder it to the desired levels. Three major areas are the part of this research project – One, human cognition has an initial & final value. The desired value lies between these two values. If we can measure the current cognition value, we can work towards reaching the desired value. Two, there are certain cognitive ability factors that can be understood as super sets for complex cognitive functions.

These are decision making ability, creativity, self estimation, focus factor & gifted ability. All of these can be measured in predefined numerical value system & can be reordered by applying customized education methodology. Three, all of us are born with a certain cognitive capacity, which is different in different people. Reordering of cognitive abilities is in direct correlation with natural cognitive capacity and learning environment, which is further influenced by early diagnosis of this capacity, action plan, learning style and overall learning process initiated in this direction. The basis to prove these findings is a standardize time bound cognitive ability test.

Over the last twenty years, research in educational practices and cognitive neuroscience has enhanced our understanding of brain functioning & its role in learning process. More than new understanding it had broken many age old myths & popular beliefs about cognitive abilities, intelligence, or capacity usage of brain. It has been over 100 years now that the first practical approach to measure primary intelligence in humans was carried out in from of IQ tests. Since then, for over half a century, IQ tests were believed to be a strong statistical measurement tool, that can help us identify potential achievers, & on the same time can identify slow learners, children with special needs, or for that matter the potential unsuccessful lot. History has a lot of evidence that these tests were used in school & other institutions as an empirical tool to adjudge general ability of children and to provide compensatory educational programs to raise their IQ. But the outcomes were disappointing & meaningless, as most children who were found to be high on IQ did not achieve much in their later years, other than academic success. In contrast to those who were average scorer or had below par IQ on these tests, went on to do big things in their lives. Psychologists and researchers were again left to think over those ingredients that can help design success. Authors have thereby developed a cognitive ability test that can measure all these factors independent of each other. An exhaustive item pool development process was put into practice that can be used across a vast age group of 7 to 16 years. Item pool selection was the key to develop and standardize this test.

## 2 Methodology

The children's of age group 9-11 years comprised of the population of the study. Both Theoretical and practical methods of research were applied.

### 2.1 Sample

A sample of 80 children's was selected from urban areas schools. (Random Sampling)

Out of 80, the 40 student were selected according to the high score and of IQ and lower score of IQ and the sample selected:

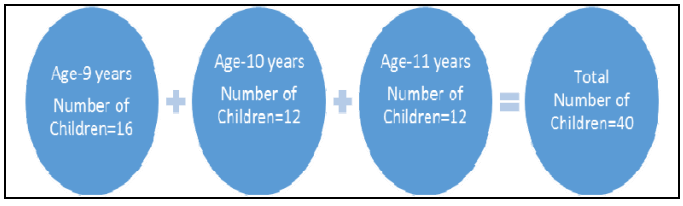


**Fig 1:** Students selected according to the Age

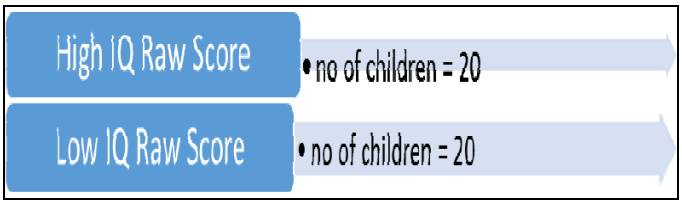


**Fig 2:** Students selected according to their IQ

### 2.2 Procedure

Criteria for the selection of test items. The test items must satisfy the following criteria:

1. An effort was made to select those items which were considered interesting according to judgment of the researcher in order to reduce unwanted variation in performance resulting from poor motivation or flagging attention.
2. Socially and culturally neutral items were selected so that they neither favor an individual nor put him at a disadvantage because of the particular group to which he/she belongs.
3. Those items not under the impact of culture one of type of culture fair items.
4. It is not such a type of item which belongs to one aspect only, those items touches the every aspect related to intellectual.
5. Those items were selected which were considered neither very easy nor very difficult.

