JOURNAL OF HEALTHCARE SCIENCES

Volume 5 Issue 11 2025, Article ID: JOHS2025001101

http://dx.doi.org/10.52533/JOHS.2025.51102

e-ISSN: 1658-8967

Review

Impact of Early Vision Screening in Primary School Children on Academic Performance

Fisal Fahad Magliah[1*], Rawan Saeed Alfaraj[2], Fares Hamoud Alghamdi[3], Nasser Ibrahim Aldawsari[4], Muna Muneer Alturki[5], Jilan Ali Zahhar[6], Abdulrahman Tariq Alkhowater[7]

[1] *Department of Family Medicine, Al Thager Hospital, Jeddah, Saudi Arabia*
[2] *Department of Family Medicine, Ministry of Health, Dammam, Saudi Arabia*
[3] *Department of General Surgery, Makkah Health Cluster, Makkah, Saudi Arabia*
[4] *General Physician, Ministry of Health, Medina, Saudi Arabia*
[5] *Diabetes Center, King Abdulaziz Hospital, Jeddah, Saudi Arabia*
[6] *College of Medicine, Batterjee Medical College, Jeddah, Saudi Arabia*
[7] *College of Medicine, King Saud bin Abdulaziz University for Health Sciences (KSAU-HS), Riyadh, Saudi Arabia*

Correspondence should be addressed **Fisal Fahad Magliah,** Department of Family Medicine, Al Thager Hospital, Jeddah, Saudi Arabia, Email: fm1411dr@gmail.com

Received: 14 September 2025, Accepted: 04 November 2025, Published: 04 November 2025.

Abstract

Children's health significantly affects their academic performance in school. Various methods to measure academic performance are available, such as standardized achievement test scores. Visual health is a significant predictor of different academic outcomes. Thus, early vision screening can detect visual disorders, probably improving children's academic performance. Vision screening can include various components, such as screening for amblyopia, visual acuity tests, and visual information processing tests. However, findings regarding the effectiveness of vision screening in improving academic performance in primary school children are inconsistent. This review aims to discuss the impact of early vision screening in primary school children on academic performance. Better visual health has been associated with better academic achievement. Children with bad academic performance had lower visual acuity and a longer near point of convergence. Vision screening can effectively detect refractive error, amblyopia, and other visual disorders; however, the direct effect of vision screening programs on academic outcomes remains inconclusive. Strengthening training, adopting standardized guidelines, and integrating evidence-based approaches are essential steps to enhance the reliability and impact of vision screening in primary school children.

Keywords: *Visual screening, Academic performance, Primary school, Children, Visual health*

Introduction

Children's academic performance has become an important topic of study in local, national, and international institutions. The OECD's Program for International Student Assessment has provided governments with educational policies to improve the academic performance of their students (1, 2). Academic performance in children can be measured by various methods, including teacher ratings of academic performance (3), standardized achievement test scores (4), and report card grades. Children's health impacts their academic performance and shapes adolescents' educational aspirations. Children with health problems have lower aspirations (5).

Visual health can significantly impact children's academic performance. It has been established that visual health is one of the significant predictors of academic performance (6). However, the effect of visual health on children's academic performance in primary school is unclear. In a series of studies in Australia, better visual information processing was associated with better academic performance in different grades of primary school (7-9). Another study in Malaysia supported the key role of visual health in academic performance (10).

Vision screening can early detect visual disorders, such as amblyopia and refractive error, in children, allowing early treatment, which may improve their academic performance (11, 12). Vision screening programs have evolved over the years, starting with the first approved vision screening program in Connecticut in 1899 (13), which was based on the traditional visual acuity test (Snellen chart). Screening is typically conducted by trained health professionals, though studies have shown that adequately trained non-ophthalmic personnel, such as nurses and lay screeners, can also perform screenings effectively (14). Currently, various vision screening programs are available involving different components, such as screening for strabismus, amblyopia, stereoacuity, visual acuity, or visual information processing tests. The effectiveness of vision screening in improving academic performance in children has shown mixed results in previous studies. This review aims to discuss the impact of vision screening in primary school children on academic performance, highlighting challenges facing the implementation of these vision screening programs.

