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Foundation Phase teachers' knowledge on common visual problems affecting children

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Background: Vision disorders are a public health problem as they cause a delay in academic progress and affect learners' future career. Teachers spend most of the time with children at school and can help in the early identification and referral of children with visual problems.

Aim: To evaluate the knowledge of Grade R to Grade 3 teachers on children's visual problems before and after educating them on the different visual disorders that affect learners in the classroom.

Setting: Low socio-economic status (Quintile 1) schools in Bloemfontein, South Africa.

Methods: Convenience sampling was carried out to include Grade R to Grade 3 teachers from 11 Quintile 1 schools. In this quantitative study, two questionnaires with nine items each were administered to determine the teachers' knowledge. A 45-min educational session on common vision disorders was presented by the researcher. The teachers were classified as having good knowledge if they obtained seven or more correct answers in each questionnaire.

Results: Thirty-six female teachers participated in the study**.** Most of the participants (72.22%) were in the age group of 36 years and older, and 44.44% had been teaching for more than 10 years. Thirty-four participants (94.44%) obtained an overall score of seven and higher before the educational session, and all participants obtained a score of seven and higher after the educational session. There was a statistically significant difference ($p < 0.0001$) between the scores of participants before and after the educational session.

Conclusion: The Foundation Phase teachers had adequate knowledge about common visual problems. The educational session was beneficial as it enhanced the teachers' knowledge.

Keywords: visual disorders in children; knowledge of teachers; educating teachers; children's vision; teachers' questionnaires; Quintile 1 school; Grade R to Grade 3 teachers.

Introduction

Globally, the major causes of visual impairment are visual problems, which include uncorrected refractive errors, cataract and glaucoma (World Health Organization 2019). An estimated 19 million children under the age of 15 are visually impaired. Of these, 12 million are visually impaired because of refractive errors, a condition that could be easily diagnosed and corrected. Only 1.4 million children have irreversible visual impairment and need visual rehabilitation interventions for psychological and personal development (Du Toit, Courtright & Lewallen 2017; Solebo, Teoh & Rahi 2017).

The most common visual problems in children are: uncorrected refractive errors, strabismus, glaucoma, vergence and accommodative dysfunction, amblyopia, conjunctivitis and congenital cataracts, which are all reversible if detected and treated early (Donnelly, Steward & Hollinger 2005; Multi-Ethnic Pediatric Eye Disease Study Group 2009; Scheiman et al. 1996; Tarczy-Hornoch et al. 2011; Thadani & Foster 2004).

These visual problems can lead to problems in a child's normal development, school performance, social interactions and self-esteem. Later in life, these visual problems may affect the individual's level of education, employment opportunities and social interactions (Adhikari et al. 2013; Ciner et al. 1999; Davidson & Quinn 2011; Donnelly et al. 2005; Giordano et al. 2009;

McKean-Cowdin et al. 2013; Snow 1983; Zaba 2001, 2011). If visual problems are not detected and corrected early, they can lead to the manifestation of learning difficulties, resulting in the failure of a grade and even dropping out of school. There is a high rate of learners dropping out of schools in South Africa for different reasons, uncorrected visual problems being one of them (Inglis & Lewis 2013).

Ezinne and Mashige (2018) reported that refractive errors accounted for 86.6% of all causes of visual impairment in school children, with myopia being the most prevalent refractive error (46.4%), followed by astigmatism (36.1%) and hyperopia (17.5%). Atowa, Hansraj and Wajuihian (2019) reported that uncorrected refractive errors in children resulted in reduced visual acuity, temporary blurred vision, headaches and continuous symptoms of sore eyes, especially when doing near visual tasks. This could hinder their reading ability and affect their school work. Early detection and management of these visual problems can reduce the prevalence of visual problems and improve the quality of life in children. Thus, vision screening is used as a tool to detect visual problems among children and help in the early treatment and management of visual disorders (Metsing, Jacobs & Hansraj 2018).

In the United States of America (USA), vision screening is done by either optometrists, school health nurses or teachers (American Academy of Ophthalmology 2015). The teachers use a vision screening checklist to screen for the visual problems among learners. Therefore, it is important for teachers to have knowledge of common visual problems to help in the early identification of children with visual problems.

