

# Assessment of attentional disorders in school-aged children with visual impairment in the province of Kenitra

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## ABSTRACT

### Background

Attention deficit disorder refers to a neurodevelopmental disorder that has attracted great interest in recent decades with a prevalence of about 5% of children according to the DSM V. The vision constitutes “the modality of knowledge” since this meaning, primitive, offers perceptual experiences at the origin of the development of the first cognitive acquisitions. However, the repercussions of a disorder affecting vision are significant as to the. It is therefore important to distinguish it from an intellectual development disorder.

### Aims and Methods

This study is intended to be descriptive and analytical. It aims to highlight the attention deficit in visually impaired children enrolled in the first year of primary school. Based on 6732 children, 1761 have a vision of less than 7/10, and only 85% of them benefit from automatic refraction at the optical unit, or 1497 children. Three devices were thus used: the test of entangled figures, the observation grid and the test of the two Zazzo dams. These devices make it possible to detect deficits in the attention and concentration of visually impaired students in school in relation to the decline in their level of visual acuity. The latter leads to attentional disorders resulting in concentration defects and distractibility. This decrease in attention occurs in proportion to that of visual acuity in visually impaired children.

### Results & Conclusion

One of the major interests in assessing attention deficit in children with visual impairments is the development of a compulsory childcare program for pre-school child and an educational awareness plan for parents.

### Keywords

visual impairment; attentional disorder; visually impaired; students.

## INTRODUCTION

The neurodevelopmental condition that has piqued experts' curiosity the most in recent decades is without a doubt attention deficit disorder. Parents, teachers, doctors, and even educators working in early childhood centers are becoming more attentive to the symptoms associated with this condition<sup>1-4</sup>. Early detection enables those involved in the child's life to observe and adapt to his unique behaviors, cognitive abilities, emotions, and social interactions<sup>2</sup>. Interventions can also start at an early stage, effectively mitigating the resulting functional consequences<sup>3</sup>. Therefore, clinicians often evaluate and follow up with children who exhibit a tendency to be restless, who struggle to understand personal boundaries, and who have difficulty following instructions. These behaviors indicate challenges in maintaining focus and attentiveness during explanations.

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These children frequently encounter difficulties in managing their behavior and emotions <sup>4</sup>. These behavioral symptoms do not necessarily indicate that all of these children have attentional disorders that require a diagnosis. Typically, a diagnosis is reached through a comprehensive psychological assessment that examines various aspects of behavior, cognition, and emotions <sup>5</sup>. Understanding the origins of the behaviors observed in our daily lives is crucial to preventing diagnostic errors. Despite the progress in understanding various events in recent years, it is important to continue making sustained efforts to gain a proper understanding of them <sup>6</sup>. As per Piaget's research, vision is considered a fundamental aspect of knowledge. It provides us with perceptual experiences that form the foundation for our cognitive development. The intricate relationship between these two levels of processing involved in constructing thought poses a significant challenge for scientific investigation. Nevertheless, considering the significant impact of a vision disorder on a child's development, it is crucial to differentiate it from an intellectual development disorder <sup>8</sup>. The current study aims to investigate the neurocognitive profile of children who have a visual impairment and also suffer from an attentional disorder. We are currently collaborating on a study regarding the occurrence of vision impairment among children in Kenitra province. Out of the total, 1761 individuals were chosen for our study due to their vision being less than 7/10.

## MATERIAL AND METHODS

This is an analytical descriptive study carried out in collaboration between the University IBN TOFAIL Kenitra and the Kenitra Health Delegation which aims to highlight the attention deficit in visually impaired children enrolled in the first year of primary school in the province of Kenitra. Our goal is to find a link between visual disorders and attentional deficits in school-age children to allow a good orientation of children and appropriate care. This can also contribute to the establishment of an early detection program from the first school year for children in schools in Morocco. Our work in association with a study relates to the prevalence of vision loss in school-aged children. It focuses on 6732 first-year primary school children in Kenitra province, spread over 208 classes and 70 schools. Thus, 1761 of them have a vision of less than 7/10 and only 85% benefit from automatic refraction at the level of the optical unit or 1497 children. The

results of optical refraction are used to classify children according to their level of vision (Table 1).