Methods

A comprehensive literature search was conducted in Medline (via PubMed), Scopus, and Web of Science databases up to August 24, 2025. Medical Subject Headings (MeSH) and relevant free-text keywords were used to identify synonyms. Boolean operators ('AND', 'OR') were applied to combine search terms in alignment with guidance from the Cochrane Handbook for Systematic Reviews of Interventions. Key search terms included: "Vision Screening" AND "Academic Performance" AND "Primary School." Summaries and duplicates of the found studies were exported and removed by EndNote X8. Any study that discusses the impact of early vision screening in primary school children on academic performance and is published in peer-reviewed journals was included. All languages are included. Full-text articles, case series, and abstracts with related topics are included. Case reports, comments, animal studies, and letters were excluded.

Discussion

Visual Health and Academic Performance

The association between vision health and academic performance among schoolchildren is well-established. Peregrina et al. evaluated the association between visual health and academic performance in 10,218 school-aged children in Spain by analyzing the children's and families' answers (15). They reported that 90.15% of children had good academic performance, while 9.85% of them had bad academic performance. The bad academic performance percentage aligned with the report of the Spanish Ministry of Education and Vocational Training (15). They also found that bad academic performance was higher in males compared with females, aligning with the Organization for Economic Co-operation and Development (OECD)'s reports, which found that at age 15, boys represented 60% of students

http://dx.doi.org/10.52533/JOHS.2025.51102

performing poorest in mathematics, reading, and science, while girls represented 40% (16).

Peregrina et al. analyzed the children's vision habits, and according to their answers, vision was better in students having good academic performance compared with those with poor academic performance (15). Children with good academic performance and who consider themselves to have good distance and near vision showed a higher percentage of seeing the blackboard clearly. Furthermore, students who experience visual fatigue while reading, headaches, eye irritation while reading, difficulty in following the text, or skipping words or lines during reading were lower in the good academic performance group. According to visual screening, children with poor academic performance had lower visual acuity and a longer near point of convergence (15). Similar results were reported by Jan et al., who reported a positive association between visual health and academic performance in children aged between 11 and 16 in China (17). Another study by Goldstand et al. reported that skilled readers had significantly better vision-screening scores and academic performance than unskilled readers (18).

Hopkins' review has reported a significant association between visual acuity and refractive error, and academic performance (19). This aligns with Peregrina et al., who reported that children with poor academic performance had problems with fusion images with both eyes (15). It is critical to underline how families recognized their children's need for glasses, as most of the time, the children themselves realized that they did not see properly. The next most frequently reported reasons were specialist prescriptions and school warnings. Given that, it is recommended to develop visual screening strategies in primary care and schools in order to improve children's academic performance.

Vision Screening Programs

Early vision screening in childhood can be effective in preventing various disorders, such as refractive error, amblyopia, and strabismus (20). Refractive error is considered a major cause of visual impairment in children; thus, vision screening programs should include screening for refractive error (20). Uncorrected refractive error is responsible for 12.8 million cases of visual impairment in children younger than 15 years out of 19 million cases worldwide (21). Various refractive error surveys were conducted in multiple countries on children of comparable age groups. These surveys used common diagnostic criteria and measurement methods and reported that 56% to 94% of cases of reduced vision in children were due to uncorrected refractive error (21). These studies indicate that early detection and spectacle correction could have effectively addressed these children's vision problems.

Amblyopia can significantly lead to vision loss during childhood. Refractive error, strabismus, and congenital cataract are the major causes of amblyopia. Multiple screening programs involve an amblyopia test due to its prevalence, its impact on children and society, and the effectiveness of available treatments. It is estimated that amblyopia affects 2% to 4% of individuals in developing countries (22, 23). Amblyopia can be effectively and cost-effectively managed by various approaches, including patching of the non-amblyopic eye, correction of significant refractive errors with optical aids, or the use of atropine in the non-amblyopic eye (20). Existing evidence shows that while amblyopia may be treated later in life, the treatment is most effective, and prevention is only possible, during early childhood.

