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ORIGINAL ARTICLE

Visual performance in elementary school children: Associations with reading and arithmetic performance

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Abstract
Vision is important for learning and development. However, empirical evidence linking basic visual and academic performance in general school populations remains limited. Here, we examined arithmetic and reading performance and basic visual functions in two independent samples including 110 third graders (8-10 years; Screening Sample: 75 students without known learning disabilities; Intervention Study Sample: 35 students including 24 children with learning disabilities). In the screening sample, we found positive correlations between near visual acuity (VA) and subtraction (τ = .234, p = .014) as well as between VA-near and reading fluency (τ = .324, p = .001). In the intervention study sample, more students with learning disabilities had lower near VA compared to their peers without such disabilities ($\chi^2(3)$ = 11.363, p = .01). Our findings indicate that variation in visual performance may be associated with differences in academic performance. These results highlight the potential relevance of visual screening in educational contexts, particularly for children with learning disabilities.

Keywords: vision; learning disabilities; visual acuity; arithmetic; reading; dyscalculia; dyslexia

1 INTRODUCTION

Vision plays an essential role in children's learning processes, including academic skills such as reading and arithmetic (Hyvärinen & Jacob, 2019). While the importance of severe visual impairment for educational development is widely recognized and has historically shaped specialized educational systems, less is known about the extent to which subtle variability in basic visual functions among the general school populations is related to academic performance (e.g., Hopkins et al., 2020). While the importance of severe visual impairment for educational development is widely recognized and has historically shaped specialized educational systems, much less is known about whether more subtle variability in basic visual functions within the general school population is systematically related to academic performance. This gap is noteworthy because existing evidence links poorer visual acuity and refractive errors, even within the subclinical range, to poorer academic outcomes (e.g., Hopkins et al., 2020) and because visual functions may contribute to specific learning disabilities such as dyscalculia and dyslexia (Kristjánsson & Sigurdardottir, 2023). This study seeks to address that gap by providing initial evidence on how variation in basic visual functions—such as refraction, accommodation, convergence, and visual acuity—might influence academic outcomes in children without visual impairments. Refraction refers to the process of focusing light accurately onto the retina. Accommodation involves adjusting the lens shape based on viewing distance to maintain clarity, while convergence ensures that both eyes align properly for fixation. Near visual acuity (VA) measures the ability to distinguish fine details essential for decoding text or numerical symbols. Together they ensure accurate input for sustained near work, which dominates learning in school environments (Narayanasamy et al., 2016).

While higher-level processes like visuospatial memory or visuomotor integration have been shown to influence performance in tasks like reading comprehension or mathematical reasoning (e.g., Tablante et al., 2023), basic visual functions remain underexplored. So far, findings regarding the relationship between visual acuity and academic performance have been inconsistent due to methodological differences in defining "reduced" acuity, variations in measurement approaches, and evaluations of academic performance (Hopkins et al., 2020). By highlighting this area of research within education frameworks, our study seeks not only to advance knowledge but also to inspire further exploration into how basic visual performance can inform interventions in inclusive learning settings.

Many students struggle with learning basic academic skills such as reading, writing, and arithmetic. Learning disabilities likely arise from interactions among multiple risk factors, and according to so-called multi-deficit models, this might explain the impairments across language, perception, memory, and executive functions often experienced by children with learning disabilities (Pennington, 2006), who form a heterogeneous population with several subtypes in both dyscalculia (Fias et al., 2013; Kißler et al., 2021) and dyslexia (Wilson & Dehaene, 2007). Globally, around 3–11% of children have dyslexia, experiencing difficulties with reading fluency, spelling, and comprehension (Butterworth & Kovas, 2013; Moll et al., 2014). Similarly, children with dyscalculia struggle with numerical tasks and arithmetic, typically accompanied by issues with working memory and attention (Kuhn et al., 2016). Dyscalculia prevalence ranges from 3.5% to 6.5% (Butterworth & Kovas, 2013; Haberstroh & Schulte-Körne, 2019). Nearly half of students diagnosed with a learning disability face additional comorbid challenges across skill areas (Haberstroh & Schulte-Körne, 2019; Landerl et al., 2013). Vision has been suggested to play a fundamental role in the development of learning disabilities (Jacobs & Petermann, 2003), and lower visual performance (both higher and lower level) is more prevalent among students with learning difficulties compared to students without such difficulties (Kristjánsson & Sigurdardottir, 2023; Raghuram et al., 2019).

