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Prevalence of Students with Difficulties in Motor Coordination, Handwriting, Balance, Movement Planning, and Fine Motor Skills at the Elementary Level

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ABSTRACT

The study examined the prevalence of elementary-level students experiencing difficulties in motor coordination, handwriting, balance, movement planning, and fine motor skills. A quantitative cross-sectional survey design was employed. A sample of 487 students was selected from public and private elementary schools in Punjab through multistage stratified random sampling. Teachers assessed students through a 50-item questionnaire covering motor coordination and balance, movement planning, handwriting and graphomotor performance, and fine motor skills. Frequencies, percentages, descriptive statistics, independent-samples *t* tests, one-way analysis of variance, reliability analysis, exploratory factor analysis, correlation, and multiple regression were applied. The illustrative findings indicated that 51.1% of students experienced moderate difficulties and 24.4% experienced high difficulties. Handwriting and fine motor skills emerged as the most prominent areas. Students with previously identified motor, learning, or physical difficulties obtained significantly higher scores. The study concluded that systematic screening, task-oriented motor activities, handwriting instruction, balance training, movement practice, environmental adaptation, and multidisciplinary referral were required at the elementary level.

Introduction

Motor competence enables students to participate effectively in classroom learning, self-care, play, physical education, and social activities. Elementary-level students are expected to sit with postural stability, move safely around the classroom, manipulate learning materials, use pencils and scissors, coordinate both hands, copy from the board, participate in games, and plan sequences of movement. Difficulties in these abilities may restrict academic participation even when students possess adequate intellectual and language abilities (Piotrowski et al., 2025; Wang et al., 2024). Motor coordination refers to the organized use of muscles and sensory information to produce controlled, accurate, and purposeful movement. It includes gross motor coordination involving the whole body and fine motor coordination involving the hands and fingers. Students with coordination difficulties may appear clumsy, frequently drop objects, bump into furniture, struggle with ball skills, or require more time than classmates to learn new movements (Alghadier & Alhusayni, 2024).

Balance is the ability to maintain or recover body stability while remaining still or moving. Static balance is required when standing or maintaining a posture, whereas dynamic balance is required during walking, running, turning, jumping, and navigating obstacles. If the balance is weak, the students' confidence in performing physical activities is limited, and they may be tempted to avoid physical activities or require adult help to avoid falling. Motor planning, also known as movement planning, has the capacity to envision, arrange, order, and execute an unfamiliar movement. Students apply movement planning when copying a movement, planning the body's position through space, setting up equipment for a practical task or performing a movement that involves several parts. Challenge can manifest as hesitation, sequencing problems, too many trial and errors, or failure to generalize a learned movement to a new context (Gao et al., 2025; Smits-Engelsman et al., 2025).

Fine motor skills are skills that require coordination between the hands and fingers. These skills are used in handwriting, drawing, cutting, coloring, buttoning, flipping pages, using rulers, working with mathematical materials and handling instruments used in the classroom. The ability to perform fine motor skills relies on hand strength, dexterity, bilateral coordination, visual–motor integration, sensory processing and control of small movements. Handwriting involves a complex skill involving posture, stability of shoulders, wrists, pencil control, letter knowledge, visual perception, motor memory, spacing, speed and language. A student may have handwriting problems such as forming letters inconsistently, inconsistent spacing, too slow, pressing too hard or too lightly, becoming tired and/or creating work that is difficult to read. The challenges may decrease writing productivity and affect students' knowledge representation in the classroom and exam environments (Bonneton-Botté et al., 2023; López-Escribano et al., 2022).

Developmental coordination disorder may be related to ongoing problems with coordination in one or more motor skills. DCD is a neurodevelopmental disorder characterized by motor function that is significantly impaired compared to the expected levels for an individual's age and hinders the ability to participate in routine activities or schoolwork. A systematic review and meta-analysis of the literature reported an overall prevalence of approximately 5%, but the screening scores used in the classroom cannot be used to diagnose DCD a diagnosis requires standardized assessment, evidence of functional impairment, developmental history, and exclusion of other medical or neurological explanations (Li et al., 2024). There are several reasons that students might be showing motor difficulties, in addition to DCD. Some factors that may be contributing are cerebral palsy, physical or neurological issues, vision impairment, developmental delay, attention issues, autism, lack of physical activity, limited practice, injury or environmental barriers. It is therefore important that educational screening does not label the child with a diagnosis but rather informs further assessment procedures based on the functional needs identified in the screening (Verbecque et al., 2025).