A study by Ambika and Nair (2013) in India found that 80% of primary school teachers were aware of refractive errors in children, and thus it was essential for teachers to have good knowledge on refractive errors in children. Another study in Pakistan conducted by Habiba et al. (2017) found that public primary school teachers showed a significantly higher knowledge about visual problems such as glaucoma, refractive errors, trachoma, conjunctivitis, pterygium, age-related macular degeneration and diabetic retinopathy.

Tchiakpe et al. (2016) found that the ocular conditions known by most junior high school teachers were red-eye (89.88%), refractive error (82.08%), eye injury (80.06%) and glaucoma (61.85%), and they concluded that teachers had adequate knowledge of most ocular diseases and healthy practices that promoted good visual health. Alemayehu, Belete and Adimassu (2018) found that 55.93% of primary school teachers had good knowledge regarding the refractive error in school children. In a study that was conducted in Durban, South Africa (Juggernath & Knight 2015) to determine the knowledge of Grade 5 teachers about the signs and symptoms that are linked to poor vision, 63% of teachers knew the signs and symptoms.

The same study also found that 95% of the teachers had good knowledge of the signs and symptoms of poor vision after a presentation on vision screening and how to recognise visual problems in learners was given.

Vision screening is part of the South African Integrated School Health Policy (SAISHP), which was introduced in 2012 to screen learners for medical conditions, including vision (Department of Health & Basic Education, S.A 2012). The SAISHP requires that every learner should be assessed once during each of the four educational phases, namely Foundation (Grade R–Grade 3), Intermediate (Grade 4–Grade 6), Senior (Grade 7–Grade 9) and Further Education and Training (Grade 10–Grade 12). The school health nurses are responsible for the screening of the learners. Those who fail the vision screening are then referred to an optometrist or ophthalmologist for further interventions.

There are, however, few school health nurses available (Dibakwane & Peu 2018), and they cannot screen all schools and all Grade R, Grade 1, Grade 2, Grade 3, Grade 4 and Grade 8 children as directed by the policy. The current study explored the knowledge of teachers about signs and symptoms of visual problems in children. The study hypothesised that good knowledge would lead to early detection of visual problems.

The rationale of investigating the knowledge of the teachers about visual problems in children is that teachers spend more time with children at school than parents do at home; in that way, they will be able to identify children with visual problems and refer them to an optometrist or ophthalmologist for a full eye examination.

Research methods and design

Study design and participants

This is a quantitative study that utilised a cross-sectional design to quantify the Grade R to Grade 3 teachers' knowledge of children's vision disorders before and after an informative session (educational session) on common visual problems in children was given to teachers. A cross-sectional design is a relatively inexpensive and quick type of research design where the researcher is able to collect data from different individuals at the same time (Salkind 2010).

Setting

The study was conducted at the low socio-economic status (Quintile 1) schools in Bloemfontein, South Africa.

Study population and sampling strategy

There are 88 primary schools in Bloemfontein, and only 12 primary schools were categorised as Quintile 1 classification (Free State Department of Education 2018). Eleven schools had Foundation Phase (Grade R–Grade 3) classes and 41 teachers of these Foundation Phase classes were recruited to participate in this study. A nonprobability convenience sampling was done to identify the participants. Inclusion criteria were Grade R to Grade 3 teachers in Quintile 1 schools

in Bloemfontein. Teachers who did not give consent and those teaching other grades or other quintile schools were excluded from the study.

Data collection

The researcher designed two questionnaires to assess the teachers' knowledge before and after the educational session. The items on the questionnaire were compiled from the vision screening checklist which the teachers used as a screening tool to screen for visual problems in schoolchildren. Previous studies in the USA also utilised questionnaires as a screening method by teachers to screen for visual problems in schoolchildren (Concannon & Robinson 1997). The first questionnaire which was administered before the educational session consisted of two sections. The first section was based on information and biographical or background data of the participants, which included gender, age, years of teaching and the highest qualifications obtained.

The second section had nine items to assess the participants' knowledge on common vision disorders in children (red, itchy, swollen eyes; cataract; strabismus), vision difficulties in the classroom (struggling to see at distance or at near, seeing double, skipping lines when reading, using a finger to keep track of their reading material, closing or covering one eye when doing distance or near tasks) and when to refer the child for a full eye examination.

