

## Assessment of language disorders in anemic pupils in Chaouen Northern region of Morocco

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**Abstract:** Reading skills have a very important impact on all school learning, and students who have difficulty in acquiring these skills find major difficulties in pursuing their studies. The association between anemia and neurocognitive and psychomotor development has been widely reported among school-age children, thus adversely affecting learning abilities and academic performance. One of the reading assessment tools is the software LABBEL which is a battery of tests for the cognitive evaluation of language. This study was conducted with 24 anemic pupils aged 9 to 16, in the region of the city of Chaouen in northern Morocco. In this study we found significant correlations at 0.05 level, between the complex word reading task and the visual lexical decision task with  $R=0.45$ , between the word and non-word reading task and the visual lexical decision task with  $R=0.42$ , and between the auditory lexical decision task and the visual lexical decision task with  $R=0.48$ . We noticed a positive correlation between hemoglobin levels and the words and non-words reading task with  $R=0.37$ , and between hemoglobin level and the complex words reading task with  $R=0.30$ . This allows us to say that reading performance is related to hemoglobin levels.

**Keywords:** Anemia, Language Disorders, Reading, Speech therapy, North Morocco.

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### I. Introduction

Reading is a complex cognitive activity that relates, on the one hand, specific reading processes and, on the other hand, more general processes also used in oral language comprehension. Thus, reading comprehension involves two components, which are the process of identifying written words and comprehension processes [1]. The prevalence of reading problems and the existence of specific disorders have led to a great deal of research in order to identify the mechanisms involved in reading learning disorders. This research, and the identification of cognitive operations involved, led to the development of models that reflect both normal reading and learning disabilities [2]. Classical models suggest the existence of two pathways for reading activity, the indirect or phonological procedure that transforms visual information into phonological information by applying rules of correspondence between graphemes and phonemes, and the direct pathway. that proceeds by direct pairing of the written configuration of the word with its visual representation in memory, without the use of phonological knowledge [3]. Difficulties in acquiring grapheme correspondences impede the acquisition of the orthographic lexicon, on which the automation of reading depends [4]. The association between anemia and neurocognitive and psychomotor development has been widely reported among school-age children [5], thus adversely affecting learning abilities and academic performance [6]. The diagnosis of anemia is based on hemogram studying and hemoglobin levels. Anemia was defined according to WHO criteria as hemoglobin levels of less than 11.5 g / dl [7]. The purpose of this study is to assess language disorders in anemic children, using 6 activities of the Language Assessment Battery (LABBEL) in Arabic [8], the only assessment software of this type for Arabic speakers [9], the other purpose is to find out if reading performance is related to hemoglobin levels.

## II. Methodology

### 2.1 Subjects

The study was conducted at the KAA ASRAS hospital center in the region of the city of Chaouen in Northern Morocco, with 24 anemic pupils aged 9 to 16 years old with an average age of 12.42 years a 2.04 standard deviation, The sample was taken at random, and is composed of 83.33% boys (N = 20) and 16.67% girls (N = 4).

### 2.2 Language assessment tools

The 24 pupils were presented with the six following activities of the language assessment battery (LABEL): Complex words reading task, word and non-words reading task, auditory discrimination task, visual discrimination task, auditory lexical decision task, and visual lexical decision task.

### 2.3 hemoglobin levels measurement

Hemoglobin levels were measured at the KAA ASRAS hospital center in the Chaouen region of Morocco

## III. Results And Discussion

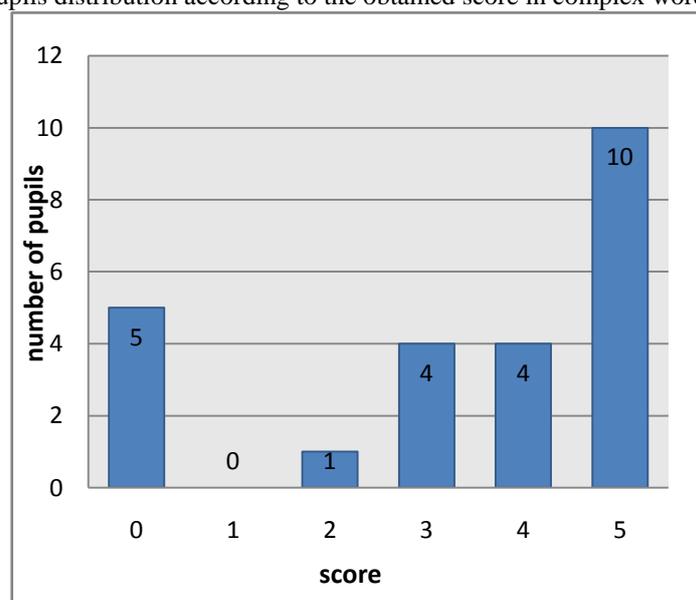
The 24 anemic pupils completed the six activities of LABEL battery, we used 5 items in each activity, so that the maximum score would be a score of 5 out of 5. Table I shows that the average score obtained in the complex words reading task is the lowest score in comparison to other tasks (score = 3,33 / 5) followed by the words and non-words reading task (score = 3,54 / 5). Statistical analyzes were performed using the statistical package for social sciences (SPSS) and Excel software.