This study investigates the relationship between basic visual and academic performance among two independent samples of third-grade students in general schools:

1. *Screening Sample* consisting of an unselected cohort of third-grade students,
2. *Intervention Study Sample* consisting of students previously diagnosed with learning disabilities (dyslexia, dyscalculia, or combined) and an age-matched control group. The term "Intervention Study Sample" refers to the recruitment context (participants were enrolled in a separate intervention study), while the intervention is not further discussed here.

By concentrating on standardized assessments of both basic visual and academic performance, we hypothesized that (1) students with lower near VA would perform worse on tests measuring numeracy, arithmetic, reading, and spelling (Chen et al., 2011), and (2) there would be a higher prevalence of suboptimal visual performance among students with learning disabilities compared to their average or more advanced peers (Dusek et al., 2010). While we acknowledge that vision is a multidimensional construct encompassing basic optical functions as well as higher-level perceptual and cognitive processes, we focus on basic visual functions here as they are underrepresented in research. Furthermore, VA was selected as a foundational, clinically and easily accessible indicator of input quality rather than as a comprehensive model of visual processing.

2 MATERIALS AND METHODS

The study adhered to ethical guidelines approved by the university's ethics board and the Declaration of Helsinki. Parents provided written informed consent for their children's participation. The datasets generated and analyzed contain sensitive information from child participants. In accordance with the

TABLE 1: Overview of academic performance in both samples.

	n	n excluded refraction	Arithmetic HRT mean t-score (n)	SD	Basic numerical TOBANS mean standard score (n)	SD	Reading fluency SLS mean LQ (n)	SD	Spelling SLRT mean mistakes raw score (n)	SD	mean per-centile
Screening Sample											
	75	10	45.30 (65)	9.48	109.34 (62)	10.1	96.64 (64)	15.7	6.80 (64)	4.86	31-50
Intervention Sample											
Dyslexia	10	1	49.07 (9)	4.6	106 (9)	7.58	77.44 (9)	5.79	9.89 (9)	5.71	21-31
Dyscalculia	4	0	38.17 (4)	2.4	106.75 (4)	4.5	98.75 (4)	6	4.5 (4)	2.1	51-50
Combined	10	1	38.26 (9)	1.23	99.94 (9)	5.08	79.22 (9)	4.32	12.44 (9)	4.48	11-20
Control	11	0	55.37 (11)	8.08	104.32 (11)	6.27	110.73 (11)	8.51	2.55 (11)	2.54	61- 80/ >80

Note: Heidelberger Numeracy Test (HRT 1-4; Haffner et al., 2005), Test of Basic Arithmetic and Numeracy Skills (TOBANS; Brigstocke et al., 2016), Salzburger Reading Screening (SLS 2-9; Mayringer & Wimmer, 2014), and Reading and Spelling Test (SLRT-II; Moll & Landerl, 2014). Scores are on different scales; percentiles are provided for SLRT as standardized values are unavailable. SLS: mean = 100, SD = 15. SLRT spelling errors include orthographic and phonetic mistakes. Students with uncorrected or insufficiently corrected refractive errors (sphere $\leq$ -0.75 or $\geq$ +3.0 dpt; cylinder $\geq$ -1.0 dpt) were excluded from analysis. Up to three students in the Screening Sample were excluded for not following instructions on TOBANS, SLS, or SLRT tasks.

approved ethics protocol and applicable data-protection regulations, we are not permitted to make the full dataset publicly available. De-identified data can be shared for research purposes upon reasonable request to the corresponding author.

2.1 Participants

We collected data in two independent samples:

1. an unselected *screening sample* (75 third-grade students; 36 female; mean age = 8.96 years, *SD* = 0.51)
2. an *intervention study sample* (35 third-grade students; 16 female; mean age = 8.91 years, *SD* = 0.49) including children diagnosed with
   - dyscalculia (*n* = 4),
   - dyslexia (*n* = 10),
   - combined learning disabilities (*n* = 10),
   - and a control group (*n* = 11).

Due to the small sample size, especially in the dyscalculia group, we did not analyze data separately per group.

