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# WORKING MEMORY, PROCESSING SPEED, VISUOSPATIAL AND CLASS NOTES; PROOF OF THE ADMINISTRATION OF INTELLIGENCE TEST ON MOROCCAN STUDENTS

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**ABSTRACT:** *The purpose of our study is to know and specify the intelligence closest to school success among the three indexes of the Wechsler Intelligence Scale for Children and Adolescents 5th Edition WISC-V. It's a cognitive test administered for children between 6 years to 16 years 8 months. The Working Memory Index (WMI), the Processing Speed Index (PSI) and the Visuospatial Index (VSI) are the three indexes used for this study. The participants in this study are 87 students (39 girls and 48 boys) between the ages of 12 and 13. The all subtests of WISC-V are administering to urban and rural children. The results for the samples who are public school students show a very high average of the working memory index compared to the other two indexes. Also, the correlation of the Working Memory Index with the Continuous Assessment scores showed higher values compared to the other correlations.*

**KEYWORD:** working memory, processing speed, visuospatial, intelligence, class notes**.**

## INTRODUCTION

Academic achievement has always remained an area of dialogue and discussion and a field for research and in-depth study. It reflects the importance attached to the activity by educational leaders, administrators, teachers and parents, dictated by the urgent need to prepare the young and new generations to be able to give, contribute and achieve social goals. Several researchers link academic achievement to several cognitive factors such as crystallized intelligence and working memory in the later years of the development of intelligence tests.

Working memory commonly defined as a system or set of processes. That processes information and temporarily holds it while performing various cognitive tasks (Baddeley and Hitch, 1974, 1994). Assessments of processing speed appeared in the first batteries of human mental tests (Cattell, 1890; Galton, 1884, 1890). In addition to being one of the many domains of cognitive function. Some have also advocated the processing speed as a critical component across cognitive domains. In that, it has been suggesting as a foundation for the competence of cognitive abilities and as influence the quality of processing, they are ageing (Jensen, 2006; Salthouse, 1996; Verhaeghen, 2014). Psychology embodies the perpetual composition of processing speed, an idea that there are measurable limits to the rate at which humans can

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correctly perform simple psychological tasks. Processing speed tests generally assess how well people can perform mental tasks that, in the absence of time constraints, would rarely be answered incorrectly. Visuospatial ability is different. It involves perceiving, generating and operating visual patterns and stimuli, and is characterized by tasks that require the perception and manipulation of visual forms (Mc Grew, 2009). One of the most robust findings in the literature is a male advantage on visuospatial aptitude tests, particularly mental rotation (Linn & Petersen, 1985; Voyer, Voyer & Bryden, 1995).

This study is carried by the Wechsler Intelligence Scale for Children and Adolescents, a test composed of five leading indexes. Still, in this work we treated the three indexes cited below: the Working Memory index WMI(Gsm short-term memory: the ability to memorize information for a short period), the Processing Speed index PSI(Gs processing speed: the ability to perform repetitive and straightforward cognitive tasks quickly and fluently over a short time) and the Visuospatial index VSI (Visual Processing Gv: the ability to analyze visual patterns and solve problems using simulated mental imagery) we compare class scores with the three WISC V indexes for find the relation with academic achievement and intelligence for the purpose of finding the intelligence closest to academic success in Morocco also to work to develop other intelligences.

## METHOD

### Participants:

The study carried on 87 Moroccan students, 25 students from urban areas and 42 students from rural areas. The aim is the administration of all sub-tests of WISC V on Moroccan students. The children participating in this study aged between 12 and 13 years (mean age = 13 years 2 months 25 days; with a standard deviation = 00 years 7 months 15 days). The sample consists of 39 girls and 48 boys. The participants are students from rural and urban areas of Safi province (25 urban and 42 rural students). According to this study by WISC V, we have taken for this article the scores of the three indexes: the working memory index, the processing speed index and the Visuospatial index also the averages of the mark in the class at the end of the school year.