**Table 1:** The classification of children according to their level of vision before and after optical correction

Number of children	10/10	Between 7/10 and 10/10	Between 5/10 and 7/10	Between 3/10 and 5/10	Less than 3/10
Visual acuity before correction	0	0	653	584	260
Visual acuity after correction	398	476	289	244	100

This leads to consider between five groups of children according to their visual acuity after optical correction (Table 2). Among the 6732 children recruited in the collaborative study, we selected 1500 children with a visual acuity of 10/10 without optical correction and without associated pathologies, as part of our study control population. These children are subject to the same criteria for assessing attention and concentration in schools. We excluded from the sample, 264 students revealing varying degrees of ophthalmic disorders requiring orthoptic and ophthalmological management and long-term follow-up making the feasibility of our assessment impossible for equal validity of the results. The study took place in two stages. The first period runs from November 2019 to March 2020. After a duration of 4 months, the study was suspended due to the COVID19 pandemic and travel restrictions and distance learning introduced among children, before resuming between September 2020 and 07/2021. In our study, several elements relating to the ethical aspect were taken into account. The data collection methods chosen aim to gather as much information as possible in order to circle the various aspects of the theme studied. To do this, the tests take place from 10am to 12pm for all study groups.

We determined this schedule because this time of day corresponds to the time when students' attention tends towards an average value. (In this regard, Gates is one of the people who demonstrated (in 1916) that attention varied throughout the day.) <sup>9</sup> As our wish is to evaluate the attention of students, it therefore seems relevant to make these observations at that time.

The following three tests are therefore used:

- The test of entangled figures (Level 1- Level 2 and Level 3)

**Table 2:** The results obtained make it possible to classify children into 5 groups according to their visual acuity after optical correction

GROUP	NUMBER OF CHILDREN	VISUAL ACUITY AFTER CORRECTION
Group 1	398	10/10
Group 2	476	Between 7/10 and 10/10
Group 3	289	Between 5/10 and 7/10
Group 4	244	Between 3/10 and 5/10
Group 5	100	Less than 3/10

- The observation grid (interest, concentration and distractibility)
- The Zazzo dam test (two dams: Inaccuracy, speed and yield)

Depending on the methods of data collection considered, statistical analysis is carried out for scale data. Excel software was used for tabbing and making the appropriate charts.

## RESULTS

The test of entangled figures (Figure 1):

**Figure 1:** Percentage of recognition of entangled figures by level according to visual acuity

Total visual attentional failure in children corrected with visual acuity < 5/10. The test reveals a link between decreased VA in corrected visually impaired children and attention deficit in children in groups 4 and 5. We thus observe, a total failure in the recognition of all the forms of the 3 levels. For groups 2 and 3, we note a failure in the recognition of the diamond in level 1. In level 2, there is a failure in the recognition of the moon, the umbrella and in level 3 of the car, the hen and the cup. The same proportion of failure is observed for the umbrella, the car and the cup, for the children of group 3. For children in group 2, failure is more important for the umbrella and cup. Children in Group 1 show better overall outcomes than children in Group 2 and Group 3. For child witnesses, it appears that in level 1, the diamond remains most often unknown. In addition, for level 3, the cup is difficult to recognize, it being either assimilated to a watering can, or the child does not know what it is. Just like the diamond, we find that the cup is less well identified.

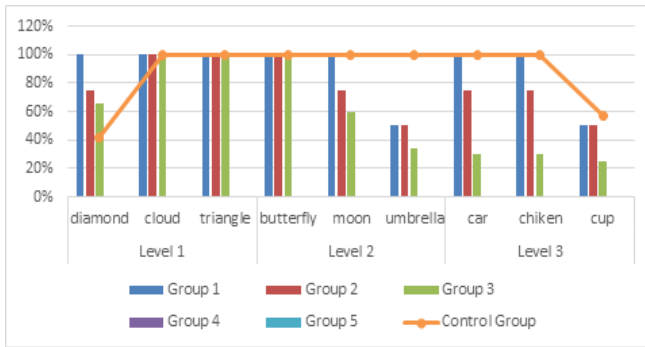
The observation grid (Table 3): The decrease in VA in

corrected visually impaired children leads to attentional disorders resulting in impaired concentration and distractibility. All the children in the study show an interest in participation, however groups 4 and 5 show a complete lack of concentration. For group 1, we note the slight presence of distraction. Group 3 reveals a slight lack of concentration represented by the delay in getting to work in addition to restless behavior. Group 2 has a neutral concentration index compared to other children. A flat concentration indicator in group 4 and group 5 shows an absence of concentration in these two groups, unlike groups 1 and 2 which stand out with a good concentration to the test carried out. Group 3 shows a slight lack of concentration due to its delay in putting to work.

