# INSIGHT IN CHILDREN WITH HIGH INTELLIGENCE LEVEL

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**SUMMARY:** Our experiment was designed to asses the insight skills are as sources of difference individuals between high level intelligence children and other individuals. The results of our study are wholly consistent both with the Sternberg information-processing theory of insight and with the role of skills insight (selective encoding, selective combination and selective comparison) in distinguishing the performance of high level intelligence (gifted) from nogifted students. The results of these analyses state that high intelligence individuals use selective encoding, combination and comparison processes such as the ones used in this work. The difference among high intellectual individuals and the average ones lies in the ability to the first ones to sift out information in order to find the relevant aspects they need to finish the task.

**RESUMEN:** El objetivo de la investigación es estudiar el insight como un aspecto diferencial entre los sujetos con alto nivel intelectual y los de inteligencia media. Los resultados de nuestro experimento son consistentes tanto con la teoría de las habilidades de los procesos de insight como con el rol que juegan dichas habilidades en las diferencias individuales de los superdotados y los que no lo son. En general, los resultados de nuestro estudio demuestran que los alumnos con un alto nivel intelectual obtienen mayores puntuaciones que los del nivel medio. La diferencia reside sobre todo en mayor capacidad de los sujetos superdotados para tratar la información y sobre todo los aspectos más relevantes para acabar la tarea.

**RESUMO:** O obxectivo da investigación é estudia-lo insight como un aspecto diferencial entre os suxetos con alto nivel intelectual e os de intelixencia media. Os resultados do noso experimento son consistentes tanto coa teoría das habilidades dos procesos de insight como co rol que xogan ditas habilidades nas diferencias individuais dos superdotados e os que non o son. En xeral, os resultados do noso estudio demostran que os alumnos cun alto nivel intelectual obteñen maiores puntuacións que os de nivel medio. A diferencia reside sobre todo na maior capacidade dos suxetos superdotados para trata-la información e sobre todo os aspectos máis relevantes para acaba-la tarea.

## 1. ABSTRACT

Most people working on intelligence regard cognition as one of the most important aspects in this field (Detterman, 1993; Gardner, 1994; Sternberg, 1994). Researchers such as Davidson and Sternberg (1984; 1986), Sternberg y Davidson (1995) consider that insight processes are especially important when people need to solve new and unconventional problems. The main aim of this work is to analyse the performance of children with a high intelligence level who have been previously located through two intelligence tests (Cattell's «g» factor test and Sternberg´s STAT), and to compare them with average intellectual students. The results support the hypothesis that gifted children perform better in insight tasks, suggesting that this is one of the components of high intellectual ability.

Children with a high IQ level are characterised by their high competence, because their general intelligence level helps them to perform better in a wide range of activities or academic subjects. According to the results of our research, there are three main aspects that seem to be always present to some extent: 1) A high general intellectual ability, 2) The ability to handle information, and 3) An intellectual character and style.

First, the general intellectual ability refers to the aspects of the so-called *fluent intelligence* or analytical intellectual ability («g» factor), and to most specific cognitive

components such as attention and memory (Detterman, 1993) implied in the executive process.

Second, the ability to handle information, be it general or more specific, plays a major role in the processes implied in knowledge acquisition (Sternberg, 1985). Sternberg (1985) belives that knowledge increases because its mechanisms of acquisition are generally present in every learning situation. The individuals who stand out in the acquisition mechanisms (selective encoding, selective combination and selective comparison) are those who are better at them and whose metacomponential ability is higher. The possibility of a person getting better at one of the fields depends on his/her ability to store information in a determined system (Sternberg, 1985).

From this point of view, insight is defined as the ability to apply knowledge acquisition components to the solution of new and unconventional problems where we do not need a large amount of previous knowledge. A high general intelligence level seems to be related to insight skills and the ability to think quickly or to act in an unconventional way, rather than to the individual's IQ (Sternberg & Davidson, 1983; Davidson, 1995). Sternberg and his colleagues consider that insight (or the ability to deal with novelty) is what best defines people with a high intelligence. Insight consists of three separate but related psychological processes: a) selective encoding involves sifting out relevant from irrelevant information; b) selective combination involves combing what might originally seem to be isolated pieces of information into a unified whole that may or may not resemble its parts; and c) selective comparison involves relating newly acquired information to information acquired in the past (Sternberg, 1986).