**Table I.** Pupils performances in the six activities of LABEL battery

|                    | Complex words reading | Words and non-words reading | Auditory words discrimination | Visual words discrimination | Auditory lexical decision | Visual lexical decision |
|--------------------|-----------------------|-----------------------------|-------------------------------|-----------------------------|---------------------------|-------------------------|
| Mean               | 3,33                  | 3,54                        | 4,21                          | 4,92                        | 3,88                      | 3,83                    |
| Standard deviation | 1,95                  | 1,98                        | 0,66                          | 0,28                        | 1,08                      | 1,05                    |
| Minimum            | 0                     | 0                           | 3                             | 4                           | 2                         | 2                       |
| maximum            | 5                     | 5                           | 5                             | 5                           | 5                         | 5                       |

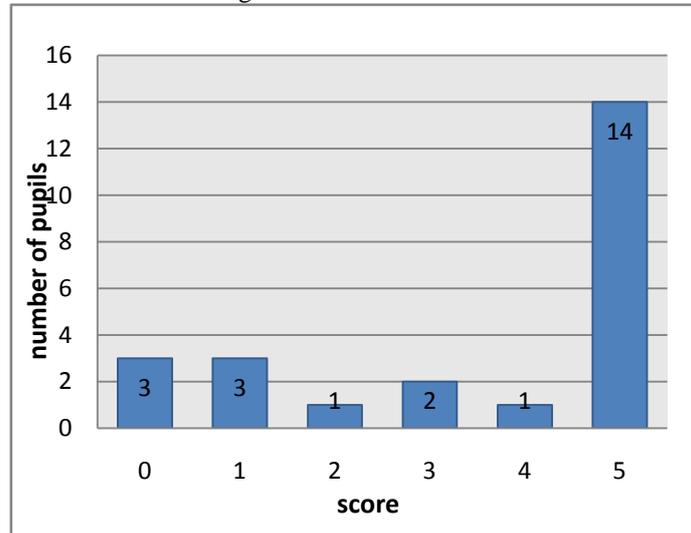
In the complex words reading task, 5 pupils (20,83 %) could not read correctly the 5 presented items, a single pupil read 2 words correctly, 4 pupils scored 3 out of 5 and four other pupils were able to obtain the score of 4 out of 5, only (41.67%) could read the 5 items without fail and get a score of 5 out of 5 (Fig 1).

**Figure 1.** Pupils distribution according to the obtained score in complex words reading task



In the words and non-words reading task, (12.5%) could not read correctly any of the 5 presented items, (12.5%) could read a single word correctly, (4.17%) obtained a score of 2 out of 5, we also found (8.33%) were able to obtain a score of 3 out of 5, a single pupil scored 4 out of 5, but more than half of the pupils (58.33%) were able to read correctly the totality of items thus obtaining a score of 5 out of 5 (Fig 2).

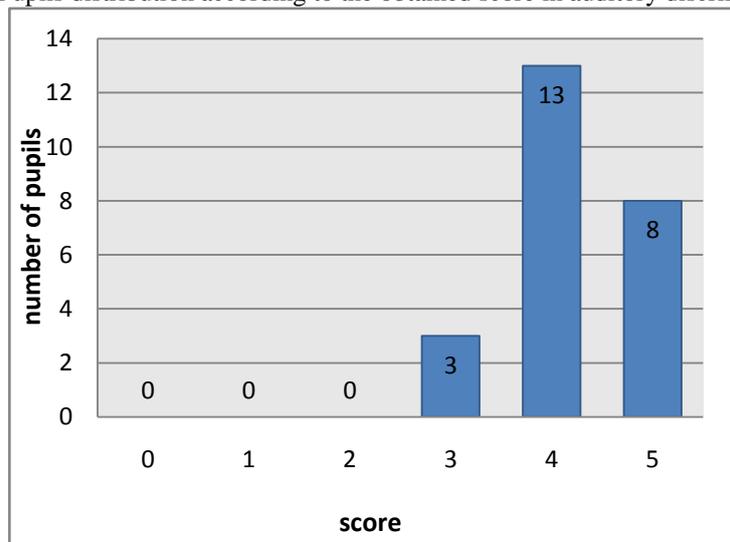
**Figure 2.** Pupils distribution according to the obtained score in words and non-words reading task



The types of errors produced in reading activities indicate that the pupils having difficulty performing these tasks have phonological processing difficulties and cannot convert the letters into their corresponding sound forms easily. We noticed a slowness that confirms decoding difficulties, thus we can note a deficit of the phonological pathway which rests on a system of rules allowing the graphemes-phonemes conversion. It is essential for reading non-words and new words [10].