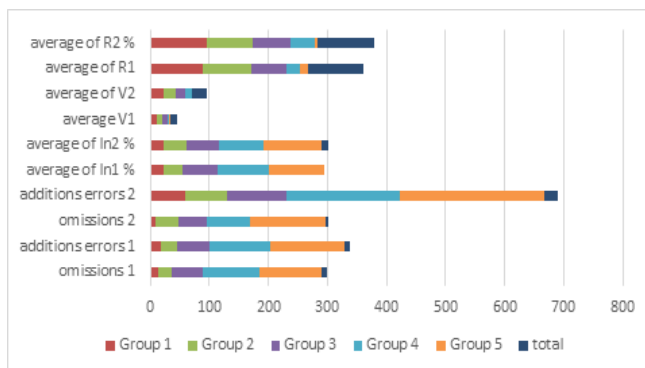
**Table 3:** Observation grid for visually impaired children and the control group for interest, concentration and distractibility

		Group 1	Group 2	Group 3	Group 4	Group 5	Control group
Interest in the task	Yes	+	+	+	+	+	+
	No	-	-	-	-	-	-
Concentration indicators	Performs the task	+	+	+	-	-	+
	Gets straight to work	+	+	-	-	-	+
	Persevere on the spot	+	+	+	-	-	+
Distractibility indicators	Seems elsewhere	-	-	-	+	+	-
	Gets distracted	+	-	-	+	+	+
	Agitation	-	-	+	+	+	-

The Zazzo dam test (Figure 2 and 3): Attentional degradation in corrected children who have a visual acuity of less than 5/10: The sustained attention of visually impaired children decreases proportionally with the decrease in VA. Inaccuracy refers to a degradation score.



**Figure 2:** The inaccuracy index, mean velocity and average yield of the groups in the Zazzo test



**Figure 3:** Comparison between the control group and the groups of visually impaired students Zazzo test

The higher this score is, the worse the performance. The mean inaccuracy for groups 3, 4 and 5 is double that of groups 1 and 2. This index does not vary between group 1 and 2. From group 3, there is a net increase in the number of errors. The accuracy therefore decreases from a VA of less than 5. The processing speed decreases between the 5 groups significantly the decent is marked between group 2 and groups 3, 4 and 5. The yield decreases with VA, knowing that the loss seems to increase between group 3 on one side, and groups 4 and 5, on the other. Performance takes into account both speed and inaccuracy. The difference observed

between group 1 and group 2 is that the speed appears lower in group 2 than in group 1. In group 3, the speed of execution decreases while the quality remains the same as in group 2, explaining the loss of performance compared to this same group, most certainly to maintain the level of precision to the responses given by children with a VA <5. The assessment at the two Zazzo dams in the group of control children (Nt = 1500) with a VA at 10/10 without correction highlights the results mentioned in Table 4.

**DISCUSSION**

Rawing any conclusive implications, it is essential to replicate these findings on a larger scale, encompassing a more extensive and geographically diverse student population across different regions of the Kingdom. Maintaining strict adherence to the same research protocol during replication is crucial for ensuring consistency and comparability. Regularly observing each student is advisable to obtain averaged results, as attention and concentration are context-dependent and can be influenced by various environmental conditions. For instance, factors like inadequate sleep, challenges in the family environment, or interpersonal conflicts with classmates can elevate stress levels and consequently impact attentional abilities. These findings affirm the existing correlation between attention deficit and visual impairment in school-aged children.