### 2.3 Administration of the test

Administration of the test items after the selection of the items pool of 300, the 70 items were selected and those items administrated to North India schools around 4000-5000 children's of the age group 3-6, 6-9, 9-12, 12-16, 16 and above the test items administrated both the gender male children's & Female children's. As the trial bases. The instruction were given to the children for each part of a test. Each sub-test was assigned specific time in which children were required to complete the sub-test and a stop watch used for the purpose. To required the material photocopies, of test items, paper, pencil.

Test administration procedure was similar for all the participants. Test were marked using standard procedure in which score +1 was given for each item passed. Thus total 70 marks were assigned for each test.

### 2.4 Data Analysis

After collecting the data, it was arranged in tabular form and following mention statistical techniques used for items analysis

=> Item analysis through Bloom's Taxonomy
=> Item analysis through Leslie Wilson
LOTS – Lower Order Thinking Skill
MOTS - Middle Order Thinking Skill
HOTS - High Order Thinking Skill
=> Item difficulty level
=> Index of discrimination
=> Reliability (Test – Retest Method) Rulon & Flanagar formula
=> Time Analysis (with time, without time)
=> Split half method
=> Correlation Coefficient – By Product moment correlation method

To find the which item reflect the knowledge, comprehension, application, analysis, synthesis & evaluation.

To find the difficulty level and discrimination index the test score divided into three groups highest 27%, middle 46%, lowest 27% percentage.

The difficulty level was calculated with the help of formula

$$P = \frac{N_p}{N}$$

Where: NP indicates the number of test of test takers in the total group who pass the items, and N indicates the total number of test takers in the group.

The formula of the item – discrimination Index is:

$$D = \frac{U_p - L_p}{U}$$

Where: $U_p$ and $L_P$ indicates the numbers of test takers in the upper and lower groups who pass the items, and U is the total numbers of the test takers in upper group.

The discrimination index was determined by the difference between the percentages of the students doing the item right in the high achieves and low achieves group discrimination index.

### 2.5 Presentation and Analysis of Data

Summary presentation in tabular form: - ITEM ANALYSIS.

**Table 1:** Summary of Bloom's Taxonomy

| | Item | Item | Item | Item | Item | Item | Item | Item | Item | Item | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Level of Learning Outcomes** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| **Knowledge** | | | | | | | | | | | |
| Recall | | | 1 | 1 | | | | 1 | | 1 | |
| Identify | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| **Comprehension** | | | | | | | | | | | |
| Interpret | | | | | 1 | 1 | 1 | 1 | 1 | | |
| Classify | | | 1 | | | | | | | | |
| Comparing | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | 1 | |
| **Application** | | | | | | | | | | | |
| Solve | | | | | | | 1 | 1 | 1 | | |
| Relate | 1 | | 1 | 1 | 1 | 1 | | | | 1 | |
| **Analysis** | | | | | | | | | | | |
| Analyse | 1 | 1 | | | | | 1 | 1 | 1 | | |
| Discriminate | | 1 | 1 | 1 | 1 | 1 | | | | 1 | |
| **Synthesis** | | | | | | | | | | | |
| Devise | | 1 | | | 1 | 1 | 1 | 1 | 1 | 1 | |
| **Evaluation** | | | | | | | | | | | |
| Justify | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| | | | | | | | | | | | |
| **TOTAL** | **5** | **6** | **7** | **6** | **7** | **7** | **7** | **7** | **6** | **7** | |

