Scientific Research Publishing

Open Journal of Medical Psychology, 2018, 7, 82-90
http://www.scirp.org/journal/ojmp
ISSN Online: 2165-9389
ISSN Print: 2165-9370

Study of Visual Perception and Working Memory in Moroccan Adolescents Attending School

Aziz Eloirdi[1], Khaoula Mammad[1*], Amine Arfaoui[2], Hassan Chtibi[1], Mamadou Ciré Diallo[1], Philippe Wallon[3], Ahmed Ahami[1]

[1]Team Clinical Neuroscience, Cognitive and Health, Laboratory of Biology and Health, Faculty of Science, Ibn Tofail University, Kenitra, Morocco
[2]Executive Training Royal Institute of Youth and Sports, Salé, Morocco
[3]INSERM Saint Rémy lès Chevreuse, Paris, France
Email: *khaoula.mammad@gmail.com

How to cite this paper: Eloirdi, A., Mammad, K., Arfaoui, A., Chtibi, H., Diallo, M.C., Wallon, P. and Ahami, A. (2018) Study of Visual Perception and Working Memory in Moroccan Adolescents Attending School. *Open Journal of Medical Psychology*, **7**, 82-90.
https://doi.org/10.4236/ojmp.2018.74007

Received: August 15, 2018
Accepted: September 23, 2018
Published: September 26, 2018

Abstract

Visual Perception and working memory are essential neuropsychological skills for any learning. The objective of this research is to study these skills, by analyzing numerical plots, according to gender, age, level of study and the stream by evaluating perceptive and memory deficits in Moroccan adolescents attending school. Our sample contains 146 high school students, including 78 boys and 68 girls participated in this study and we used the numerical version of The Rey-Osterrieth complex figure test (ROCF-A) to assess visual perception and working memory. The results of this study showed that, on the one hand, more than 34% of the subjects examined show signs of perceptual deficit and more 21% show signs of memory deficit and, on the other hand, that the scores of the visual perception are significantly associated with age and that working memory scores are significantly associated with age, level of education, and stream.

Keywords

Visual Perception, Working Memory, Deficit, ROCF-A

1. Introduction

Visual perception is a neuropsychological process that refers to the processing and integration of sensory information at the cortical level. The processing of visual information at the cortical level allows, among other things, the detection of shapes and colors and the location and identification of objects. This

processing begins with the retinal cells' reaction to light and ends with the cortical processing of visual information.

The working memory is a cognitive function evoked by [1]. It allows to maintain for a certain time and to process dynamically the information in order to realize cognitive tasks like the reasoning, the computation, the written production, reading and understanding.

Memory and perceptual disorders are widely encountered among school-age children in Morocco and constitute a real problem that influences the learning process and may lead to school failure among students [2]. These disorders often go unnoticed by parents or even educators, and their consequences are very serious on the health and development of the child, their evaluation is a major issue, because it allows identifying and diagnosing neurocognitive disorders in the subject [3]. In Morocco, few studies are interested in perceptual and mnemic profiles among school-aged adolescents.

The ROCF-A is a test that allows the evaluation of different neurocognitive processes such as visual perception, visuospatial organization, working memory, cognitive inhibition and attention [4]. Several calibrations of this test have been done; we will limit ourselves to the most recent ones. The 2009 calibration [5] is based solely on the age variable. Another calibration appeared in 2012 [6] which proposed adding gender and level of study variables. Note that the first was conducted with a population aged between 18 and 34 years and the second with a population aged between 20 and 39 years. Based on these observations, we set an aim of studying visual perception and working memory by analyzing digital plots according to gender, age, level of study and stream by evaluating perceptive and memory deficits in Moroccan adolescents attending school.

2. Material and Method

1) Population

The study was conducted in December, January and February 2016 at the high school qualifying ZINEB NAFZAOUIA which is part of the province of Sidi Slimane of the Rabat region, Salé, Kenitra, located in north western Morocco. Otherwise, in order to provide a representative sample of the general population, we have established the following exclusion criteria: Uncorrected visual disorders, neurological antecedents (cerebrovascular accident or head trauma...), pharmacological treatment causing attention disorders and/or drowsiness, severe depression or unstabilized psychiatric disorders. In this school, there are 834 students, of which 434 are girls. 146 students including 68 girls participated in this study. All topics have been included. The sample consisted of 146 students including 78 boys (mean age = 17.29 ± 1.40 years) and 68 girls (mean age = 16.94 ± 1.43 years). All participants agreed to conduct this research.

