



## Better Vision – Better Reading Teachers with Vision Competence Change Pupils Reading Skills

Gunvor B. Wilhelmsen<sup>1</sup>

### Abstract

At a school in Tanzania, 13 local vision teacher students carried out a vision screening and intervention program with 26 pupils in Standard two. The pupils were collected after a larger vision-screening program some months earlier. The criteria for being included in the intervention were vision disturbances that could affect reading and writing. In this school, pupils have no books. Therefore the teachers have to write all the text that pupils have to read and learn on the blackboard and the pupils have to copy this into their notebooks. In this school the actual classes had nearly seventy pupils each. The screening procedure included testing of visual acuity for a reading distance and on three meters. It was also looked into their stereo vision and reading skills. The intervention was individually adjusted and consisted of 12 lessons focusing on developing steadier and more precise eye motor functions and to improve their visual attention. After the intervention, the results are positive with respect to pupil's visual functions and their reading performance. These positive changes will be a big help for the pupils further work in school and education.

**Keywords:** *Improving reading, vision development, the reading process, primary school;*

### Introduction

In every class, all over the world, there are children with vision disturbances. These will influence their work in school negatively (Heim et al. 2004; Sterner et al. 2004; The Center for Health and Health Care in Schools 2004; Wilhelmsen 2012). We know that vision problems can lead to academic challenges because it complicates reading and writing (White et al. 2017). Some pupils with vision problems are seen as hyperactive, others as passive or having dyslexia (Lane 2005). For some children the consequences are serious. They are more prone to drop out of school than pupils with good vision (Al-Majali & Al-Thneibat 2013). *“Even the most gifted students will struggle academically if they have trouble seeing the blackboard or focusing on a book.”* (Kotlicky 2018).

Narayanasamy et al. (2016) found that pupils in Australia 47 % of their time in class use for near academic activities and 29 % for distance viewing. In-between these activities they use 15 % of the time to switch focus between distance and near. This illustrates the importance of good vision in school. The pupils need a clear visual acuity for distance and for near, precise fixations, necessary light adaptation, accommodation and convergence and a variety of precise eye movements for the shift of gaze to new positions due to the spot of visual attention and interest.

In Tanzania, the Public Schools have 60 to 100 pupils in each class and there is no public vision screening. The lack of books, lead the teachers to write everything on the blackboard, and the pupils to copy these texts into their notebooks. It is a challenge to sit far from the blackboard also because there is no electricity, only daylight supports the individual vision capacity. The health care system have ophthalmologists and opticians, but they are few and families do not have the money to travel to the services.

Western Norway University of Applied Sciences in Bergen (HVL) and Patandi Teachers College of Special Needs Education in Arusha, Tanzania, are partners in the project “Securing Education for Children in Tanzania”. Children's vision and the viewing conditions in the classrooms are studied in the project. We want to know if viewing conditions or vision problems are among the reasons for why pupils do not learn to read, or for the drop out of school. For some of the 70 % who are failing the final primary school exams (Prime Ministers Office 2014), vision problems may be a primary reason. We want to see if teachers with vision competence are able to make positive changes for pupils with vision disturbances.

At a public primary school in Tanzania, local special needs teachers in the Continuing Professional Development (CPD) course *Vision for reading and learning* (30 cred) carried out vision screening and an intervention program with pupils in Standard 2.

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<sup>1</sup> Western Norway University of Applied Sciences, Norway



This article present and discuss the effect that the educational intervention had on pupil's vision disturbances and their reading skills.

## Methods

The teachers who conducted the vision screening and intervention are 13 special needs teachers who are in the end phase of the 30 credit CPD-course *Vision for reading and learning*. Last semester they have been screening all 122 pupils in Standard 1 at this particular primary school. Now these pupils are in Standard 2, and 27 of them were invited for the intervention due to their screening results. Normally children are 7-8 years old in Standard 2, but some had delayed school start or had done Standard 1 twice. The participant's age span was 7 to 13 years of age.

*The screening:* The large vision-screening program some months earlier included testing of VA (vision acuity) for a reading distance and on three meters. It was also looked into pupil's stereo vision, eye movements, color vision and reading skills. The criteria for being included in the intervention were reduced VA for near or distance, disturbed binocular vision or other eye movement problems that can affect reading and writing. Standardized tests were used. For binocular vision stereo tests and structured observations of eye movements with cover, saccades and pursuit eye movements were carried out. Also accommodation and convergence were measured. Reading-tests were done with an eye-tracker, which software is developed at HVL. This system showed the eye movements during reading and on other activities. It was given two reading test, with syllables. One easier than the other.

*The intervention:* The 27 participants were all screened before and after the intervention. Each pupil got a structured vision training for 30-45 minutes daily, 12 days, for three weeks. The intervention was individually adjusted. It was important to work with head control to be sure that the child did not turn or tilt their head instead of using the fine and effective eye muscles. The teachers were focusing on developing steadier and more precise eye motor functions and to improve pupil's visual attention. They were eager to vary the methods according to each child's needs using stimulating exercises. After the intervention, the teacher students had to write reports and reflections from the work

*Supervision:* Both the screening and the intervention were conducted with supervision.

*Ethics:* All children and parents were informed about the possibility to withdraw from the project whenever they wanted. Some parents were so interested in the project that they came to school for more information.

The results presented are data from the pre- and post-screening.