| | Item | Item | Item | Item | Item | Item | Item | Item | Item | Item | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Level of Learning Outcomes** | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | |
| **Knowledge** | | | | | | | | | | | |
| Recall | | 1 | 1 | | | | | | | | |
| Identify | 1 | 1 | | 1 | 1 | | 1 | 1 | 1 | 1 | |
| **Comprehension** | | | | | | | | | | | |
| Interpret | 1 | | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | |
| Classify | | | | | | | | | | | |
| Comparing | 1 | 1 | 1 | | | | 1 | | | | |
| **Application** | | | | | | | | | | | |
| Solve | | | 1 | | | | | | | | |
| Relate | 1 | 1 | | 1 | | 1 | 1 | | | | |
| **Analysis** | | | | | | | | | | | |
| Analyse | 1 | | | 1 | 1 | 1 | | 1 | 1 | 1 | |
| Discriminate | | 1 | 1 | | 1 | | | 1 | 1 | 1 | |
| **Synthesis** | | | | | | | | | | | |
| Devise | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| **Evaluation** | | | | | | | | | | | |
| Justify | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| | | | | | | | | | | | |
| **TOTAL** | **6** | **6** | **7** | **6** | **6** | **5** | **5** | **6** | **6** | **6** | |

| | Item | Item | Item | Item | Item | Item | Item | Item | Item | Item | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Level of Learning Outcomes** | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | |
| **Knowledge** | | | | | | | | | | | |
| Recall | | | 1 | 1 | 1 | 1 | | | 1 | 1 | |
| Identify | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| **Comprehension** | | | | | | | | | | | |
| Interpret | | 1 | 1 | | | | 1 | | 1 | 1 | |
| Classify | | | | | | | | | | 1 | |
| Comparing | 1 | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| **Application** | | | | | | | | | | | |
| Solve | | 1 | 1 | | | 1 | | 1 | 1 | | |
| Relate | 1 | | | 1 | 1 | | 1 | | | 1 | |
| **Analysis** | | | | | | | | | | | |
| Analyse | | 1 | 1 | 1 | 1 | | | 1 | 1 | 1 | |
| Discriminate | 1 | | 1 | | | 1 | 1 | 1 | | | |
| **Synthesis** | | | | | | | | | | | |
| Devise | | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | | |
| **Evaluation** | | | | | | | | | | | |
| Justify | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| | | | | | | | | | | | |
| **TOTAL** | **5** | **6** | **8** | **6** | **7** | **7** | **7** | **7** | **8** | **8** | |

| | Item | Item | Item | Item | Item | Item | Item | Item | Item | Item | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Level of Learning Outcomes** | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | |
| **Knowledge** | | | | | | | | | | | |
| Recall | | 1 | 1 | | | 1 | | | 1 | | |
| Identify | | 1 | | 1 | 1 | | 1 | 1 | | 1 | |
| **Comprehension** | | | | | | | | | | | |
| Interpret | | | | 1 | 1 | | 1 | 1 | 1 | | |
| Classify | 1 | | 1 | 1 | | 1 | | | | | |
| Comparing | 1 | 1 | | | 1 | | | | | 1 | |
| **Application** | | | | | | | | | | | |
| Solve | | 1 | | | 1 | | 1 | | 1 | | |
| Relate | 1 | | 1 | 1 | | 1 | 1 | 1 | | 1 | |
| **Analysis** | | | | | | | | | | | |
| Analyse | 1 | | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | |
| Discriminate | 1 | 1 | | | | 1 | 1 | | | 1 | |
| **Synthesis** | | | | | | | | | | | |
| Devise | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| **Evaluation** | | | | | | | | | | | |
| Justify | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| | | | | | | | | | | | |
| **TOTAL** | **7** | **7** | **5** | **7** | **7** | **6** | **8** | **6** | **6** | **7** | |