### Procedure:

By administering all the WISC V subtests individually to the participants, we keep the results of the following three indexes: Working Memory Index, Processing Speed Index and Visuospatial Index. Knowing that two subtests calculate the Working Memory Index WMI: Digit span and Picture Span. The Processing Speed Index PSI is calculating by coding and symbols search. The Block Design and Visual Puzzles calculate the Visuospatial Index VSI Wechsler, D. (2016a,b). According to an administrative authority received from the colleges and parents. After, the permission gives from the region academic. We administrate the test during non-school hours on the premises of various colleges in the Safi region.

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## RESULT

The mean values and standard deviations of the three indexes and the class scores of the students participating in this study are presented in Table 1. It shows that the Working Memory index WMI is slightly higher than the theoretical average, while the Processing Speed index PSI and the Visuospatial index VSI is lower than the theoretical average.

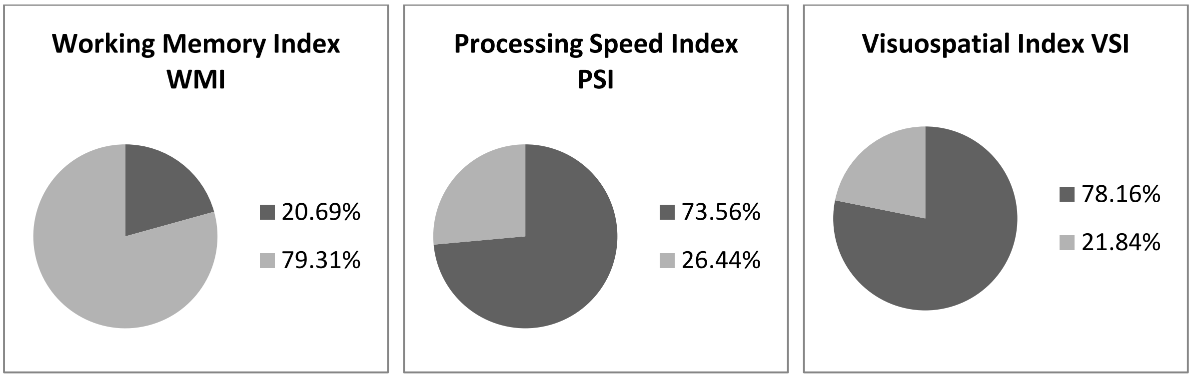


Figure1: percentage of students in index scores.

The difference between WMI and the two indexes is 15 points that is more than one standard deviation. The standard deviation of the two indexes WMI and PSI is equal and it is greater than the standard deviation of VSI.

To make the observation about the superiority of mean WMI over the other mean factor indexes more subtle, we notice that the three figures show the different percentages of children scoring high and low on the three indexes.

| | WMI | PSI | VSI | CS |
|---|---|---|---|---|
| **M** | **109,3** | **94,63** | **94,02** | **13,71** |
| **SD** | **12,72** | **12,02** | **9,58** | **2,65** |

Table 1: M=Mean, SD=Standard Deviation, VCI= Verbal Comprehension Index, FRI= Fluid Reasoning Index, CS=Class Scores.

The percentage of children scoring above the theoretical mean in WMI is equal to the percentage of children scoring below the theoretical mean in the PSI and VSI indexes.

The correlations between the three WISC V indexes and class scores are presented in Table 2 with average positive correlations.

| | WMI | PSI | VSI |
|---|---|---|---|
| **PSI** | **0,32** | | |
| **VSI** | **0,41** | **0,28** | |
| **CS** | **0,36** | **0,22** | **0,28** |

Table 2: VCI= Verbal Comprehension Index, FRI= Fluid Reasoning Index, CS=Class Scores.