Our discussion outlines the results obtained from the three devices used in our research— the entangled figures test, the observation grid, and the test of the two Zazzo dams—in assessing attention deficits and concentration levels among visually impaired students. Here’s a breakdown of the key points:

**Devices and Results:**

The entangled figures test, observation grid, and the test of the two Zazzo dams all indicate a correlation between visual impairment and attention deficits in school settings. The decline in visual acuity appears to

**Table 4:** Assessment at the two Zazzo dams in the control group (Nt= 1500)

AV control group=10/10 (without correction)	Omissions	Addition errors	The inaccuracy index	Speed	Performance
1st barrier	8	10	In1 t=13.33	V1 t= 11.7	R1 t= 93.6
2nd dam	Sign 1:2 Sign 2:6	23	In2 t=11.35	V2 t= 24.2	R2 t= 96.8

be linked to challenges in attention and concentration among visually impaired students.

### **Need for Replication and Scale:**

To establish the reliability and generalizability of the findings, it is recommended to replicate the study on a larger scale with a more extensive sample of students. Replicating the research across different geographical regions within the Kingdom will provide a broader perspective and help identify potential regional variations.

### **Consistent Protocol:**

Strict adherence to the same research protocol during replication is crucial to ensure the validity and comparability of the results. Maintaining consistency in the methodology will enhance the robustness of the findings and facilitate accurate comparisons.

### **Regular Observation and Context Consideration:**

Emphasize the importance of continuous observation of each student to account for variations in results over time. Acknowledge that contextual factors, such as environmental conditions and personal circumstances, can significantly impact a student's attention and concentration levels.

### **Average Results and Contextual Influences:**

Averaging results over time for each student can provide a more stable representation of their attentional abilities. Recognize the influence of environmental conditions, family dynamics, and personal stressors on a student's attention and concentration.

### **Implications for Future Research:**

Acknowledge the need for a holistic approach that considers both visual impairment and environmental factors in understanding attention deficits among school-aged children. Encourage future research to delve deeper into the specific aspects of the school environment or personal circumstances that may contribute to variations in attention and concentration. By addressing these considerations, future research can build upon your current findings and contribute to a more comprehensive understanding of the relationship between visual impairment, attention deficits, and concentration in school settings.

In the following section we will present the analysis of the main results

## **1. Entangled figures: (Figure 1)**

Following the analysis of the results of the children in the control group, we can say that the non-recognition of the diamond (level 1) and the cup (level 3) are not significant.

Indeed, children do not know the diamond and they usually call a square or two triangles attached. This indicates a very good mental representation and therefore this result is not to be taken into account.

In level 3 of the entangled figures, children do not recognize the cup. They see that there is something but do not know how to name it. They generally identify the handle of the cup and look by deduction for objects that may have a handle (watering can or elephant).

On the other hand, for visually impaired children, we achieve total failure on all levels for children in groups 4 and 5 and a high failure rate in level 2 and level 3, especially for children in groups 2 and 3. Like the control group, visually impaired children do not recognize the diamond or the cup.

However, unlike the control group, the visually impaired groups do not identify the shapes easily identified by this first group (e.g., moon, umbrella, car and hen).

This means that visually impaired children in groups 4 and 5 who have an acuity of less than 5/10 show total visual attentional failure on all levels while those with acuity greater than 5/10 show difficulties at level 2 and 3 of this part of the test compared to control children. The test demonstrates a significant link between decreased VA in corrected visually impaired children and attention deficit.

## **2. The observation grid: (Table 3)**

The results obtained by the analysis of the observation grid in the control children, highlight an excellent degree of motivation to start the previous test which testifies to an initiation of attentional activation. These control children have no problem concentrating to perform the test, they go directly and persevere until the end of the evaluation with an absence of restless behaviors.

On the other hand, they have a slight distraction index that we consider negligible given the good level obtained in the previous test. The distraction therefore probably comes from external factors.

Indeed group 4 and group 5 prove motivated to start the previous event. However, during this one, they are agitated, inattentive and very distracted. This highlights the presence of distractibility factors so that they could not start the requested task directly and once started, they revealed difficulties in persevering. This observation

highlights the lack of concentration in these children which generated an attention deficit during the test.

Group 3 found it difficult to start the event, despite the interest shown in its realization. However, he eventually performed it and persevered until it was finalized. Nevertheless, he adopted agitated behaviors. These explain the delay in putting oneself to the test because of an attentional problem.