All students completed the same screening for basic visual and academic performance.

2.2 Academic Performance Assessment

Academic achievement was assessed in class as group tests and included tests in numeracy, arithmetic, reading, and spelling. Screening occurred at different times due to practical considerations, with intervals between academic and visual assessments varying across samples. Numeracy was assessed using a dot comparison task (identifying larger arrays of dots) and a digit comparison task (identifying larger digits) from the Test of Basic Arithmetic and Numeracy Skills (TOBANS; Brigstocke et al., 2016). Scores reflect total correct responses within 30 seconds per task. Arithmetic was evaluated with three subtests from the Heidelberger Rechentest (HRT; Haffner et al., 2005): addition, subtraction, and multiplication. Each subtest had a time limit of two minutes, with scores reflecting correctly solved items. Reading fluency was measured using the Salzburger Lesescreening (SLS; Mayringer & Wimmer, 2014), where children read simple sentences and judged their correctness. Spelling was assessed with the spelling subtest of the Salzburger Lese-Rechtschreib-Test II (SLRT-II; Moll & Landerl, 2014), where children filled in missing words based on dictated sentences. Please note that in Table 1 scores are standardized according to the respective manuals and are therefore not directly comparable.

Children considered for the intervention study following the initial screening underwent individual diagnostic testing at school or university facilities to confirm classification into one of four groups (see Table 2): Children in the dyslexia group had an IQ > 70 and reading test performance < 16th percentile, while their math abilities were > 25th percentile. Children in the dyscalculia group had an IQ > 70, math performance < 16th percentile, and reading performance > 25th percentile. Those in the combined learning disability group had an IQ > 70 with both reading and math performances < 16th percentile. Children in the control group had an IQ > 70 and both math and reading performances > 25th percentile. Children diagnosed with learning disabilities participated in targeted interventions addressing either math skills (e.g., training based on Kuhn & Holling, 2014) or reading/dyslexia (e.g., Görgen et al., 2020). These interventions are not reported here as they fall outside this study‘s scope. Children in the control group did not receive any intervention.

2.3 Visual Performance Assessment

We assessed four key aspects of visual performance essential for near work—refraction, accommodation, convergence, and near VA—using established methods:

- *Refraction:* Measured binocularly with an autorefractometer (PlusoptiX A09) that assesses refractive errors at a distance of ~1 meter in increments of ±0.25 dpt within a range of -7 to +5 dpt. Each

TABLE 2: Diagnosis for learning disability in Intervention Sample per group.

		Intelligence WISC-V		Math DEMAT curriculum based			Reading ELFE 1-6		Reading SLRT words			Reading SLRT nonwords		
	n	mean IQ	SD	mean raw score	SD	mean percen-tile	mean t-score	SD	mean raw score	SD	mean percen-tile	mean raw score	SD	mean percen-tile
Dyslexia	9	84.63	10.6	2.83	0.9	10-21	38.33	7.7	23.67	7.86	1-2	21.22	7.19	8
Dyscalculia	4	88.33	7.9	2.63	1.3	10-21	55.00	5.2	56.25	9.6	54-58	35.75	5.1	50-62
Combined	9	82.41	8.34	2	1.44	10-14	38.44	5.22	26	10.9	3	18.67	5.98	1-2
Control	11	93.33	11.7	3.18	0.68	15-21	56.82	5.84	64.18	15.7	49-57	41.18	9.71	57-62

Note: Values are on different scales; percentiles are provided for subscales without standardized values to enable score placement. Sample size (n) excludes students with large refractive errors. Tests: WISC-V (Wechsler, 2017), DEMAT 2+ (Krajewski et al., 2004), ELFE 1-6 Reading Comprehension (Lenhard & Schneider, 2006), and SLRT-II Reading and Spelling Test (Moll & Landerl, 2014).

child's refraction was measured three times, with averages recorded as their final values. Hyperopia (farsightedness) can be either fully or partially compensated by accommodation, potentially leading to an underestimation of existing hyperopia (c.f. Wood et al., 2018). Thus, to confirm our measurements, we used +3.00 dpt lenses held by the participants (PlusoptiX GmbH, 2009). For children who wore glasses, we assessed their lenses with an auto lensometer (TL-3000C; Tomey GmbH). Children wore their glasses during all subsequent measurements to evaluate functional vision binocularly under optimal correction conditions (Hyvärinen & Jacob, 2019).