In 1899, the first school vision screening program was conducted in Connecticut, involving only a Snellen chart. However, under-standardization of the testing conditions led to poor results (13). The first commercially available stereoscope was developed in 1934, which involved the assessment of visual acuity, fusion, and stereopsis, after incorporating it into the Keystone Ophthalmic Telebinocular Vision Testing instruments (13). However, in 1939, the American Medical Association considered it inadequate due to its high failure rates (85%) (13). The Massachusetts Vision Test, developed in 1938, was the first screening test involving ocular examination. It also included screening for visual acuity, hyperopia, and

http://dx.doi.org/10.52533/JOHS.2025.51102

heterophoria (13). The test showed a strong correlation with ophthalmologists' findings, though it lacked consistent pass/fail criteria.

Thereafter, optical companies began to develop commercially available vision screening instruments involving the modified Keystone Telebinocular, the Massachusetts School Vision Screening Test, the Titmus Optical School Vision Tester, and the modified Bausch and Lomb School Ortho-Rater. While rapid and cost-effective, controversies persisted regarding administration, frequency, and referral criteria (13). A landmark development was the Modified Clinical Technique (MCT), validated in the Orinda School District (1954). Using a battery of tests for visual acuity, refractive error, strabismus, and ocular pathology, the MCT showed high sensitivity (98%), specificity (99%), and predictive value, becoming regarded as the "gold standard." (24, 25). Yet, its reliance on ophthalmic personnel and lack of standardized pass/fail criteria limited reproducibility (24, 25). Computerized methods have led to a significant improvement in vision screening programs. Visual Efficiency Rating (VERA) is a computer software developed to enable school nurses to screen for visual acuity and hyperopia as well as ocular motor, accommodative, and binocular disorders. It demonstrated low sensitivity (45%) and specificity (83%) at the beginning; however, refinement with symptom surveys and behavioral data improved sensitivity to 64% and specificity to 100% (26).

Recently, various pediatric vision screening programs have been implemented in developed countries. In British Columbia and Canada, vision screening occurs at the age of 3, involving screening for amblyopia and strabismus, and is performed by public health staff (27). In Kansas, USA, vision screening is performed starting from birth until the age of 12, involving basic reflexes and tracking assessments in infants to near point of convergence, stereopsis, and color vision in older children. Screening is usually performed by school health nurses and volunteers (28). The International Agency for Prevention of Blindness (IAPB) has developed guidelines for school vision screening in low- and medium-income countries depending on the available resources and the structure of existing pediatric eye care services within a given system (29). The guidelines recommend that school vision screening programs should be provided by health care professionals and trained non-health professionals, such as school teachers, and that schools should be visited every 1 to 2 years (29). Guidelines also recommend that the screening strategy should focus on visual conditions that can cause reduced visual acuity and loss of vision in children.

Vision Screening in Primary Schools

The impact of vision screening in primary schools on the academic performance of children is still unclear. A previous study by Wood et al. investigated the association between standard vision tests and visual information processing tests in vision screening and the academic achievement outcomes for literacy and numeracy performance in Grade 3 Australian children (aged 8–9 years) (8). They found a significant association between visual information processing test performance and academic achievement outcomes across the Australian National Assessment Program for Literacy and Numeracy (NAPLAN) subsets, which include Reading, Writing, Spelling, Grammar/Punctuation, and Numeracy in children in one grade level of school (8). The linear regression and receiver operating characteristic (ROC) analyses showed that the vertical and horizontal Development Eye Movement (DEM) test had the highest association with NAPLAN scores. Notably, horizontal DEM was strongly linked to academic performance, aligning with Ayton et al.' (30) findings, which showed that DEM horizontal subsets were strongly associated with Burt reading test raw scores in children aged 8–11 years.