2) Tools used

a) ***The Rey-Osterrieth Complex Figure Test*** **(*ROCF-A*)**

In order to evaluate visual perception and working memory, we used *ROCF-A*

digital version, which consists of using:

- A digital pen (Anoto pen system) with a pencil lead and an infrared camera.
- Halftone paper with a usual appearance and does not disturb the writer, the frame consists of the juxtaposition of a myriad of points, this weft, generated by a mathematical algorithm, the pen reads the weft and is therefore precisely located.

Expert Line Information Analyzer (ELIAN) software was developed by Seldage (http://www.eliansoftware.com) to visualize and analyze data from the pen. Several versions are available, we used the "Expert" version which provides an Excel data table and offers an analysis to help the diagnosis. ELIAN provides access to very fine objective data (1/10 of mm, 1/100 of sec) and gives automated analyzes. After making the layout, place the pen on its place, connected to the computer via its USB socket, we launch the software "ELIAN" and the loading of the traces is done immediately.

The ROCF test is divided into two phases: For the copy phase, that informs the visual perception, the model is presented horizontally to the subject and must be clearly visible and we ask him to copy this drawing. The second phase of the test is reproducing from memory that informs the working memory: the models removed and the subject is asked to reproduce the figure again. The duration of the test is free for both copying and reproduction. Wallon and Mesmin, 2009 [5], in their handover manual, specify that the two phases must be separated by an interval of less than three minutes. Two procedures are applied to the results: numerical scoring of points, which evaluates the quality of the production, and an analysis of the method of approach to the reproduction task.

The numerical score makes it possible to establish a score, the FCR-A is divided into 18 elements, they are listed one by one as follows: Correctly drawn and well placed (4 points), Correctly drawn and misplaced (2 points), Properly drawn, well placed but imperfect (3 points), Distorted or incomplete but recognizable and well placed (2 points), Distorted or incomplete but recognizable and misplaced (1 points) and finally Unrecognizable or absent (0 points). The type rating makes it possible to understand the method or strategy used by the subject to copy and then reproduces the figure [7]. To know the type of organization used, the ELIAN software allows you to record the succession of features. According to [8], there are seven types of organization: 1) construction of the structure, 2) details encompassed in the structure, 3) general outline, 4) juxtaposition of details, 5) details on a confused background, 6) reduction to a familiar scheme, 7) scribbling. However, we interested in the numerical rating.

b) ***Information sheet***

All students participating in this study completed a fact sheet that provided information on age, gender, level of education and stream. It also made it possible to identify possible exclusion criteria.

3) Statistical analysis

We presented the results for mean scores of visual perception and working

memory as mean ± standard deviation. In order to compare the mean of visual perception and working memory according to the groups studied, we used the Student's test and the ANOVA test. In addition, to assess the perceptual and memory deficits in the subjects examined, we proceeded to a distribution according to the reference percentiles.

3. Results

1) Distribution of the sample

Table 1 presents the distribution of our sample by sex, by age, by level of education and by stream. Indeed, according to sex, boys constitute 53.4% of the population. By age, students under 17 represent 60.3%. By level of study, the sample is composed of 28.8% of the students in the 1st year of high school, 39.7% of the 2nd year and 31.5% of the 3rd year of high school. Finally, by stream, scientists represent 45.9% of the sample.

2) Perceptive and mnemic profiles

In order to evaluate the perceptive and memory deficits in the subjects examined, we proceeded to a distribution according to the reference percentiles. Indeed, if the subject obtains a score lower than the 10th percentile or higher than the 90th percentile, it's mean a perceptive or mnemic deficits.

a) *Visual perception*

Regarding, to the copy phase that provides information on visual perception, the results in Figure 1 show the distribution of our subjects according to the reference percentiles. In fact, 32 students, 21.9% belong to the first decile (first 10 percentiles) and 25 belong to the second decile. In third place, arrive the 3rd decile and the last decile with 19 cases each. It should be noted that the 35% belonging to the first and the last decile would present signs of perceptual deficits.

b) *Working memory*

The figure below represents the distribution of students according to the reference percentiles in the reproduction phase that informs the working memory.

Table 1. Distribution of the sample by sex, age, level of education and stream.

		Frequency	Percentage
Gender	*Girls*	68	46,6
	Boys	78	53,4
Age	≤17 *years*	88	60.3
	>17 *years*	58	39.7
Level of education	1st *year of HS*	42	28.8
	2nd *year of HS*	58	39.7
	3th *year of HS*	46	31.5
Stream	*Scientist*	79	45.9
	Literary	67	54.1

HS: High school.

We observe that 25 students belong to the first decile, that 17.1%. 19 belong to the 3rd decile. The 8th and 10th decile contain 7 students each. The 22% belonging to the first and last deciles would be subject to memory deficits (Figure 2).