The second questionnaire consisted of nine items, including pictures depicting different common vision disorders, questions on vision difficulties in the classroom and when to refer them to an optometrist or an ophthalmologist for a full examination. The second questionnaire was to test the participants' knowledge after the educational presentation by the researcher, who is a qualified optometrist.

The researcher designed a PowerPoint presentation (Microsoft Corporation, Redmond, Washington, United States) which consisted of definitions of common visual disorders (myopia, hyperopia, astigmatism, glaucoma, cataract, ptosis and strabismus) and explanations with pictures of conditions commonly found in learners, including growth on eyelids, crusty eyes, red-watery eyes, swollen eyelids and incorrect postures adopted by learners when they have visual difficulties.

After the study was explained and consent forms were signed by the participants, the first questionnaire was administered. Thereafter, a 45-min PowerPoint interactive presentation was offered to the participants by the researcher as an educational session. The participants were encouraged to ask questions and discuss the presentation. Immediately after the presentation and discussion, the researcher administered the second questionnaire to assess the knowledge after the presentation. Information material in the form of a pamphlet on common visual problems in children was printed and distributed to teachers to guide and remind them of the conditions that were discussed in the presentation.

Data analysis

Each correct response in the questionnaire was assigned a score of *one*, while the incorrect response was given a score of *zero*. The data were checked and captured on an Excel spreadsheet (Microsoft Corporation, Redmond, Washington, United States). The total score for each participant was calculated by adding the total responses given by the participant. The participants were scored as having adequate knowledge of vision disorders affecting children if they obtained a score of *seven* and *higher* (≥ 78%). The results before and after the educational session were compared.

The descriptive statistics, namely frequencies and percentages for categorical variables, were calculated. The groups were compared by means of 95% confidence intervals (CI) and the McNemar's test (1947) for paired data comparison. A *p*-value of less than 0.05 was considered to indicate statistical significance.

The data were analysed by a biostatistician in the central region of South Africa using SAS (Statistical Analysis System) software (SAS Institute Inc., Cary, North Carolina, United States).

Results

Demographics

Data were collected from 36 participants, who were all female teachers. The majority of the participants (n = 26, 72.22%) were in the age group of 36 years and older, and there were few participants (n = 2, 5.56%) who were younger than 33 years (Table 1).

Many of the participants (n = 16, 44.44%) had been teaching for more than 10 years, while eight (22.22%) had been teaching between 6 and 10 years. The age and years of teaching of participants could have a direct or indirect impact on the participants' knowledge about common vision disorders in children.

Most participants (27.78%) had an Advanced Certificate in Education (Table 2). The highest qualifications attained by the participants (n = 2, 5.56%) were Bachelor of Education Honours (B.Ed. Hons), followed by Postgraduate Certificate in Education (PGCE) (n = 7, 19.44%) and Bachelor of Education (B.Ed.) (n = 2, 5.56%). There was one participant in each of the following qualifications: matric certification, Primary Teacher Certificate (PTC), National Professional Diploma in Education and Grade R diploma. The level of education of participants could have a direct or indirect impact on the participants' knowledge about common vision disorders in children.

Findings

Seven participants (19.44%) gave correct responses to all the items on the questionnaire, 23 (63.89%) had one incorrect

TABLE 1: Demographic characteristics of the participants.

Age group	Frequency	Percentage (%)
Age		
22–26 years	0	0.00
27–32 years	2	5.56
33–35 years	8	22.22
36 years and older	26	72.22
Years of teaching		
0–2 years	6	16.67
3–5 years	6	16.67
6–10 years	8	22.22
11 years and more	16	44.44

TABLE 2: Level of education of participants.

Level of education	Frequency	Percentage (%)
Matric	1	2.78
Advanced Certificate in Education (ACE)	10	27.78
Postgraduate Certificate in Education (PGCE)	7	19.44
Bachelor of Education (B.Ed.)	2	5.56
Bachelor of Education Honours (B.Ed. Hons)	2	5.56
Grade R diploma	1	2.78
Early Childhood Diploma (ECD)	6	16.67
N6 Educare	2	5.56
National Professional Diploma in Education	1	2.78
Primary Teachers' Certificate (PTC)	1	2.78
No answer	3	8.33

response and four (11.11%) had two incorrect responses (Table 3). Two participants (5.56%) obtained the total score of less than seven. Thus, 34 participants (94.44%) had obtained the overall score of seven and higher and were therefore considered to have adequate knowledge of children's vision disorders.