Third, if we want to explain high achievement we must include personal characteristics related to inter and intrapersonal abilities (Gardner, 1994), motivation and self-concept (Renzulli, 1994) and intellectual styles (Sternberg, 1990).

This work has two principal elements: Analytical general intelligence or «g» factor, and the study of the general ability to handle information in particular contexts. Although the latter still has to be operatively defined, the main purpose of Sternberg's intelligence assessment model and the STAT (Sternberg Triarchic Abilities Test), which has been developed according to this theory, is to assess the way intelligence work when dealing with information in specific contexts. On the other hand, Sternberg and his colleagues have developed a series of tasks to define insight as the ability to handle information in new situations where previous knowledge is not necessary (Sternberg, 1986; 1991).

Using this theoretical frame as a basis, we will try to fulfil two objectives: a) Location of students whith high intellectual level, and b) Analysis of the different characteristics of these students in relation to average ones regarding their insight. The first objective consists in validating the procedure used to locate and select high intellectuall individuals since there is not any criteria a hundred per cent reliable to define this construct. The second objective focuses on the analysis of the characteristics of insight tasks that differentiate high intellectual individuals.

These general aims give place to the following **specific working hypotheses**:

1) There is a moderate relation between the IQ results obtained in the STAT and in a traditional intelligence test («g» factor test).

2) There is a moderate coincidence in the classification results of the STAT and the «g» factor tests when they are established according to a previously set IQ score.

3) There are important differences in insight tasks among the groups formed according to their intelligence level. These differences are to the advantage of students with higher intellectual level.

4) The subgroup of individuals selected using both tests («g» factor and STAT) presents the highest degree of significant differences in insight tasks in relation to average individuals.

5) There are also important differences between high intellectual individuals selected by their scores in the «g» factor test and the ones selected by their scores in the STAT. These differences are to the advantage of the latter in insight tasks.

6) There is a significant correlation between performance in insight tasks and intellectual level. The relation is more important when using STAT.

7) There is an important relation between scores in mathematical and verbal tasks, what means that, to a large extent, we are dealing with the same construct in both tasks and that neither of them is more specific.

## 2. METHOD

### Subjects

The initial sample involved in stage one of this research consists of 1255 students from 8 to 9 years old from 22 state schools in the region of Murcia (Spain). In stage two, the sample consists of 208 pupils selected from the previous one. This second sample is divided into four subgroups according to their scores in two intelligence tests: «g» factor and STAT.

The characteristics of the individuals in those groups are: 1) Group I, the student´s IQ score in both tests was > 120; 2) Group II, students who scored > 120 in Cattell´s «g» factor test but 120 or less in the STAT; 3) Group III, students who scored > 120 in the STAT but 120 or less in Cattell´s «g» factor test; 4) Group IV, students who scored < 120 in both tests. Individuals in group I were selected from the whole sample depending on their scores in both tests (more than 120 IQ). Individuals in groups II, III and IV were selected at random from the students in each of the three groups. Table 1 shows the statistical data corresponding to the IQ of each subgroup and to the whole sample involved in part II.

TABLA 1. Shows the statistical data corresponding to the IQ of each subgroup and to the whole sample involved in part II.

| DESCRIPTIVE STATISTICS OF THE SUBGROUPS ACCORDING TO THE IQ | | | | | | |
|---|---|---|---|---|---|---|
| | G IQ | | | STAT IQ | | |
| **GROUP** | **MEAN** | **DEVIA.** | **N** | **MEAN** | **DEVIA.** | **N** |
| **+120 BOTH** | 126.91 | 4.03 | 36 | 124.92 | 3.4 | 36 |
| **+120 G** | 127.42 | 6.44 | 74 | 109.44 | 10.1 | 74 |
| **+120 STAT** | 106.16 | 11.77 | 39 | 124.51 | 3.9 | 39 |
| **–120 BOTH** | 105.32 | 10.85 | 56 | 103.89 | 9.88 | 56 |
| **TOTAL** | 115.56 | 19.62 | 208 | 111.87 | 18.08 | 208 |

**Instruments**

The instruments used include two intelligence tests, Cattell's «g» factor and the STAT (Sternberg's Triarchic Ability Test), as well as other tasks, to assess insight processes developed by Sternberg and Davidson (1986).