Group 2 showed great interest in performing this test and maintained its level of concentration from the beginning to the end of the realization without distracting factors. This underlines the good attentional degree implemented.

Group 1 is curious and shows good concentration in general. However, he is slightly distracted, which may explain the non-recognition of the cup and the umbrella among the figures.

These data allow us to deduce that children in groups 3, 4 and 5 with visual impairments, with a VA of less than 5/10, reveal an attentional disorder resulting in problems with concentration and distractibility. These phenomena become more pronounced and worsen with the decrease in the level of visual acuity compared to control children. The observation highlights that the decrease in VA in corrected visually impaired children leads to attentional disorders manifested by defects in concentration and distractibility.

### 3. The test of the two Zazzo dams: (Figures 2 and 3)

The control group has a high yield at the first dam with a good speed in terms of target examination per minute and a very low inaccuracy index. We therefore conclude a very good focused attention on their part. At the level of the second dam the yield is very good with a speed in the number of signs examined per minute and an index of inaccuracy even lower than in the first, highlighting their sustained attention dispensed. This reveals that the children in the control group capitalized on the achievements of the first test.

For groups of visually impaired children 3, 4 and 5, the inaccuracy index at the first dam is double that of groups 1 and 2. The processing speed decreases significantly between the 5 groups and more markedly from group 3. However, group 3 retains a yield moderately close to that of groups 1 and 2 unlike that of groups 4 and 5 which are very low. The focused attention of children in groups 1 and 2 is maximum unlike that of groups 4 and 5 and remains average for group 3.

At the second dam the inaccuracy increases

significantly with the decrease in VA and the speed and yield decrease with the decrease in VA. As a result, the sustained attention of visually impaired children decreases proportionally with the reduction in VA. The test therefore examines the focused and sustained attention in corrected visually impaired children, which decreases as children's vision decreases.

A study by Nielsen (1997) on the theme *Concept and permanence of the object in children with visual impairment*, within the framework of special education, highlights an important relationship between visual field impairments in children and attentional deficits. Cécile Le Sage Beaudon, (Ophthalmologist) and Marion Torossian, (Orthoptist) (2013) examine learning disabilities in children with visual deficits. The study thus demonstrates that visual impairment leads to a slowness in the speed of acquisition of visual information and this slowness affects all activities that require a visual support including attention.<sup>11</sup> Two studies: the first conducted in 1994 by Woods and Lindsey *Perceived and actual mathematical competencies of children with visual impairments and learning disabilities* and the second conducted by Koller in 1999 *How does vision affect Learning?* highlight the negative influence of visual disorders on children's cognition. They see them as an obstacle to normal development in visually impaired children.<sup>12-13</sup>

From the results of the two tests, from the evaluation through the observation grid and by comparing them to the data of the studies identified in the literature, we can provide a clear answer to our research question and confirm the effect of visual disorders on attention in school-age children. Our study aims to assess attention deficit in children with visual impairments. This population was studied by comparing them with healthy control children (free of any visual pathology). The study of the literature highlights the presence of research in this direction. However, the latter remain minimal in view of the importance of the subject. The studies identified and our analytical data prove the existence of an attention deficit proportional to the visual deficit in these children. However, this generates a risk on cognitive development and can have far-reaching consequences on children's schooling. It is therefore essential to take into account the distress that these children may feel. In this sense, a study on remediation methods adapted to fill the attention deficit, remobilize concentration and potentiate the academic performance of these children, is necessary. Such a

study would make it possible to solve even partially school failure and dropout.

## CONCLUSION

Our study aims to assess attention deficit in children with visual impairments in the province of Kenitra [14]. This population was studied by comparing them with healthy control children (free of any visual pathology). The study of the literature highlights the presence of research in this direction. However, the latter remain minimal in view of the importance of the subject. The studies identified and our analytical data prove the existence of an attention deficit proportional to the visual deficit in these children. However, this generates a risk on cognitive development and can have far-reaching consequences on children's schooling. It is therefore essential to take into account the distress that these children may feel. In this sense, a study on

remediation methods adapted to fill the attention deficit, remobilize concentration and potentiate the academic performance of these children, is necessary<sup>15</sup>. Such a study would make it possible to solve even partially school failure and dropout.

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