In the auditory discrimination task, we found that (12.5%) obtained a score of 3 out of 5, and more than half of the pupils (54.17%) scored 4/5, and only (33.33%) were able to obtain the maximum score 5/5 (Fig 3). The failure to succeed in this task supposes a pathological deficit in their ability of auditory discrimination, since at this age the central auditory system should be fully developed [11]. Others stress the importance of having good acoustic discrimination capabilities for subsequent language development [12].

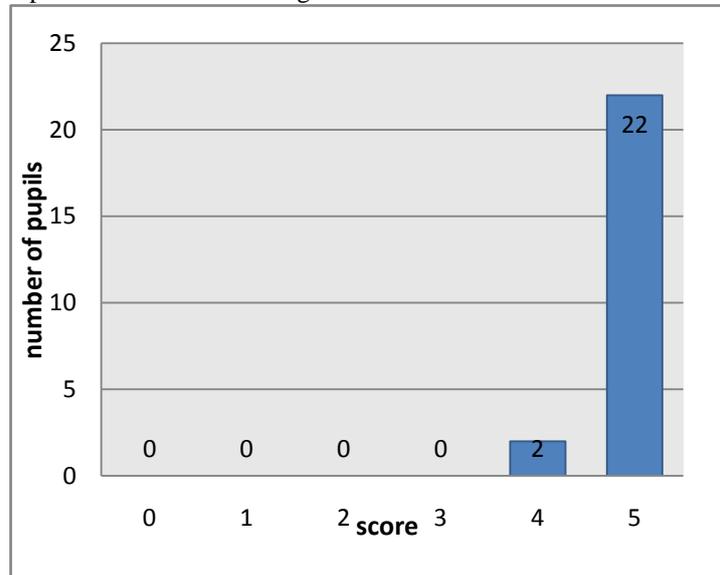
**Figure 3.** Pupils distribution according to the obtained score in auditory discrimination task



In the visual word discrimination task, we found that the vast majority of students (91.67%) had no problem to visually discriminate the presented words, only (8.33%) of our sample found some difficulties and obtained a score of 4/5 (fig 4), these results suggest that the pupils who could not accomplish this task use the logographic procedure of identification (global identification) of the written words which not only makes it

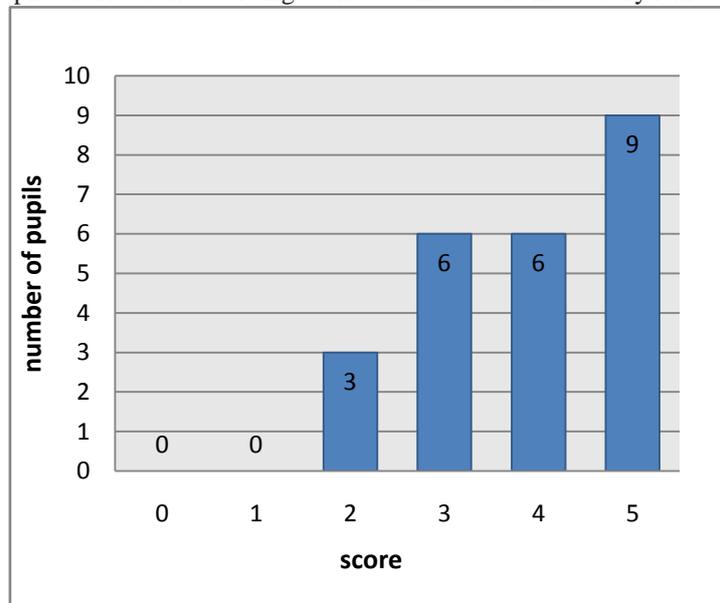
possible to recognize a limited number of words, but in addition, it leads to confusion of words visually close [10]. The ability to immediately recognize stored words is necessary for easy and fast reading [13].