The last table 3 presents the correlation between the results of the six subtests that make up the three indexes in this study and the class scores. The correlations between the subtests are positive but for the correlations of the subtests with the class scores are positive and negative.

| | BD | VP | DS | PS | CD | SS |
|---|---|---|---|---|---|---|
| **VP** | **0,38** | | | | | |
| **DS** | **0,32** | **0,24** | | | | |
| **PS** | **0,28** | **0,36** | **0,46** | | | |
| **CS** | **0,26** | **0,13** | **0,33** | **0,23** | | |
| **SS** | **0,36** | **0,11** | **0,39** | **0,14** | **0,71** | |
| **CS** | **-0,09** | **-0,21** | **0,05** | **0,07** | **0,21** | **0,28** |

Table3: BD=Block Design VP=Visual Puzzles DS=Digit Span PS=Picture Span CD=Coding SS=Symbols Search CS=Class Score.

The correlation between the speed of processing index (code and symbols) subtests and class scores is a weak positive relationship although the correlation between the two subtests is a very strong positive relationship.

## DISCUSSION

The average value of the working memory index WMI is higher than the theoretical one hundred averages in comparison to the other indexes, as is the number of students scoring above the one hundred averages. This index assesses the child's concentration, listening ability, and self-control. We found that children with below-average academic achievement and learning disabilities had deficits in memory functioning that required more repetition to record. They will need more time to assimilate the information. On the other hand, children with regular school results did not have deficits in working memory. Also, the standard deviation is higher than the three standard deviations of the other indexes. This index can be a good indicator of student intelligence. Stauffer et al (1996) found a correlation of +.995 between a factor representing general intelligence (g) and a factor representing working memory. (Colom, Flores-Mendoza, & Rebollo, 2003).

The mean value of the processing speed index PSI is lower than the theoretical mean 100 so the standard deviation is closer to the standard deviation of the working memory indexes so we note that the percentage of students scoring below the theoretical mean 100 is higher than two thirds of the students participating in this study. This index estimates the speed and accuracy with which a child assimilates information, by maintaining attention and concentration. Teachers and parents of students with very low scores are very shy. However, since working memory and processing speed are essential components of overall intellectual capacity, they may not be ignored. Indeed, numerous studies have shown that high working memory capacity and effective processing speed facilitate learning and the resolution of complex and cognitive tasks (Ackerman, Beier, & Boyle, 2005; de Ribaupierre, Fagot, & Lecerf, 2011; de Ribaupierre & Lecerf, 2006; Gignac, 2014; Salthouse, 1992).

The students participating in this study are children from families with a very low household income, and the parents are illiterate. The mean value of the visuospatial index VSI is the lower of the two other indexes compared to the theoretical mean 100. This index measures visual processing, representing the ability to generate, perceive, analyze and manipulate visual stimuli to solve problems. A low score could be a harbinger of difficulties in school mathematics. The standard deviation of this index is less than the other two indexes.

The mean value and standard deviation of the visuospatial index VSI is the lower of the two other indexes relative to the theoretical mean 100, which is evidenced by the large percentage of students scoring below average. This index is a measure of visual processing, representing the ability to generate, perceive, and analysis and manipulate visual stimuli to solve problems. Students with low scores may predict difficulties in mathematics at school, indicating their academic performance in mathematics. Not to mention that the students participating in this study are children from families with very low household incomes, so the parents and their family circle are illiterate. Especially the participants from rural areas never received pre-school education, so they suffer from the absence of all the social activities that serve to develop their intellectual levels.

On a theoretical level, there is no link between the three indexes and the class marks, and there is almost no link between the six index tests and the class marks. The link between the two subtests of each index is in the direction of good congruence: they seem to solicit the same cognitive aspect. The results of the three indexes, which are many domains of intelligence, would therefore guide us more towards models where the intelligences should be considered independently of each other.

## CONCLUSION

Very clearly, our results support the idea that working memory functioning plays a vital role in educational success according to the administration of the three WISC V indexes in urban and rural settings. We conclude that differences in working memory may explain school success regardless of parental education level. Working memory appears to be the most important predictor of academic success. There was no significant interaction between academic achievement and other indexes also with their subtests. In spite of the very low social and economic difficulties of the participants, there are students above the theoretical average without forgetting the impact of absence from pre-school education and all social activities. The solution remains to develop the economic and educational state for all students with low results in one of the tested intelligence even there are several types of knowledge still to be studied like multiples intelligences.