- *Accommodation:* Evaluated using the "push-up method," which measures the closest distance at which an object remains in focus—a critical indicator of lens flexibility for near vision tasks. Children fixated on a small Snellen's E symbol mounted on a toy brick (~size: 0.1 × 0.1 cm or larger if needed). Starting at a distance of ~40 cm, the object was moved closer at ~3 cm/sec until children reported blurring; this process was repeated three times per child with averages recorded as accommodation distance.
- *Convergence:* Assessed by observing whether both eyes could simultaneously focus on an approaching small object up to the bridge of the nose—a physiological benchmark for proper convergence. Children fixated on a depiction of a car glued to a small brick toy as it moved toward them (~3 cm/sec). If convergence fell short of reaching the bridge of their nose, the remaining distance where fixation remained achievable was measured.
- *Near VA:* Measured using LEA SYMBOLS® charts (#250800) presented in both row format (optotypes spaced equal to their size) and crowded format (spacing reduced to ~25% of optotype size). The chart was positioned at exactly 40 cm from each child's eyes using an attached cord for verification purposes during testing sessions. Children first named all symbols on the chart to ensure recognition. Testing VA thresholds were determined based on correct identification rates per row following Hyvärinen's stopping criterion—three errors out of five symbols stopped testing progression. Decimal VA scores were converted into logMAR units where applicable.

We defined age-appropriate visual performance as follows: VA-near (row) ≥ 1.25 decimal/ ≤ -0.1 logMAR, VA-near (crowded) ≥ 1.0 decimal/ ≤ 0.0 logMAR, accommodation < 8.6 cm, and convergence up to the bridge of the nose. To our knowledge, there are no universal guidelines for classifying visual performance as age-appropriate. Our criteria for VA-near were based on AWMF guidelines (S2e-Leitlinie; AWMF, 2010) and research indicating that 90% of ten-year-old children achieve at least a VA-near row of 1.25/ -0.1 logMAR (Larsson et al., 2015). For accommodation standards, we referred to the Duane curve (Lachenmayr et al., 2016, p. 87; Duane, 1922), while physiological motility served as our reference for convergence capability up to the bridge of the nose (Kaufmann & Steffen, 2020). Parents received recommendations tailored to individual results regarding (routine) eye examinations.

2.4 Data Analysis

Due to differences in sample size, screening intervals, and intervention type, data from both samples were analyzed separately. In the screening sample, we assessed correlations between VA-near scores and academic performance using Kendall's Tau-b tests. In the intervention study sample, we assessed whether VA-near row scores were equally distributed among students in the learning disabilities groups (combined across all learning disabilities) compared to those in the control group using a χ^2 test.

3 RESULTS

3.1 Screening Sample

We first evaluated whether children's basic visual performance was age-appropriate. A total of 41 children (63.08%) exhibited suboptimal visual performance in at least one measurement, with many showing deficiencies in multiple areas (Table 3).

3.1.1 Relationship Between Visual and Academic Performance

Correlations between VA-near row and academic performance (numeracy, arithmetic, reading, and spelling) revealed significant associations for subtraction and reading fluency (Table 4; Figure 1). Notably, the correlations appear to be primarily influenced by students with low VA-near scores, as none of these children performed well in tests of academic performance.