R.J. Sternberg's *STAT* (1991) assesses intellectual ability. Initially it consists of ninety items divided into nine scales that measure metacomponential, practical and creative intelligence in verbal, numerical and figurative modalities. The test offers adequate psychometric rates in a sample of 1255 individuals. The score distribution is normal according to the Kolmogorov-Smirnov's test and we have established scales for each age group (8 and 9 years). The reliability of the internal consistency of each task, assessed using Cronbach's alpha rate, goes from .50 to .82; on the other hand, the whole internal consistency rate of the task is .93. The lineal correlation between Pearson's «r» and Cattell's «g» factor test in a group of 1255 individuals is .56.

The general intelligence test, that is, Cattell's «g» *factor* (Cattell & Cattell, 1973) is supposed to be «free of cultural influences» and one of the most frequently used methods of intelligence assessment when working with groups of this age.

*Insight* tasks are a set of tests aimed at assessing the reasoning procedures in which insight takes place. These tasks were initially elaborated by Sternberg and his colleagues (Davidson and Sternberg, 1986). This test includes the following tasks: 1) *Insight problems with mathematical contents*, ten problems where pupils have to reason about everyday matters using their mathematical knowledge in an innovative way. 2) *Insight problems with verbal contents*, ten tasks where the individual has to understand the meaning of a concept in a particular context. 3) *Mystery problems*, seven problems that tell a story and where students have to discover the hint or hints necessary to solve the problem. 4) *Series of letters*, where the student is asked to find a letter or a group of letters that form a determined sequence in fifteen different examples; this task is aimed at measuring inductive reasoning processes. 5) *Innovative verbal analogies*, a task that consists of ten verbal analogies where the student has to find relations among words. 6) *Finding hints*, twelve tasks verbally formulated where the student is asked to enumerate the hints that lead to the solution of the problem. 7) *Selective encoding problems with and without hints*, where the individual faces six verbal problems, three with underlined words used as hints for selective encoding and three without concrete hints (Sternberg, 1986).

**Procedure**

In stage I we apply and adapt the STAT intelligence test and Cattell's «g» factor test. Since this a test of capacity, we explain to the students that there is no limit of time for its completion. The person in charge of the tasks explains to the students the process to solve the two examples that appear at the beginning of each subtask, making sure that everybody understands them. The STAT is carried out in morning sessions. Once it is over the individuals are classified in four categories according to their scores in both tests.

In stage II we select some individuals from each intellectual subgroup according to the procedure explained in the section «*Subjects*». Then we carry out insight tasks.

## 3. RESULTS

### Identification and classification of individuals with diverse ability levels

First of all, we have to determine the IQ score required to be considered high-skilled; this is the case of scores surpassing percentile 90, that is, an IQ score **higher than**

**120** in both tasks (STAT and «g» factor). The number of individuals whose IQ is higher than 120 in both tasks is 36, what represents 2.86% of all individuals who sat both tests.

As we can see in table 2, the number of individuals that scored higher than 120 in Cattell's «g» factor test and in the STAT is not the same, what means that the rate of agreement in the decision is not very high.

TABLA 2. Results of the classification of students according to their scores in both intellectual tests.

| | | G | | |
|---|---|---|---|---|
| | | YES | NO | |
| STAT | YES | 36 | 73 | 109 |
| | NO | 131 | 1015 | 1146 |
| | | 167 | 1088 | 1255 |

There are 131 individuals whose IQ score is higher than 120 in the «g» factor test but lower in the STAT; similarly, there are 73 individuals selected by the STAT but not by the "g" factor test.