3) Study of visual perception and working memory by gender, age, level of education and stream

a) ***Visual perception***

Table 2 presents the distribution of means visual perception scores by gender, age, level of education and stream. Moreover, the distribution of the means of the age-specific scores shows that they are higher among students under 17 (66.78 ± 4.89), compared to students over 17 (65.49 ± 5.01). The Student test shows that the difference is statistically significant (t = 2.21, p = 0.02). However, the differences between the means of the visual perception scores by gender, level of education and stream are not significant. This implies that visual perception depends on age.

b) ***Working memory***

Table 3 shows that the average scores for students under 17 (42.18 ± 12.29) is

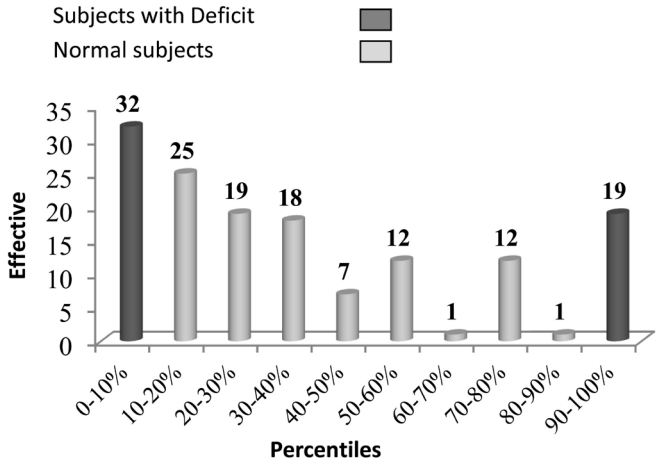

Figure 1. Distribution of copy phase results by reference percentiles.

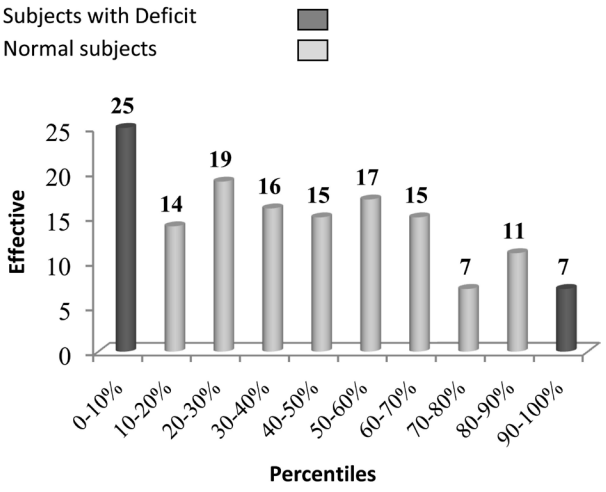

Figure 2. Distribution of reproductive phase results by reference percentiles.

Table 2. Distribution of the means of the visual perception by gender, age, level of education and stream.

		Mean ± SD	Test	Sig
Gender	*Boys*	65.68 ± 5.034	t = −1.210	p = 0.23
	Girls	66.68 ± 4.891		
Age	≤17 *years*	66.78 ± 4.891	t = 2.21	p = 0.02
	>17 *years*	65.49 ± 5.010		
Level of Education	1st *year of HS*	65.83 ± 4.674	F = 2.585	p = 0.08
	2nd *year of HS*	67.22 ± 4.615		
	3th *year of HS*	65.07 ± 5.487		
Stream	*Scientist*	66.75 ± 4.735	t = −1.599	p = 0.11
	Literary	65,43 ± 5,191		

HS: High school.

Table 3. Distribution of the means of working memory by gender, age, level of education and stream.

		Mean ± SD	Test	Sig
Gender	*Girls*	42.18 ± 12.296	t = 1.472	p = 0.14
	Boys	39.21 ± 12.037		
Age	≤17 *years*	44.66 ± 10.946	t = 4.57	p < 0.001
	>17 *years*	36.82 ± 12.264		
Level of Education	1st *year of HS*	44.50 ± 10.627	F = 11.298	p < 0.001
	2nd *year of HS*	43.34 ± 12.611		
	3th *year of HS*	34.20 ± 10.559		
Stream	*Scientist*	42.85 ± 12.015	t = −2.234	p = 0.02
	Literary	38.37 ± 12.113		

HS: High school.

higher than that for students over 17 (39.21 ± 12.03), the difference is highly significant (t = 4.57, p < 0.001). The same observation for the stream. Thus, the mean scores for students of 1st and 2nd year of HS are larger than those for students of 3th year of HS, with analysis of variance showing that the difference is highly significant (F = 11.29, p < 0.001). However, the difference between the averages of the working memory scores by gender is not significant. This implies that the working memory depends on the age and the level of study and the stream.