| | Item | Item | Item | Item | Item | Item | Item | Item | Item | Item | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Level of Learning Outcomes** | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | |
| **Knowledge** | | | | | | | | | | | |
| Recall | 1 | | | 1 | 1 | 1 | 1 | | | 1 | |
| Identify | | 1 | 1 | | | 1 | 1 | 1 | 1 | | |
| **Comprehension** | | | | | | | | | | | |
| Interpret | | 1 | 1 | | | 1 | | 1 | 1 | | |
| Classify | 1 | | | | | | | | | | |
| Comparing | 1 | | 1 | 1 | 1 | 1 | 1 | | 1 | 1 | |
| **Application** | | | | | | | | | | | |
| Solve | | | | | 1 | | | | | | |
| Relate | 1 | 1 | 1 | 1 | | 1 | | 1 | 1 | 1 | |
| **Analysis** | | | | | | | | | | | |
| Analyse | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Discriminate | | | 1 | 1 | | | | | 1 | | |
| **Synthesis** | | | | | | | | | | | |
| Devise | | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | |
| **Evaluation** | | | | | | | | | | | |
| Justify | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| | | | | | | | | | | | |
| **TOTAL** | **6** | **6** | **7** | **6** | **6** | **8** | **6** | **6** | **8** | **6** | |

| | Item | Item | Item | Item | Item | Item | Item | Item | Item | Item | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Level of Learning Outcomes** | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | |
| **Knowledge** | | | | | | | | | | | |
| Recall | 1 | 1 | | | | | | | 1 | 1 | |
| Identify | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| **Comprehension** | | | | | | | | | | | |
| Interpret | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | |
| Classify | | | 1 | | | | | | 1 | 1 | |
| Comparing | 1 | 1 | 1 | | | 1 | 1 | 1 | 1 | 1 | |
| **Application** | | | | | | | | | | | |
| Solve | | | | | | 1 | 1 | 1 | | | |
| Relate | 1 | 1 | 1 | 1 | 1 | | | | | | |
| **Analysis** | | | | | | | | | | | |
| Analyse | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | |
| Discriminate | | | | 1 | 1 | | | | 1 | 1 | |
| **Synthesis** | | | | | | | | | | | |
| Devise | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| **Evaluation** | | | | | | | | | | | |
| Justify | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| | | | | | | | | | | | |
| **TOTAL** | **6** | **8** | **8** | **7** | **7** | **7** | **7** | **7** | **7** | **7** | |

| | Item | Item | Item | Item | Item | Item | Item | Item | Item | Item | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Level of Learning Outcomes** | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | |
| **Knowledge** | | | | | | | | | | | |
| Recall | 1 | 1 | 1 | 1 | | | | | | | |
| Identify | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| **Comprehension** | | | | | | | | | | | |
| Interpret | | | | | 1 | 1 | 1 | 1 | 1 | 1 | |
| Classify | 1 | 1 | 1 | 1 | | | | | | | |
| Comparing | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| **Application** | | | | | | | | | | | |
| Solve | | | | | 1 | 1 | 1 | 1 | 1 | 1 | |
| Relate | | | | | | | | | | | |
| **Analysis** | | | | | | | | | | | |
| Analyse | | | | | 1 | 1 | 1 | 1 | 1 | 1 | |
| Discriminate | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| **Synthesis** | | | | | | | | | | | |
| Devise | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| **Evaluation** | | | | | | | | | | | |
| Justify | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| | | | | | | | | | | | |
| **TOTAL** | **7** | **7** | **7** | **7** | **8** | **8** | **8** | **8** | **8** | **8** | |