Of the two participants who obtained a score of less than seven, the participant with the lowest score (four) was younger than 33 years in age and had between 3 and 5 years of teaching experience, with an early childhood diploma (ECD) as her highest level of education. The participant with a score of six was older than 35 years and had more than 10 years of teaching experience, and there was no information in the questionnaire about her highest educational qualification. Of the two participants who obtained the total score of less than seven, it seemed that neither age nor teaching experience contributed to acquiring knowledge.

The questionnaire results after the educational session showed that all participants obtained a score of seven and higher (Table 3). Twenty-one participants (58.33%) showed improvement in knowledge, 36.11% showed no improvement, while two participants (5.56%) regressed (Table 4). Overall, the Wilcoxon signed-rank test indicated that there was a statistically significant difference ($p < 0.0001$) between the scores of participants before and after the educational sessions.

A difference of 0 indicates that there is no improvement, a positive difference means an improvement in knowledge and a negative difference indicates a regression in knowledge.

Thirty-three participants (91.67%) had correct responses about the white pupil and squinting eyes before the

TABLE 3: Scores of participants before and after the educational session.

Number of correct responses out of nine items	Before the educational session		After the educational session	
	Frequency	Percentage (%)	Frequency	Percentage (%)
4	1	2.78	0	0.00
6	1	2.78	0	0.00
7	4	11.11	2	5.56
8	23	63.89	9	25.00
9	7	19.44	25	69.44

TABLE 4: Difference in knowledge before and after the educational session.

The difference in knowledge *(scores after the educational session – scores before the educational session)*	Frequency	Percentage (%)
–1	2	5.56
0	13	36.11
1	17	47.22
2	2	5.56
3	1	2.78
4	1	2.78

TABLE 5: Participants' responses per different vision symptoms and signs.

Vision symptoms and signs	Questionnaire results before the educational session		Questionnaire results after the educational session		McNemar's test *p*
	n	%	*n*	%	
White pupil (cataract)	33	91.67	36	100	0.39
Squinting eyes (strabismus)	33	91.67	36	100	0.12
Red, swollen, crusty eye	34	94.44	36	100	0.24
Itchy and painful eyes	34	94.44	35	97.22	0.31
Blurred vision, holds book closer	35	97.22	33	91.67	0.20
Closes or covers eye, double vision	35	97.22	35	97.22	1.00
Skips lines	31	86.11	33	91.67	0.58
Uses finger, tilts head	15	41.67	32	88.89	< 0.0001

educational session, and all participants (100%) gave the correct answers after the educational session (Table 5). However, there was no statistically significant difference ($p > 0.05$) between the responses to the two questionnaires. Thirty-four participants (94.44%) indicated before the educational session that children with swollen red eyes should be referred, and after the educational session, all participants indicated that they would refer such children ($p > 0.05$). Concerning itchy and painful eyes, 34 participant gave correct responses before the education session, while 35 participants (97.22%) gave a correct response after the educational session ($p > 0.05$).

McNemar's test (1947) showed that there was a significant difference ($p < 0.0001$) between the scores of the participant before and after the educational session concerning the question on children using fingers or tilting their heads when doing near tasks. Thus, more participants (88.89%) gave correct responses after the educational session compared to before the educational session.

Discussion

The current study found that most participants (94.44%) had good knowledge and 5.56% had inadequate knowledge of children's vision disorders before the educational session.

After the 45-min presentation and discussion about the common visual problems in children, all participants achieved a score of ≥ 78%. There was a significant difference between the baseline knowledge (before the educational session) and knowledge after the educational session ($p < 0.0001$). This is an indication that the teachers understood the material presented and discussed regarding children's vision disorders.

These findings agree with a study conducted by Krumholtz (2004) in New York which showed that the teachers' ability to identify children with common vision problems correctly was enhanced by increasing their awareness about the visual problems through a lecture and handouts. The current study is also in agreement with the results of the study done in Chatsworth, South Africa, whereby Grade 5 teachers were more knowledgeable about signs and symptoms of poor vision in learners after the training (Juggernath & Knight 2015).