**Correlational analysis**

Table 3 shows the correlation among insight tasks and between their results and the intellectual performance. All the relations are significant although their values change with the tasks. (See Table 3).

First of all, we observe that there is an average correlation between insight tasks and the intelligence level (either using the STAT or the «g» factor test), although the correlation is slightly higher when the former is used. This means that insight tasks do not measure the same features as the intelligence tests used to make the intellectual level operative; they are different types of constructs. From this point of view we can say that insight tasks have their own specificity, different from intellectual ability, although this ability is, to a large extent, related to the reasoning process required by insight tasks, and even to a larger extent if that ability has been defined by the STAT, which seems to be more inclined towards insight than towards general and abstract intelligence as it is defined by the «g» factor test.

The same happens among insight tasks. While there is a significant correlation among them, the values are average, what means that although they share a common factor, each task has specific features slightly different from the others. However, in accordance with our hypotheses, the common factors surpass the specific ones; that is, although each task is specific to a certain extent, all of them are committed to insight beyond their own

TABLA 3. Pearson s r correlations between insight tasks and intellectual level.

| | (1) | (2) | Mystery | Letters | Analogies | Hints | (3) | Total Sc. | G IQ | STAT IQ |
|---|---|---|---|---|---|---|---|---|---|---|
| (1) | 1.00 | | | | | | | | | |
| (2) | .61** | 1.00 | | | | | | | | |
| Mystery | .40** | .40** | 1.00 | | | | | | | |
| Letters | .51** | .40** | .43** | 1.00 | | | | | | |
| Analogies | .27** | .28** | .33* | .40** | 1.00 | | | | | |
| Hints | .40** | .42** | .32** | .49** | .44* | 1.00 | | | | |
| (3) | .37** | .39** | .31** | .44** | .24** | .34** | 1.00 | | | |
| Total Sc. | .70** | .68** | .63** | .82** | .59** | .71** | .62** | 1.00 | | |
| G IQ | .32** | .31** | .31** | .42** | .36** | .55* | .36** | .54** | 1.00 | |
| STAT IQ | .46** | .46** | .36** | .61** | .52** | .62** | .44** | .73** | .61** | 1.00 |

n = 208; * - .01 ** - .001

(1) MATHEMATICAL INSIGHT TASK
(2) VERBAL INSIGHT TASK
(3) SELECTIVE ENCODING

elements. We deduce the insight common factor from the relation among tasks that include different contents such as verbal and numerical tasks but which show a high correlative degree, r=.61 in this case.

There is an important correlation between the Series of Letters and the other insight tasks, including a global average measure of insight obtained from the addition of the other tasks. The highest correlative degree takes place between the Series of Letters and the global score in insight tasks.

**Differential analysis**

We have carried out a series of one-way variance analyses with each variable used in order to check whether there are significant differences among the four groups of individuals classified according to their scores in both intelligence tests. The existing differences between two groups are stated by Fisher's LSD test (Least Significant Difference).

Table 4 summarises the results from the variance analysis carried out in each insight task to state whether there are differences among groups or not. This figure presents the following variables: F rate, signification level and pairs of groups whose measures and significantly different. Thus, the mathematical insight variable registers a significant F rate (F = 3.80) and the signification level is .0110. There are differences between groups 1 and 3 and between groups 2 and 4. Those differences make sense if we take into account that groups 1 and 3 scored higher than groups 2 and 4 (in the mathematical insight task).