| Type of Questions Age 11 Years Acc To Leslie Owen Wilson | | | | | |
|---|---|---|---|---|---|
| **S.no** | **Factual** | **Convergent** | **Divergent** | **Evaluative** | **Combination** |
| 1 | 1 | | | | |
| 2 | 1 | | | | |
| 3 | 1 | | | | |
| 4 | 1 | | | | |
| 5 | | 1 | | | |
| 6 | 1 | | | | |
| 7 | | 1 | | | |
| 8 | | | | 1 | |
| 9 | | 1 | | | |
| 10 | 1 | | | | |
| 11 | 1 | | | | |
| 12 | | 1 | | | |
| 13 | | | | 1 | |
| 14 | | 1 | | | |
| 15 | | | | | 1 |
| 16 | | | | 1 | |
| 17 | | 1 | | | |
| 18 | | | | 1 | |
| 19 | | | | 1 | |
| 20 | | | | 1 | |
| 21 | | | | 1 | |
| 22 | | 1 | | | |
| 23 | | 1 | | | |
| 24 | 1 | | | | |
| 25 | 1 | | | | |
| 26 | | | | | 1 |
| 27 | | 1 | | | |
| 28 | | | | 1 | |
| 29 | | | | 1 | |
| 30 | | 1 | | | |
| 31 | | | 1 | | |
| 32 | | 1 | | | |
| 33 | 1 | | | | |
| 34 | | 1 | | | |
| 35 | | | 1 | | |
| 36 | 1 | | | | |
| 37 | | 1 | | | |
| 38 | | | | 1 | |
| 39 | | 1 | | | |
| 40 | 1 | | | | |
| 41 | 1 | | | | |
| 42 | | | | 1 | |
| 43 | 1 | | | | |
| 44 | | | | | 1 |
| 45 | 1 | | | | |
| 46 | | | 1 | | |
| 47 | | | 1 | | |
| 48 | | | 1 | | |
| 49 | | | | | 1 |
| 50 | | | | | 1 |
| 51 | | | 1 | | |
| 52 | 1 | | | | |
| 53 | | | | | 1 |
| 54 | | | 1 | | |
| 55 | | 1 | | | |
| 56 | | 1 | | | |
| 57 | | 1 | | | |
| 58 | | 1 | | | |
| 59 | | 1 | | | |
| 60 | | 1 | | | |
| 61 | | 1 | | | |
| 62 | | 1 | | | |
| 63 | | 1 | | | |
| 64 | | 1 | | | |
| 65 | | | 1 | | |
| 66 | | | 1 | | |
| 67 | | | 1 | | |
| 68 | | | 1 | | |
| 69 | | | 1 | | |
| 70 | 1 | | 1 | | |
| Total | 17 | 24 | 14 | 11 | 6 |

**Table 4:** Summary of Time analysis with time item analysis, without analysis time of item.

| Time (Independent without time) | Easy 43 | Moderate 27 | Difficult 0 | Total Items 70 |
|---|---|---|---|---|
| Controlled (With Time) | 14 | 21 | 35 | 70 |

An Item with 50% difficulty, level is considered to be an ideal test item. However research shows that items with discriminations indices ranging from 16% to 84% could be included preferably.

To this item analysis researches followed these criteria. However some expert of the field such as Ebel and Frisbie (1986, P. 324) also accept it as valid beyond this range. But in no case items with discrimination indices less than or equal to zero were accepted.

**Table: 5 Item Difficulty**

Total No. of Items in Test = 70

Item difficulty index = $$P = \frac{N_p}{N}$$

$N_P$ – Indicates the number of test takers in total group who passed the item = 18

N – Indicates the total number of test takers in the group = 40

$$P = \frac{N_p}{N} = \frac{17}{40}$$

P= .45

The item difficulty index (P) has a range of 0.00 to 1.00. If no one answers the item correctly, P value would be 0.00. An item that everyone answer correctly would have a P value of 1.00

Item: Discrimination Index is $$D = \frac{U_p - L_p}{U}$$

$U_P$ - No. of test takers in upper group

$L_P$ – No. of test takers in lower group

U – is the total number of test takers in upper group

$U_p$ – 18

$L_p$ – 22

U – 18

$$D = \frac{17 - 23}{17}$$

D= 0.35

The optional level for an acceptable P value depends on the no. of options per item. In present test, have 4 options

Then g = .25

P value = 1.0

G value = .25

Constant value = 2

$$\frac{1.0 + .25}{2}$$

Optional level = .63

As the number of options increases, the option P – value decreases, these test have more option to also be more difficult to answer.
The difficulty level increases.
After optional level of item: - we get lower Bond

$$\frac{\left[1 + 1.645\sqrt{\frac{(k-1)}{n}}\right]}{k}$$

K= No. of multiple choice item
K= 70
N – No. of examiners
N = 40
Optional value .63 after computing formula:-
0.049 The lower bond value