4. Discussion

We recall that the objective of this work is to study the visual perception and working memory, by the analysis of numerical plots, according to the sex, the age, the level of study and the stream in assessing perceptual and memory defi-

cits in schooled Moroccan adolescents.

Regarding the perceptual and memory profiles of the students in the study, the results showed that more than 34% show signs of perceptual deficit and 21% show signs of memory deficit. [3] reported a similar result among Moroccan children of school age. Indeed, perceptual and mnemic deficits are generally accompanied by signs of inhibition, anxiety and instinctual defect and can result in maladaptive behavior and impaired academic performance.

The study also showed that sex does not significantly influence the performance of the ROCF-A test in either copy or reproduction phase. In other words, sex has no effect on visual perception and working memory. Previous studies have found no difference between male and female performance in ROCF-A [6] [9] [10] [11] [12] [13]. As far as age is concerned, it turned out that younger students are more successful in terms of visual perception and working memory than older ones. Several previous studies show a strong relationship between age and performance in the ROCF-A copy and reproduction phase [9] [10] [14] [15] [16] [17]. Similar results have been reported by researchers working in different age groups [18]. In addition, other studies have suggested that age does not influence performance in the copy phase of the ROCF-A test, while influencing reproduction phase [16] [19] [20]. According to [16], the difference by age is not related to the strategy used. However, the work [5] [6] did not reveal any influence of age on the performance of the ROCF-A test. These results suggest that the age difference in the performance of the ROCF-A test is likely to be due to the fact that the least aged students are the least inhibited, especially since their average copy speed is higher.

The study also showed that student of 1st and 2nd year of high school perform better in terms of working memory compared to 3th year of high school students. This result was confirmed by Alice's study, 2012 even though the chosen levels are different. Also, some studies report a significant relationship between schooling and performance at ROCF-A [14] [20]. However, other studies have failed to highlight this relationship [15] [21]. In order to establish a more precise study, we proposed to study the influence of the stream on the performance of the ROCF-A test. Moreover, our results showed that this variable is significantly associated with working memory. In fact, scientists students are stronger in terms of working memory compared to literary students, this can be explained by the fact that scientists are much more involved in tasks that solicit working memory, such as experiments in physics, chemistry or biology, according to a study, science graduates have average scores significantly higher than other high school graduates (literate, technological and professional) in terms of working memory [22].

5. Conclusion

Finally, this study emerges, on the one hand, that a significant part of the participating students show signs of perceptual and memory deficits and on the other

hand that the visual perception depends only on age, however the working memory depends on age, level of education and stream. The results we obtained may not reflect the situation of the general population since the number of participants is very small compared to the total number of students in Morocco and the study was conducted in only one region of the country. Nevertheless, they shed some light on the neurocognitive profile of the participating students. This could explain the deterioration of the school performance of students declared by the Higher Council of Education in 2008 [23]. Otherwise, the results of this research suggest an accompaniment, by specialists for the subjects who present a perceptive and/or mnemic deficit. Thus, more deeply studies with brain imaging techniques could add important insights in this direction.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Baddeley, A.D. and Hitch, G.J. (1974) Working Memory. In: Bower, G.H., Ed., *Recentadvances in Learning and Motivation*, Vol. 8, Academic Press, New York.

[2] Ahami, A., Mammad, K., Azzaoui, F.-Z., Boulbaroud, S., Rouim, F.-Z. and Rusinek, S. (2017) Early Maladaptive Schemas, Working Memory and Academic Performances of Moroccan Students. *Open Journal of Medical Psychology*, **6**, 53-65. https://doi.org/10.4236/ojmp.2017.62004

[3] Ahami, A.O.T., Lachheb, A., Dik, K., Azzaoui, F., Aboussaleh, Y., Wallon, P. and Et Mesmin, C. (2010) Étude des déficits perceptifs et mnésiques chez des enfants d'âge scolaire. Front. Neurosci. Conference Abstract: 2nd NEUROMED Workshop.

[4] Vannetzel, L. (2010) Testons les tests: la Figure Complexe de Rey: Au goût du jour. *Approche neuropsychologique des apprentissages chez l'enfant*, **109**, 323-325.

[5] Wallon, P. and Messmin, C. (2009) Figure complexe de Rey A et B: guide d'utilisation et d'interprétation. Edition ECPA.

[6] Alice, T.C. (2012) Etalonnage du test de la Figure Complexe de Rey auprès de la population 20-39 ans. Cognitive Sciences. Dumas. 00730784.