Studies done in low-income countries such as India, Pakistan, Libya and Ghana showed that although teachers had some knowledge, they benefitted from educational sessions aimed at increasing their knowledge, awareness and attitude towards common vision disorders in children (Ambika & Nair 2013; Elbahi 2014; Habiba et al. 2017; Tchiakpe et al. 2016).

The participants were more knowledgeable on eye health problems (cataracts, swollen red eyes, strabismus), in agreement with a study done by Tchiakpe et al. (2016), which concluded that teachers overall had adequate knowledge of most ocular diseases and healthy practices that promote good visual health.

The current study showed that before the educational session, the teachers were less knowledgeable on signs and symptoms of learners with ocular motility problems. The signs were children skipping lines when reading and children using fingers to keep track of their reading material; both these ocular motility problems can impede the child's ability to read faster. All participants achieved a score of ≥78% after the educational session, indicating an improvement in the knowledge concerning these symptoms and signs of ocular motility problems.

Even though most teachers (94.44%) improved their knowledge on common vision disorders after the educational session, some (36.11%) did not improve their knowledge. It could be speculated that they were not motivated enough and the subject matter could be something they feel is not part of their job, and the same reasons could also be for those teachers (5.56%) who regressed after the educational session. The other reason could be that the teachers were not keen to learn, as the study was conducted after school; several teachers alluded to the fact that they had to stay behind after school hours for the educational sessions, and they had to arrange alternative transport to go home.

Strength and limitations

The strength of this study was its ability to address the most common vision disorders experienced by children and increase the teachers' awareness of the conditions. The use of pictures in the questionnaire after the educational session might have contributed positively, as teachers were reminded of the conditions as they were shown in the presentation, resulting in an improvement seen after the educational session. Methods of collecting data were short and precise, making it easy for completion by participants.

The limitations of the study included the small sample size and the limited duration for the presentation. This study had 36 teachers, which is a small sample from Quintile 1 Foundation Phase teachers, and thus the results cannot be inferred to all the Grade R to Grade 3 teachers in all quintiles. The duration for the presentation of approximately 45 min after school was not sufficient, and it was also after school and teachers wanted to go home.

Recommendations

The Department of Education could include or set aside professional training time for teachers during school hours to cover eye health education for teachers; that way, they can refresh their knowledge of all the common visual conditions children have, and that could assist to keep them motivated. The study done by Sudhan et al. (2009) also recommended that teachers be visited often to refresh their knowledge and maintain their interest. It is also recommended that the study be done in other quintile schools and include teachers from other grades.

The study could involve a large sample of teachers, whereby a qualitative survey on the attitudes and practices of teachers about vision disorders is conducted to find reasons why some teachers did not improve their knowledge and their interest in visual disorders in children.

Conclusion

This study indicated that the Grade 1 to Grade 3 Quintile 1 teachers in Bloemfontein had adequate knowledge about the common visual disorders among children. The educational session on common vision disorders was beneficial, as the teachers demonstrated significant improvement in their knowledge. Therefore, teachers can play a pivotal role in identifying children with visual difficulties and assist in detecting early signs and symptoms of some eye problems among the children. Their understanding and knowledge of the common vision disorders can further assist in referring those children in need of full eye examinations.

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Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

The first author (B.M.L.R.) was a master of optometry student, supervised by the second author (T.A.R.), with the third author as cosupervisor (T.J.). This article emerged from B.M.L.R.'s master of optometry thesis. While B.M.L.R. carried out the actual writing, T.A.R. and T.J. made considerable contributions to the discussions around the topic, responded to earlier drafts of the article and provided constructive suggestions regarding the overall content.

Ethical considerations

Ethical clearance to conduct this study was obtained from the University of the Free State Health Sciences Research Ethics Committee (ref. no. UFS-HSD2017/0985). Permission to conduct the study in the schools was obtained from the Free State Department of Education and the principals of the Quintile 1 schools. Written consent to participate in the study was obtained from the teachers after a verbal and written explanation of the study. The study adhered to the general principles outlined in the Declaration of Helsinki.

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Data availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Disclaimer

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