Furthermore, the Visual Sequential Memory test showed a significant association with NAPLAN outcomes, particularly Numeracy, while the Symbol Search test was significantly associated with Numeracy, Spelling, and Grammar/Punctuation (8). Previous studies also reported that visual-spatial memory is strongly associated with mathematical abilities (31-33). Kulp et al. reported an association between visual-spatial memory and reading ability

http://dx.doi.org/10.52533/JOHS.2025.51102

(32). Additionally, Chen et al. found a strong association between visual information processing skills, including visual analysis, visual spatial, and visual motor integration, and academic performance (10). Studies exploring the association between standard vision tests, particularly visual acuity and stereoacuity, and academic performance have shown mixed results. Some studies reported positive associations between visual acuity (8, 10, 34-36) and stereoacuity (37-39) and NAPLAN outcomes, while others reported no association (8, 40-42).

Glewwe et al. evaluated the impact of vision screening and free eyeglasses on the academic performance in elementary schools in Florida, USA. The study indicated that vision screening did not improve children's academic performance, but instead deteriorated academic performance in some districts (43). This deterioration may be due to the time spent on the screening, and that students do not follow up with care. Toledo et al. assessed the effect of early detection of visual impairment on academic performance in primary school children in Brazil. Impaired visual acuity was found in 34.8% of the students. Among them, only 75% showed adequate academic performance, while 89.5% of students with normal visual acuity showed adequate academic performance (44).

Barriers to Vision Screening

Lack of direct evidence proving that vision screening in childhood can decrease the prevalence and incidence of ocular diseases or improve visual functions is a considerable barrier to the development of vision screening programs for school children. The American Academy of Ophthalmology and the American Academy of Pediatrics (45) And some indirect evidence supports (46, 47) and recommend visual screening from birth and at all routine health visits. However, a previous Cochrane review stated that no robust trials are available for assessing the advantages of school vision screening (48). Another challenge is the differences in the components of various vision screening programs. Although computerized methods of vision screening are available, vision screening programs in developing countries are still based on traditional methods. Conventional visual acuity testing, commonly applied in school vision screening programs, may fail to detect children with reading difficulties. Furthermore, the provision of vision screening by adequately trained health personnel is a major challenge. It is critical to adequately train health professionals in order to effectively detect visual disorders during childhood. The age to administer vision screening can be a significant challenge. There is no agreement regarding the optimal age for administering vision screening in children.

Conclusion

Vision screening in children plays an important role in the early detection of refractive errors, amblyopia, and other visual disorders that may impact learning and academic performance. While numerous studies demonstrate a strong association between visual health and school achievement, the direct effect of vision screening programs on academic outcomes remains inconclusive. Strengthening training, adopting standardized guidelines, and integrating evidence-based approaches are essential steps to enhance the reliability and impact of vision screening in primary school children.

Disclosure

Statement

The authors declare that they have no conflict of interests.

Funding

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Ethical Consideration

Not applicable.

Data Availability

The contributions presented in the study are included in the article further inquiries can be directed to the corresponding author.

http://dx.doi.org/10.52533/JOHS.2025.51102

References

1. OECD P. Results.(2019).(Volume I): What Students Know and Can Do. Paris: OECD Publishing; 2018.

2. PISA O. Results (Volume II): Where all students can succeed. 2019. View Article. 2018.

3. DuPaul GJ, Rapport MD, Perriello LM. Teacher ratings of academic skills: The development of the Academic Performance Rating Scale. School psychology review. 1991;20(2):284-300.

4. Sattler JM. Assessment of children: Cognitive applications: Jerome M Sattler Publisher; 2001.

5. Dobewall H, Lindfors P, Karvonen S, Koivusilta L, Vainikainen MP, Hotulainen R, et al. Health and educational aspirations in adolescence: a longitudinal study in Finland. BMC public health. 2019;19(1):1447.

6. Shin HS, Park SC, Park CM. Relationship between accommodative and vergence dysfunctions and academic achievement for primary school children. Ophthalmic & physiological optics : the journal of the British College of Ophthalmic Opticians (Optometrists). 2009;29(6):615-24.

7. Hopkins S, Black AA, White SLJ, Wood JM. Visual information processing skills are associated with academic performance in Grade 2 school children. Acta ophthalmologica. 2019;97(8):e1141-e8.