**Table 5:** shows all computational steps of item analysis – of all Items:

| | |
|---|---|
| P = .45 | Optional Level = .63 |
| D = 0.27 | Lower Bond = 0.049 |

**Table 6:** of items with difficulty level < 16

| Age Level | Serial No. of Items |
|---|---|
| 9 | 70, 69, 68, 66, 67, 65, 67, 34, 10, 54, 54, 28 |
| 10 | 70, 69, 67, 54 |
| 11 | 70, 69 |

Difficulty level <16 means these items are very difficult.

**Table 7:** of items with difficulty level > 84

| Age Level | Serial No. of Items |
|---|---|
| 9 | 1, 2, 6, 22, 45 |
| 10 | 1, 2, 3, 4, 5, 6, 8, 9, 11, 13, 15, 22, 33, 45 |
| 11 | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 17, 22, 23, 24, 25, 27, 30, 32, 33, 34, 36, 37, 40, 41, 43, 45, 52, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64 |

Difficulty level >84 means that items are very easy because the %age of both high achieve and low achieve is high in these items.

**Table 8:** of items with index of discriminations:

| Age Level | Serial No. of Items |
|---|---|
| 9 | 55, 65, 69, 70, 48 |
| 10 | 70, 69, 67, 54 |
| 11 | 69, 70, 45, 52, 53 |

Ebel & Frisbie (1986) gives us the following role of thumb for determining the quality of the items in terms of the discrimination index

**Table9:** Shows the value D and their corresponding interpretation

| D | Quality | Recommendation |
|---|---|---|
| > 0.39 | Excellent | Retain |
| 0.30 – 0.39 | Good | Possibilities for improvement |
| 0.20 – 0.29 | Mediocre | Need to check/review |
| 0.00 – 0.20 | Poor | Discard or reviewing depth |
| < –0.01 | Worst | Definitely Discard |

**Table 10**: Summary for correlation and & Reliability:

| Other Statistical each of test | Reliability | |
|---|---|---|
| Test – Retest method | 0.97 | |
| Split Half Method | 0.74 | |
| Correlation by Product measurement method | 0.59 | |

## 3 Findings

When general ability of people doing well in life is probed Authors found that there are many more factors other than acquired knowledge or IQ that has a bigger impact. These are Focus, Decision Making Ability, Creativity, Passion, Judgment, Estimation Level, Nature of Work & Professional Choice. These factors are not taken into consideration most of the time as they are understood to be more psychological nature than statistical. Factors like Focus, Decision Making Ability, Creativity has a direct impact on an individual's life and common beliefs put these factors under the category of wisdom or general intelligence. It was found that no convincing test or comprehensive analysis was available to measure these factors in numerical values. Factors like focus or decision making ability are confused with problem solving ability. Creativity is confused with performing art or drawing skills. The theory of cognitive development by Jean Piaget always remain the foremost base while formulating anything new for future generation. It gives insight that cognitive ability happens in stages formally and its understanding can help us design it.