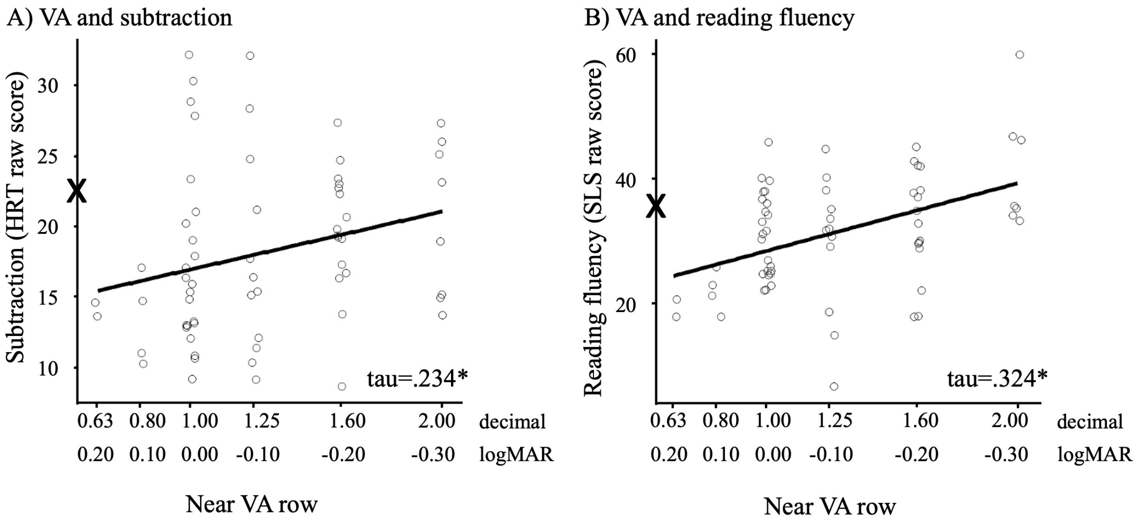
3.1.2 Exploratory Analysis

Since measures of visual performance are interrelated (e.g., accommodation affects VA-near), we calculated a "suboptimal visual performance" sum score ranging from 0 to 4. Points were assigned per function when performance was below our predefined benchmarks of VA-near row (<1.25 decimal/ >-0.1

TABLE 3: Suboptimal Visual Performance: Frequency, Types, and Combinations observed.

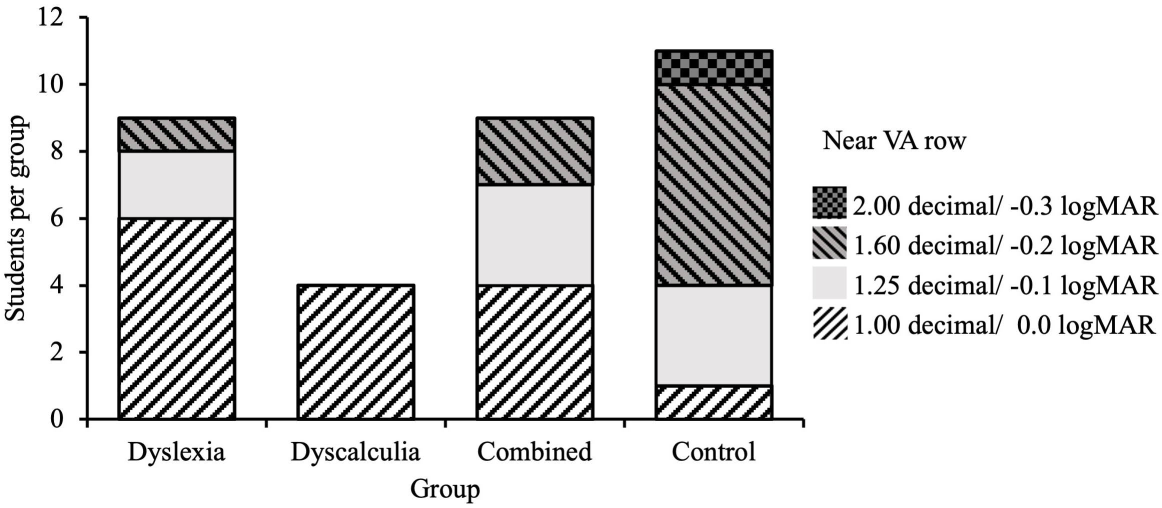
Number of functions with suboptimal visual performance	Functions with suboptimal visual performance and their combination	Screening sample (n=75)	Intervention sample (n=35)	
		n	Children with learning disability, n	Control group, n
Not further assessed	Excluded due to too large refractive error	10	2	0
0	none	24	3	3
1	VA-near row	4	3	1
	VA-near crowding	4	1	4
	Convergence	6	2	0
	Accommodation	1	1	1
2	VA-near row + VA-near crowding	18	6	0
	VA-near row + Accommodation	1	1	0
	VA-near row + Convergence	0	1	0
	VA-near crowding + Convergence	1	0	0
	VA-near crowding + Accommodation	0	1	0
	Accommodation + Convergence	0	0	1
3	VA-near row + VA-near crowding + Convergence	2	0	0
	VA-near row + VA-near crowding + Accommodation	2	2	0
	VA-near row + Convergence+ Accommodation	2	0	0
	VA-near crowding + Accommodation + Convergence	0	0	1
4	VA-near row + VA-near crowding + Convergence+ Accommodation	0	1	0