8. Wood JM, Black AA, Hopkins S, White SLJ. Vision and academic performance in primary school children. Ophthalmic & physiological optics : the journal of the British College of Ophthalmic Opticians (Optometrists). 2018;38(5):516-24.

9. White SL, Wood JM, Black AA, Hopkins S. Vision screening outcomes of Grade 3 children in Australia: Differences in academic achievement. International Journal of Educational Research. 2017;83:154-9.

10. Chen AH, Bleything W, Lim YY. Relating vision status to academic achievement among year-2 school children in Malaysia. Optometry (St Louis, Mo). 2011;82(5):267-73.

11. Solebo A, Rahi J. Vision screening in children aged 4–5years. External review against programme appraisal criteria for the UK National Screening Committee (UK NSC). 2013.

12. Stewart-Brown S, Haslum MN, Butler N. Educational attainment of 10-year-old children with treated and untreated visual defects. Developmental medicine and child neurology. 1985;27(4):504-13.

13. Appelboom TM. A history of vision screening. The Journal of school health. 1985;55(4):138-41.

14. Preschool vision screening tests administered by nurse screeners compared with lay screeners in the vision in preschoolers study. Investigative ophthalmology & visual science. 2005;46(8):2639-48.

15. Alvarez-Peregrina C, Sánchez-Tena M, Andreu-Vázquez C, Villa-Collar C. Visual Health and Academic Performance in School-Aged Children. International journal of environmental research and public health. 2020;17(7).

16. OECD. The ABC of Gender Equality in Education: Aptitude, Behaviour, Confidence. OECD Publishing. 2015.

17. Jan C, Li SM, Kang MT, Liu L, Li H, Jin L, et al. Association of visual acuity with educational outcomes: a prospective cohort study. The British journal of ophthalmology. 2019;103(11):1666-71.

18. Goldstand S, Koslowe KC, Parush S. Vision, visual-information processing, and academic performance among seventh-grade schoolchildren: a more significant relationship than we thought? The American journal of occupational therapy : official publication of the American Occupational Therapy Association. 2005;59(4):377-89.

19. Hopkins S, Narayanasamy S, Vincent SJ, Sampson GP, Wood JM. Do reduced visual acuity and refractive error affect classroom performance? Clinical & experimental optometry. 2020;103(3):278-89.

20. Atowa UC, Wajuihian SO, Hansraj R. A review of paediatric vision screening protocols and

http://dx.doi.org/10.52533/JOHS.2025.51102

guidelines. International journal of ophthalmology. 2019;12(7):1194-201.

21. Aldebasi YH. Prevalence of correctable visual impairment in primary school children in Qassim Province, Saudi Arabia. Journal of optometry. 2014;7(3):168-76.

22. Akpe B, Abadom E, Omoti E. Prevalence of amblyopia in primary school pupils in Benin City, Edo State, Nigeria. African Journal of Medical and Health Sciences. 2015;14:110.

23. Elsahn M. International Vision Screening: Results from Alexandria, Egypt. Current Ophthalmology Reports. 2014;2:137-41.

24. Hopkins S, Sampson GP, Hendicott P, Wood JM. Review of guidelines for children's vision screenings. Clinical & experimental optometry. 2013;96(5):443-9.

25. Paech M. The Orinda Study: should the 'modified clinical technique' retain its 'gold standard' status as a vision screening tool? Clinical & experimental optometry. 2010;93(1):31-6.

26. Gallaway M, Mitchell GL. Validity of the VERA visual skills screening. Optometry (St Louis, Mo). 2010;81(11):571-9.

27. Poon B, Hertzman C, Holley P. BC Early Childhood Vision Screening Program: Final Evaluation Report: Human Early Learning Partnership, University of British Columbia; 2012.

28. Edition F. VISION SCREENING GUIDELINES: For Infants, Toddlers, Children and Youth. 2004.

29. Blindness IAftPo. Standard school eye health guidelines for low and middle-income countries. International Agency for the Prevention of Blindness London; 2018.