TABLA 1. Summary of the differences among intellectual groups in each variable that shows significant disparities.

| INSIGHT TASKS | F RATE | F SIGNIF. | GROUPS DIF. |
|---|---|---|---|
| MATHEMATICAL | 3.8071 | .0110 | 1, 3 / 4<br>3 / 2 |
| VERBAL | 4.7585 | .0032 | 1, 3 / 4<br>1, 3 / 4 |
| MYSTERY | 1.9129 | .1287 | 1 / 4 |
| SERIES OF LETTERS | 6.4261 | .0004 | 1, 3 7 4<br>1, 3 7 2 |
| ANALOGIES | 6.3521 | .0004 | 1, 3 / 2<br>1, 3 / 4 |
| HINTS | 2.6863 | .0477 | 1 / 4 |
| SELECT. ENCODING | 4.7407 | .0032 | 1, 3, 2 / 4 |
| TOTAL INSIGHT | 9.5249 | .0000 | 1, 3 / 4<br>1, 3 / 2 |

There are significant differences among the four groups in all insight tasks.

In relation to the differences among groups we can see that the insight tasks of groups 1 and 3 show the highest scores in all tasks. Group 4 is the one with the lowest scores in all tasks. Groups 1 and 3 did better than group 2 in most tasks.

The meaning of these differences seems to be clear if we look at them as a whole. High intelligence groups (when their ability has been defined using the STAT) do better in insight tasks; they perform even better than group two, whose general intelligence score was high (using a traditional test such as the «g» factor). On the other hand, group 4, which is made up of average people, got the lowest scores in all insight tasks.

## 4. DISCUSSION

There is not an important correspondence between the STAT and the «g» factor test when classifying individuals according to their intellectual abilities. Students identified as high intelligence level are not the same to a large extent when we use one test or the other.

In relation to insight processes, the results make clear that there are differences in all insight tasks among groups with different intellectual levels. These differences always take place between high intelligence level and average groups to the advantage of the former. One of the characteristics that differentiate high-level groups from individuals of average abilities seems to be their higher capacity to activate cognitive insight mechanisms that will enable them to find new relations and solutions to new problems by making use of selective encoding, combination and comparison, which apparently, are embedded in insight tasks (Davidson and Sternberg, 1984; Davidson, 1986; Davidson, 1995).

There are also differences among high-skilled groups depending on the test we use to assess it, that is, traditional intelligence tests or tests that include assessment processes related to significant information processing in determined contexts and in innovative situations. High-skilled groups or high intellectual level groups (when their ability has been defined using the STAT) perform better in most insight tasks than the groups that got high scores in Cattell's «g» factor test.

When studying in depth the differences among the way those groups perform in insight tasks, we find out that there are not differences among all of them, since there are no differences in most tasks between group 1 (selected by both tests) and group 3 (selected according to the STAT). Similarly, there are very few differences between group 2 (selected according to the «g» factor test) and group 4 (the average one). In conformity with our hypotheses, group 1 presents the highest number of differences with the other groups. The same happens with group 3 (except in two tasks), which is made up of individuals selected by the STAT only. Groups 1 and 3 generally behave in a similar way in insight tasks.

In accordance with our expectations, there are differences between the high intelligence individuals selected by the STAT and the one selected by the «g» factor test to the advantage of the former in most insight tasks, including the total score. Therefore, it seems that the STAT is related to insight processes to a larger extent than to general intelligence measured using the «g» factor test.

We deduce from the results obtained that there is a correlation between performance in insight tasks and intelligence level. However, in all cases, the correlation between insight tasks and the scores in the STAT is higher than the correlation between scores in

insight tasks and the «g» factor test. Both tests show a moderate and significant relation, what means that both constructs have their specificity but they also share common aspects.

On the other hand, in accordance with the existence of a unitary insight construct, there is an important and significant correlation between the scores in mathematical and verbal insight tasks, what proves that we are dealing with the same construct and that it goes beyond the specificity of the verbal or mathematical content of the task. The converging validity of the insight construct is reinforced by the meaningful relation that takes place between the series of letters task and the other insight tasks. The series of letters task is used to measure inductive reasoning that surpass the information given in order to establish a new relation inferred from the aforementioned relations.

The results of these analyses state that high intelligence individuals use selective encoding, combination and comparison processes such as the ones used in this work. The difference among high intellectual individuals and the average ones lies in the ability to the first ones to sift out information in order to find the relevant aspects they need to finish the task (Davidson, 1995).

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