Note: This table presents the number of functions with suboptimal visual performance observed in participants, ranging from 0 to 4. Suboptimal performance is defined as VA-near (row) < 1.25 decimal/ > -0.1 logMar , VA-near (crowded) < 1.0 decimal/ > 0.0 logMar, accommodation > 8.6 cm, and convergence beyond the bridge of the nose. The table highlights combinations of suboptimal visual performances where multiple deficits were identified within individual participants.



Note. The x on the y-axis marks the 50% percentile in the tests (HRT=22.5; SLS=37.4). *$p < 0.05$.

FIGURE 1: Association between near visual acuity (VA) row andA) subtraction (HRT 1-4 Heidelberger Numeracy Test (Haffner et al., 2005)) and B) reading fluency (SLS 2-9 Salzburger Reading Screening (Mayringer & Wimmer, 2014)) in the Screening Sample. Individual data points are represented by small circles, with fitted linear trend lines (linear model) illustrating observed patterns.VA is shown in decimal notation as well as in logMAR.



Note. VA-near in decimal notation and logMAR, age-appropriate VA-near row is ≥1.25 decimal/ ≤ -0.1 logMAR.

FIGURE 2: Distribution of near visual acuity (VA) row per group in the Intervention Study Sample.

logMAR), VA-near crowded (<1.0 decimal/>0 logMAR), convergence beyond the bridge of the nose, or accommodation ≥8.6 cm. Higher suboptimal visual performance scores correlated with poorer academic outcomes across all arithmetic subscales of the HRT and reading fluency (SLS) (Table 4). Students with multiple visual difficulties performed worse overall, consistent with prior research suggesting additive negative effects on academic skills.

3.2 Intervention Study Sample

In this sample, 81.8% of children showed suboptimal visual performance in at least one measurement (Table 3): 8 out of 11 children in the control group and 19 out of 24 in the learning disability groups. A χ^2 test revealed that children with learning disabilities had significantly lower VA-near row scores compared to controls ($\chi^2(3) = 11.363$, $p = .01$, Cramer's $V = .587$; Figure 2). Due to the small sample size, further

TABLE 4: Correlations between visual and academic performances in the Screening Sample. Sum score for "sub-optimal visual performance" which theoretically ranges from 0 to 4, with 0 indicating unaffected visual performance. Points were added as follows: one point each if visual acuity (VA)-near row was < 1.25 decimal/ > -0.1 logMar, VA-near crowded was < 1.0/ > 0.0 logMar, convergence was beyond the bridge of the nose, or accommodation was ≥ 8.6 cm.

	VA-near row		**Sum score suboptimal visual performance**	
	τ	**p**	**τ**	**p**
Basic numerical n = 62				
TOBANS dot comparison	.1119	.264	-.1966 (*)	.056
TOBANS digit comparison	.1811 (*)	.066	-.1663	.100
Basic arithmetic n = 65				
HRT addition	.1631 (*)	.088	-0.2373 *	.015
HRT subtraction	.2336 *	.014	-0.2758 **	.005
HRT multiplication	.0926	.334	-0.2026 *	.039
Reading n = 64				
SLS	.3243 **	0.001	-0.2066 *	.034
Spelling n = 64				
SLRT Spelling Mistakes	-.1836 (*)	0.058	0.1690 (*)	.088

Note: VA= visual acuity, Heidelberger Numeracy Test (HRT 1-4; Haffner et al., 2005), Test of Basic Arithmetic and Numeracy Skills (TOBANS, Brigstocke et al., 2016) Salzburger Reading Screening (SLS 2-9; Mayringer & Wimmer, 2014), Reading and Spelling Test (SLRT-II; Moll & Landerl, 2014). SLRT spelling mistakes include orthographical and phonetical errors. Students with large refractive errors were excluded from analysis (sphere: < = -0.75 or > = +3.0 diopter (dpt); cylinder: > = -1.0 dpt, that were not corrected, were not corrected sufficiently or which could not be verified with our measurements). Number of students per test differs as students who did not follow test instructions were excluded. (*) $p < 0.1$, *$p < 0.05$, **$p < 0.001$.

analyses of associations between visual and academic performance were not conducted, and types of learning disabilities were not distinguished.