30. Ayton LN, Abel LA, Fricke TR, McBrien NA. Developmental eye movement test: what is it really measuring? Optometry and vision science : official publication of the American Academy of Optometry. 2009;86(6):722-30.

31. Geary DC. Cognitive predictors of achievement growth in mathematics: a 5-year longitudinal study. Developmental psychology. 2011;47(6):1539-52.

32. Kulp MT, Edwards KE, Mitchell GL. Is visual memory predictive of below-average academic achievement in second through fourth graders? Optometry and vision science : official publication of the American Academy of Optometry. 2002;79(7):431-4.

33. Dumontheil I, Klingberg T. Brain activity during a visuospatial working memory task predicts arithmetical performance 2 years later. Cerebral cortex (New York, NY : 1991). 2012;22(5):1078-85.

34. O'grady J. The relationship between vision and educational performance: a study of year 2 children in Tasmania. Aust J Optom. 1984;67(4):126-40.

35. Bruce A, Fairley L, Chambers B, Wright J, Sheldon TA. Impact of visual acuity on developing literacy at age 4-5 years: a cohort-nested cross-sectional study. BMJ open. 2016;6(2):e010434.

36. Marchman VA, Fernald A. Speed of word recognition and vocabulary knowledge in infancy predict cognitive and language outcomes in later childhood. Developmental science. 2008;11(3):F9-16.

37. Kulp MT, Ciner E, Maguire M, Moore B, Pentimonti J, Pistilli M, et al. Uncorrected Hyperopia and Preschool Early Literacy: Results of the Vision in Preschoolers-Hyperopia in Preschoolers (VIP-HIP) Study. Ophthalmology. 2016;123(4):681-9.

38. Kulp MT, Schmidt PP. Visual predictors of reading performance in kindergarten and first grade children. Optometry and vision science : official publication of the American Academy of Optometry. 1996;73(4):255-62.

39. Barker BM. Interrelationships of perceptual modality, short-term memory and reading achievement. Perceptual and motor skills. 1976;43(3 pt. 1):771-4.

http://dx.doi.org/10.52533/JOHS.2025.51102

40. Vinuela-Navarro V, Erichsen JT, Williams C, Woodhouse JM. Saccades and fixations in children with delayed reading skills. Ophthalmic & physiological optics : the journal of the British College of Ophthalmic Opticians (Optometrists). 2017;37(4):531-41.

41. Helveston EM, Weber JC, Miller K, Robertson K, Hohberger G, Estes R, et al. Visual function and academic performance. American journal of ophthalmology. 1985;99(3):346-55.

42. Dirani M, Zhang X, Goh LK, Young TL, Lee P, Saw SM. The role of vision in academic school performance. Ophthalmic epidemiology. 2010;17(1):18-24.

43. Glewwe P, West KL, Lee J. The Impact of Providing Vision Screening and Free Eyeglasses on Academic Outcomes: Evidence from a Randomized Trial in Title I Elementary Schools in Florida. Journal of policy analysis and management : [the journal of the Association for Public Policy Analysis and Management]. 2018;37(2):265-300.

44. Toledo CC, Paiva AP, Camilo GB, Maior MR, Leite IC, Guerra MR. Early detection of visual impairment and its relation to academic performance. Revista da Associacao Medica Brasileira (1992). 2010;56(4):415-9.

45. Eye examination in infants, children, and young adults by pediatricians. Pediatrics. 2003;111(4 Pt 1):902-7.

46. Powell C, Hatt SR. Vision screening for amblyopia in childhood. The Cochrane database of systematic reviews. 2009(3):Cd005020.

47. Chia A, Dirani M, Chan YH, Gazzard G, Au Eong KG, Selvaraj P, et al. Prevalence of amblyopia and strabismus in young singaporean chinese children. Investigative ophthalmology & visual science. 2010;51(7):3411-7.

48. Powell C, Wedner S, Richardson S. Screening for correctable visual acuity deficits in school-age children and adolescents. The Cochrane database of systematic reviews. 2005(1):Cd005023.

http://dx.doi.org/10.52533/JOHS.2025.51102