### 3.1 Background and Recorded History

Some people obviously and consistently understand new concept quicker solve unfamiliar problem faster, see relationships that others don't and are more knowledge about a wider range of topics than other. Such people are called smart, bright, quick or intelligent. Psychologists have developed tests to measure these traits. Spearman (1904) first popularized the observation that individuals who do well on one type of mental task also tend to do well on many others. For example, people who are good at recognizing patterns in sequences of abstract drawings are also good at quickly arranging pictures in order to tell a story, telling what three dimensional shapes draw in two dimensions will look like when rotated, tend to have large vocabularies and good reading comprehension, and are quick at arithmetic. This pattern of moderate to strong positive correlations across the whole spectrum of material abilities led Spearman to hypothesize the existence of a general mental ability similar to the common notion of intelligence. A person's ability plus considerations unique to that particular task. This general ability could be measured by constructing subtests of a number of similar items (individual tasks of the same type such as arithmetic problems) of differing complexity. Each subtest would present items of a different type and individual scores across subtests could be aggregated. Task specific factors would be aggregated. Task specific factors would be average out leaving the final score as mainly a measur4e of general ability or "g". Using an approach like this Binet (1905) developed the first IQ test as a way of identifying student's academic potential. That test was adapted for use in English by Terman and in 1916 became the standford-Binet IQ tests – still one of the most commonly administered tests of cognitive ability. Spearman's hypothesis of a single general mental ability and many

specific abilities was challenged by Thurstone (1935), who popularized the notion that people had a number of independent primary mental abilities rather than a single general mental ability. Both Spearman and Thurstone made contributions to the development of factor analysis as a way to identify the presence of unobserved variables (abilities) that affect a number of observable variables (sub-test or item scores). Today, the Spearman-Thrustone debate has been resolved with compromise. The most common view among psychometricians who study cognitive ability is that there are a number of different abilities. Some people are better at solving problems verbally while others are good at solving problems that involve visualization. Some people who are good at both of these things may be only average at tasks that rely heavily on memory. However, there is a tendency for people who perform well in any of these broad areas to perform well in all other ask well (Carroll 1933). Most modern tests of that is most reflective of general intelligence, and a number of special ability specific sub-scores as well.

Schools adopted these tests and put it under practice till date. But their purpose remained largely defeated as they had very limited tools to design success as desired. At best they designed curriculum and pedagogy to deliver as per these stages of development. May be they took the theory as it is, like a revered book, and failed to take benefit of this most powerful observation about human mind. Intelligence Diagnosis on the other hand remained with psychologists, who worked with limited sample sizes, and those who regularly lost the direction by not talking straight. All of them believed that human mind has unlimited potential and it can achieve anything, but within this belief their limitation to benchmark & measure its capabilities is reflecting. IQ tests or aptitude tests are the first references that they tried to benchmark certain abilities but it proves that a vague definition like a limitless mind may be sheer guesswork. For an instance even if we believe that it is limitless, in no way it solves our purpose of reordering it and put into practice as desired for a meaningful & successful life. Universe is believed to be limitless, but that does not stop us from exploring it and doing meaningful research for the larger benefit of mankind. In quest, we have achieved the unbelievable landing on moon & this was like fulfilling the seemingly impossible dream. One major factor behind this achievement was numerical measurement of distance, temperature, weight, velocity and all that is required to propel a machine with a man to scale moon. It further strengths our faith that what can be measured well can be achieved or reordered or worked upon. Alternately, that what cannot be measured cannot be achieved or reordered. This philosophy has worked very well for the advancement in medical science. Medical science has developed its own matrix of measuring the human body in numerical values. It has worked wonders to elongate human life. Same has worked well with engineering and commercial field experts.

### 3.2 Chief Investigator View

The first 16 years of a human being, where it is formidably easy to develop cognitive abilities and enhance learning process, have been the topic of research for decades now. Many great contributions from psychologists to researchers, educators to neuroscientists have been talked over and implemented to seek solve certain mysteries. A lot of myths have also been broken down convincingly all through years. Numerous attempts were made all through human history to understand, diagnose & measure human intelligence so as to reorder it. But guesswork in imparting education is still prevalent in schooling & parenting. The goal of our research is to provide an insight into those scientific methodologies that can help us measure and reorder human intelligence to enhance learning process in children, to scientifically pick & select suitable career choice for a more meaningful & successful life, and to help hire right people for right jobs for maximum business efficiency. There is still a lot to be done to establish concrete outcomes and conclusions in this direction. The ongoing work intends to establish said hypothesis and practical analysis in determining the factors that can help design success than desire for it.

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