**Figure 4.** Pupils distribution according to the obtained score in visual discrimination task



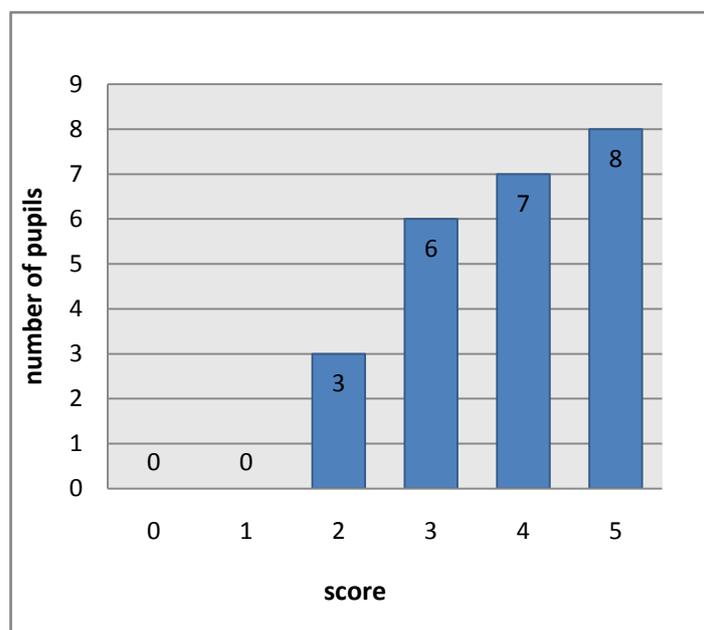
In the auditory lexical decision task, (12.5%) scored below average 2/5, (25%) scored 3/5 and another (25%) scored 4/5, and just (37.5%) were able to obtain the maximum score (Fig 5). These results suggest that these pupils have difficulty accessing the phonological representations of the presented items, this task not only requires that the child is able to differentiate between two very similar sounds but also that he can decide whether or not a proposed form belongs to his lexicon. The interest of this type of task is that it allows, by manipulating the nature of the modifications made to the words to construct pseudo-words, to evaluate the precision of the phonological representations of the children [14].

**Figure 5.** Pupils distribution according to the obtained score in auditory lexical decision task



In the visual lexical decision task, we note that (12.5%) scored below average 2/5, (25%) obtained 3/5, then (29.17%) scored 4/5 and just (33.33%) were able to reach the maximum score (Fig 6). These results suggest difficulties accessing the mental lexicon since visual recognition of words corresponds to the recovery of the mental representation of that word from its written form [15].

**Figure 6.** Pupils distribution according to the obtained score in visual lexical decision task



A significant correlation was found at 0.05 level between the complex word reading task and the visual lexical decision task ( $R = 0.45$ ), and also a significant correlation at the 0.05 level between the word and non-word reading task and the visual lexical decision task ( $R = 0.42$ ). This significant correlation between reading and visual lexical decision suggests that these pupils have difficulties in visual processing, since after the visual analysis, a first step allows to segment the written word into graphemes and convert them into phonemes. A second stage makes it possible to assemble the phonemes in order to reconstitute the word [16]. As a result, these pupils have difficulties in constructing a mental lexicon that would facilitate the identification of written words without recourse to grapheme-phoneme conversion as suggested by type of errors produced, The difficulty of reading non-words suggests a difficulty in the mechanism of conversion of the written form to its corresponding sound form, this suggests a phonological deficit and difficulties of articulation, because to produce a word, the child must have access to a detailed specification of articulatory gestures [14]. Several studies indicate a significant link between an uncorrected vision abnormality and a risk of difficulty learning to read [17]. We also found a significant correlation at the 0.05 level between the auditory lexical decision task and the visual lexical decision task ( $R = 0.48$ ). This correlation is very important because it confirms the difficulty of installing a mental lexicon in these students, because the mental lexicon consists of three representations: orthographic, acoustic and semantic, and this correlation shows that these students have difficulties in both sound and visual processing that are essential in the identification of words in these two tasks. The significant correlation between the complex words reading and the words and non-words reading tasks at 0.01 level ( $R = 0.92$ ), suggests that the pupils who have successfully completed one of those two tests have a strong chance of succeeding the other, and vice versa, this may suggest that using one of the two tasks may be indicative of the language level.

We noticed a positive correlation between hemoglobin levels and the words and non-words reading task ( $R = 0.37$ ), and a positive correlation between hemoglobin levels and the complex words reading task ( $R = 0.30$ )., thus we can say that reading performance is related to hemoglobin levels and we can say that in our sample, the lower the hemoglobin level the lower the score in reading tasks is. Failure in this cognitive task in anemic pupils is consistent with findings from Petranovic who concluded that cognitive ability is strongly associated with hemoglobin levels [18], and Sunghong et al. (2002) found that hemoglobin levels correlate with school performance [5]. And other studies confirm the existence of an important relationship between anemia and children's cognitive performance [19].

#### IV. Conclusion

In this study we assessed language disorders in 24 anemic pupils in the region of Chaouen (Morocco) using LABBEL language assessment battery. This assessment showed different difficulties to accomplish the presented activities, which shows that the necessary pathways to accomplish these cognitive tasks are deficient in these pupils. We were also able to find a positive correlation between hemoglobin levels and reading performance. Anemia is a public health problem, affecting more than one third of the population at

a national level, a low hemoglobin level can lead to alterations of cognitive functions and consequently learning disorders.

## V. Acknowledgements & conflicts of Interest

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