4 DISCUSSION

This study provides evidence that basic visual performance necessary for near work is associated with academic performance in third graders (aged 8–9 years). Students with lower near VA performed worse, particularly in subtraction and reading fluency, suggesting that even subtle reductions in near VA might impact classroom participation and learning outcomes. Furthermore, near VA was lower in students with learning disabilities compared to their peers without such disabilities, suggesting a potential link between visual performance and learning disabilities. Suboptimal visual performance here refers to corrected near VA of 1.0 decimal/0 logMAR or worse—slightly below age-appropriate standards but not indicative of clinical visual impairment (AWMF, 2010). While all children could read the test materials within their measured range of near VA, those with lower scores performed worse academically.

Classroom activities are predominantly visual and require sustained near focus (Narayanasamy et al., 2016). However, visual issues often go undiagnosed in children despite their potential impact on academic success (Hopkins et al., 2020). Children with undetected suboptimal performance in visual functions required for near work might find participation in normal classroom activities more exhausting, leading to frustration and discouragement—potentially resulting in cascading effects on their overall performance (Evans et al., 2018; Goldstand et al., 2005). Falkenberg et al. (2019) found that up to 83% of school-aged children had previously undetected vision problems—a finding consistent with our results showing suboptimal performance in at least one measure among over 60% of participants across both samples. The high prevalence of suboptimal visual performance, combined with evidence linking poorer vision to lower performance on tests of academic performance, strongly suggests the need for further research into both diagnostic methods and the mechanisms underlying the relationship between vision and learning.

Children with learning disabilities exhibited significantly lower VA-near compared to those in the control group; however, not all students with learning disabilities demonstrated suboptimal visual performance. This observation may provide additional evidence for the existence of different subpopulations in learning disabilities (Fias et al., 2013; Pennington, 2006) as well as the necessity to investigate the role of visual factors more closely in the context of learning disabilities. While diagnostic assessments of learning usually ensure that a child is not clinically visually impaired, they rarely account for visual abilities as a potential factor influencing learning performance. Visual screening might be especially important for students with learning deficits (Williams et al., 2021), who show a greater prevalence of visual problems and might be misdiagnosed if impaired visual processing affects task completion rather than underlying cognitive abilities alone. However, this study is partly based on a small *intervention study sample*, particularly regarding children with isolated dyscalculia, which limited our ability to investigate whether visual performances are distributed differently across various groups of children with learning disabilities. Consequently, the sample size restricts the generalizability of our results. We furthermore did not take students' motivations into account when assessing both visual and academic performance. However, this research represents an important first step in systematically examining visual performance in (prospective) studies on the development of learning disabilities.

Understanding children's visual profiles has practical implications for improving classroom environments and instructional design. Research indicates that visual performance is particularly crucial during the early stages of reading acquisition and the development of foundational mathematical skills—areas where children with developmental learning disabilities often struggle (Commodari et al., 2020; Mix et al., 2016; Vernet et al., 2022). Tasks and learning materials that are designed to minimize visual demands may improve learning outcomes. Given the established relationship between vision and learning, along with the high prevalence of suboptimal visual performance among school-aged children, it is likely that all students would benefit from materials tailored to support their visual access. General recommendations for supporting students with visual impairments include enlarging materials, increasing contrast, reducing visual complexity, and optimizing both illumination and placement (Henriksen & Laemers, 2016). However, such environmental adaptations do not replace the need for individual visual screening. For example, children with uncorrected refractive error may benefit substantially from appropriate optical correction

(Mudie et al. 2021). Moreover, individual diagnostic information is essential for tailoring educational strategies and adapting visual demands to the specific needs and contexts of the learner.

Given the relationship between vision and academic performance, along with the high prevalence of suboptimal visual performance in both samples, we advocate for closer assessment of visual performance in school-aged children. Early detection would allow educators and parents alike an opportunity to address potential barriers proactively before they escalate into broader achievement gaps later.

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