**Reference**

Ackerman, P. L., Beier, M. E., & Boyle, M. O. (2005). Working memory and intelligence: The same or different constructs? Psychological Bulletin, 131, 30–60. https://doi.org/10.1037/0033-2909.131.1.30.

Baddeley, A.D., Hitch, G.J., 1974. Working memory. In: Bower, G.H. (Ed.), The psychology of learning and motivation. Academic Press, New York, pp. 47–89 (Vol. 8).

Baddeley, A.D., Hitch, G.J., 1994. Developments in the concept of working memory. Neuropsychology 8 (4), 485–493.

Cattell, J.M. (1890). Mental tests and measurements. Mind, 15, 373–380.

Colom, R., Flores-Mendoza, C., & Rebollo, I. (2003). Working memory and intelligence. Personality and Individual Differences, 34, 33-39.

de Ribaupierre, A., Fagot, D., & Lecerf, T. (2011). Working memory capacity and itsrole in cognitive development: Are age differences driven by the same processesacross the lifespan? In P. Barrouillet, & V. Gaillard (Eds.), Cognitive developmentand working memory: From neo-Piagetian to cognitive approaches (pp. 105–133).Hove, East Sussex: Psychology Press.

de Ribaupierre, A., & Lecerf, T. (2006). Relationships between working memory andintelligence from a developmental perspective: Convergent evidence from aneo-Piagetian and a psychometric approach. European Journal of Cognitive Psy-chology, 18(1), 109–137. http://dx.doi.org/10.1080/09541440500216127

Galton, F. (1884). Anthropometric laboratory. London, UK: William Clowes and Sons Ltd.

Galton, F. (1890). Remarks on 'Mental tests and measurements' by J. McK. Cattell. Mind,15, 380–381

Gignac, G. E. (2014). Fluid intelligence shares closer to 60% of its variance with work-ing memory capacity and is a better indicator of general intelligence. Intelligence,47, 122–133. http://dx.doi.org/10.1016/j.intell.2014.09.004

Jensen, A.R. (2006). Clocking the mind: Mental chronometry and individual differences.Amsterdam, The Netherlands: Elsevier.

Linn, M., & Petersen, A. (1985). Emergence and characterization of sex differences in spatial ability: A meta-analysis. Child Development, 56, 1479–1498.

McGrew, K. (2009). CHC theory and the human cognitive abilities project: Standing on the shoulders of the giants of psychometric intelligence research. Intelligence, 37, 1–10.

Salthouse, T. A. (1992). Mechanisms of age-cognition relations in adulthood. Hillsdale,New Jersey: Lawrence Erlbaum Associates, Publishers.

Salthouse, T.A. (1996). The processing-speed theory of adult age differences in cognition. Psychological Review, 103, 403–428. http://dx.doi.org/10.1037/0033-295X.103.3.403.

Stauffer, J. M., Ree, M. J., & Caretta, T. R. (1996). Cognitive-components tests are not much more than g: An extension of Kyllonen's analysis. Journal of General Psychology, 123, 193-205.

Verhaeghen, P. (2014). The elements of cognitive aging: Meta-analyses of age-related differences in processing speed and their consequences. Oxford, UK: Oxford University Press.

Voyer, D., Voyer, S., & Bryden, M. P. (1995). Magnitude of sex differences in spatial abilities: Ameta-analysis and consideration of critical variables. Psychological Bulletin, 117, 250–270.

Wechsler, D. (1939). Wechsler-Bellevue Intelligence Scale. New York: The Psychology Corporation.

Wechsler, D. (2016a). WISC–V. Echelle d'intelligence de Wechsler pour enfants-5e édition. Paris, France: Pearson France-ECPA.

Wechsler, D. (2016b). WISC–V. Echelle d'intelligence de Wechsler pour enfants-5e édition, manual d'interprétation. Paris, France: Pearson France-ECPA.