## Results

Normally vision screening, is reduced to the measure of VA for a distance of 6 or 3 meters. This gives information about the detail vision for looking far away, but is not enough information for the ability to see the text clearly on a reading distance. We measured the VA for both distances.

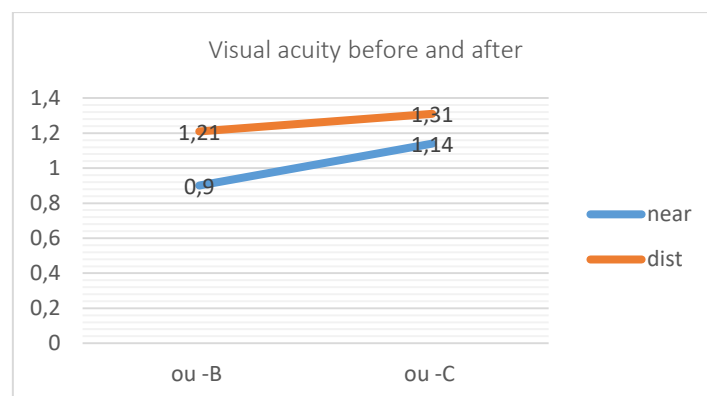


Figure 1 - The mean of binocular VA before and after the intervention, at near and distance, N=27.

Figure 1 shows the mean results from the VA pre- and post-test for near and distance when both eyes are working together. The mean distance VA for the hole group went up from 1,21 to 1,31 after the intervention. Better distance VA helps to read the text on the blackboard. Some children with a low distance VA were asked to be moved forward in the classroom.



The near VA gives a clearer picture of the text in the notebook and has here a positive change from 0,9 to 1,14 during intervention. The gap-reduction between the two curves, Figure 1, is an indication of better accommodation, the ability to adjust the lens to near work. Also the convergence was better after the intervention, the mean reduced from 7,74 cm to 6,80 cm. Some pupils even had a change from 13 to 6 cm, which indicates that it is easier to keep the eyes together for close work.

The stereo test measures to which degree the eyes are fixating precisely on the same spot. The very best possible result on the test is 20 arcsec. This short test is carried out when the eyes are directed straight ahead. It is therefore possible to have binocular problems although the result on this test is good. It was interesting to see that most of the children with the largest improvements on the stereo-test also had positive changes in VA for near. Those who could read before the intervention had a better reading performances afterwards together with the improved binocular vision, Table 1.

Table 1 Pupils with better stereo vision and their changes in VA-near and reading speed.

no	Stereo in arcsec	VA-near from-to	Reading easy w/m*	Reading difficult w/m
46	1000 to 20	0,63 – 1,00	45 - 58	42 - 61
47	1000 to 20	0,80 – 1,00	33 - 73	32 - 72
52	400 to 20	1,00 – 1,46	64 - 90	54 - 85
92	400 to 25	1,05 – 1,00	0 – 0	0 - 0
95	100 to 32	0,88 – 1,00	37 - 48	33 - 43
67	63 to 25	0,88 – 0,80	0 – 0	0 - 0

\* w/m = Word per minute

The mean of word per minute for all pupils (N=27) improved during the structured vision exercises, both on the easy and the difficult tests.

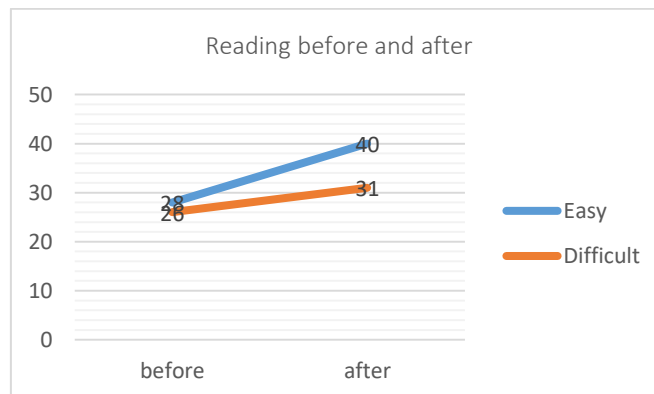


Figure 2 - Changes in words per minute when reading easy words and difficult words before and after vision training (N=27).

Three of the students who did not read on the screening three months earlier and not on the pre-screening, were reading on the post-test.

## Discussion

There was a lot of vision components tested before and after the intervention. The connection with VA and stereo vision is an example of the relationship between vision functions. For good inputs in reading, it is not enough with good VA. The eyes have to work smoothly together so that no double vision occurs. Also blurred vision is a problem in reading, due to weak accommodation. This may be seen as reduced VA for near if it is constant. Better VA for near is therefore a sign of increased ability to accommodate.

Vision is developing through the years in school (Daw 2007; Wilhelmsen 2012), but although nearly all academic education are bound to visual stimulus, teachers have limited insight in vision qualities and the consequences of vision disturbances.

## Conclusion

This project has so far shown that teachers are in the need of more competence on vision functions, vision development and the knowledge of how vision disturbances influence pupil's academic development. Some teachers ought to be able to do vision functional screening on vision qualities important for reading, and to be qualified to carry out educational methods for better vision. Our practical period with intensive vision exercises for 12 lessons, showed positive result with respect to pupil's visual functions and their reading performance. The experiences fascinated the teacher students, and the positive changes will be a help for the pupils further work in school and for their academic education.

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