[7] Rey, A. (1959) Test de copie d'une figure complexe d'A. Rey. Manuel. Paris, éditions du CPA.

[8] Osterrieth, P.A. (1945) Le test de copie d'une figure complexe. Contribution à l'étude de la perception et de la mémoire. *Archives de Psychologie*, **30**, 306-356.

[9] Bennett-Levy, J. (1984) Determinant of Performance on the Rey-Osterrieth Complex Figure Test: An Analysis, and a New Technique for Single-Case Assessment. *British Journal of Clinical Psychology*, **23**, 109-119. https://doi.org/10.1111/j.2044-8260.1984.tb00634.x

[10] King, M.C. (1981) Effects of Non-Focal Brain Dysfunction on Visual Memory. *Journal of Clinical Psychology*, **37**, 638-643. https://doi.org/10.1002/1097-4679(198107)37:3<638::AID-JCLP2270370332>3.0.CO;2-9

[11] Meyers, J.E. and Meyers, K.R. (1994) Meyers Scoring System for the Rey Complex Figure Test and the Recognition Trial. Psychological Assessment Resources, Odessa,

FL.

[12] Tombaugh, T.N., Hubley, A.M., Faulkner, P. and Schimidt, J.P. (1990) The Rey-Osterrieth and Taylor Complex Figures: Comparative Studies, Modified Figures and Normative Data for the Taylor Figure. Paper Presented at the 18th Annual Meeting of the International Neuropsychology Society, Orlando, FL.

[13] Waber, D.P. and Holmes, J.M. (1986) Assessing Children's Memory Productions of the Rey-Osterrieth Complex Figure. *Journal of Clinical and Experimental Neuropsychology*, **8**, 565-580. https://doi.org/10.1080/01688638608405176

[14] Ardila, A. and Rosselli, M. (1989) Neuropsychological Characteristics of Normal Aging. *Developmental Neuropsychology*, **5**, 307-320. https://doi.org/10.1080/87565648909540441

[15] Boone, K.B., Lesser, I.M., Hill-Gutierrez, E.H., Berman, N.G. and D'Elia, L.F. (1993) Rey-Osterrieth Complex Figure Performance in Healthy, Older Adults: Relationship to Age, Education, Sex and IQ. *The Clinical Neuropsychologist*, **7**, 22-28. https://doi.org/10.1080/13854049308401884

[16] Janowsky, J.S. and Thomas-Thrapp, L.J. (1993) Recall in the Elderly: A Deficit in Memory or Constructional Strategy? *Journal of Clinical and Experimental Neuropsychology*, **75**, 159-169. https://doi.org/10.1080/01688639308402554

[17] Rapport, L.J., Charter, R.A., Dutra, R.L., Farchione, T.J. and Kingsley, J.J. (1997) Psychometric Properties of the Rey-Osterrieth Complex Figure: Lezak-Osterrieth versus Denman Scoring Systems. *The Clinical Neuropsychologist*, **11**, 46-53.

[18] Tombaugh, T.N., Faulkner, P. and Hubley, A.M. (1992) Effects of Age on the Rey-Osterrieth and Taylor Complex Figure: Test-Retest Data Using an Intentional Learning Paradigm. *Journal of Clinical and Experimental Neuropsychology*, **14**, 647-661. https://doi.org/10.1080/01688639208402853

[19] Mitrushina, M., Satz, P. and Chervinsky, A.B. (1990) Efficiency of Recall on the Rey-Osterrieth Complex Figure in Normal Aging. *Brain Dysfunction*, **3**, 148-150.

[20] Berry, D.T.R., Allen, R.S. and Schmitt, F.A. (1991) Rey-Osterrieth Complex Figure: Psychometric Characteristics in a Geriatric Sample. *The Clinical Neuropsychologist*, **5**, 143-153. https://doi.org/10.1080/13854049108403298

[21] Delaney, R.C., Prevey, M.L., Cramer, J. and Mattson, R.H. (1992) Test-Retest Comparability and Control Subject Data for the Rey Auditory-Verbal Learning Test and Rey-Osterrieth/Taylor Complex Figures. *Archives of Clinical Neuropsychology*, **7**, 523-528.

[22] Marielle Lambert-Le Mener (2012) La performance académique des étudiants en première année universitaire: Influence des capacités cognitives et de la motivation. Education. Université de Bourgogne. Français.

[23] Higher Council of Education (2008) National Acquisitions Evaluation Program. Synthetic Report. http://www.csefrs.ma/wp-content/uploads/2017/10/rappor_synthetique_VF.pdf