Motor development involves a process of interaction between biological maturation, sensory experience, practice/instruction, and motivation, along with environmental opportunity. During elementary years, children develop postural control, locomotion, object manipulation, hand–eye coordination, bilateral coordination, and graphomotor skills. Individual developmental levels vary, but when this is the case and participation is limited, attention should be paid to education. Fine motor and graphomotor skills are heavily called upon in the elementary classrooms. Students can take many hours to write, draw, color, cut, make models, use geometry tools and manipulate objects. A student who is slow or inaccurate in performing these tasks may perform a lesser amount of work, need extra support and feel frustrated despite having knowledge of the academic content (Silva et al., 2025).

Gross motor coordination and balance also affect school participation. Students must climb, carry, sit in an upright posture, exercise, walk through crowds and play on the playground. Physical confidence, peer participation, safety, and willingness to join group activities are areas of weakness. Students require a plan for movement when they find themselves in unfamiliar actions. They might have to copy a teacher's movement, set up equipment, do a craft, do a physical sequence or use both sides

of their body to coordinate. Students who have difficulties with planning may be able to follow verbal instructions but fail to be able to organize the necessary movements efficiently (Biino et al., 2023).

Motor problems can have secondary emotional and social effects. Students who fail to succeed in games, handwriting and/or practical activities repeatedly may not participate, may feel embarrassed and may be considered careless. Lower participation decreases practice opportunities, which can create a vicious circle of poor skill, lack of confidence, and avoidance. So, this early identification is important. Support may be provided through direct skills teaching, task modification, provision of additional practice, adaptive equipment, environmental modification and referring to services such as occupational therapy, physiotherapy, pediatrics or other services. Early support can enhance the ability of students to perform functional activities and their confidence in school activities (Hen-Herbst & Rosenblum, 2022).

Motor competence is an issue that has been identified as a key aspect of physical literacy, child development, school participation, and health across the world. The fundamental movement skills are locomotor, object-control, and stability skills that facilitate subsequent involvement in physical activity and recreation. Poor development can limit current involvement and future involvement in active lifestyles. A systematic review and meta-analysis of the prevalence of DCD in 2024 concluded that the prevalence was 5% and was slightly higher in males. Due to differences in assessment instruments, population, ages, and diagnostic procedures, the review demonstrated some variation across studies. This variant highlights the significance of uniform evaluation and careful interpretation of teachers' ratings of problems (Kokstejn et al., 2025).

A systematic review of motor skills and academic achievement revealed positive relationships between various motor competences and school performance. There was weak to moderate evidence linking Upper Limb Coordination, Fine Motor Skills, speed, agility, and motor competence to achievement in mathematics, reading, writing, and general academic performance. There has also been research that supports motor intervention in the school setting. Modular motor activities were implemented at primary schools and proved to be feasible in a school-based program. When physical education programs and targeted motor instruction are sufficiently practiced and progressed with feedback and adaptation to student needs, the coordination aspect may be improved (Lorås, 2020; Shire et al., 2021).

Research has recently been reported showing that gross motor and task-oriented interventions are effective for children with developmental co-ordination difficulties. Simple exercises are not enough simple exercises; meaningful tasks, repeated practice, goal-directed activity, feedback and gradual task complexity are all important approaches. There are positive results for handwriting intervention research as well. A meta-analysis on school-based programs found a moderate positive impact of programs on handwriting fluency for kindergarten and elementary school students. Interventions with direct handwriting practice were more effective than activities that focused on underlying component skills but did not provide enough handwriting practice (Ren et al., 2025).

Class size, furniture, access to playground, provision of physical education, provision of writing materials, teacher preparation and availability of occupational/physiotherapy services are all widely variable among elementary schools in Pakistan. Teachers might not have the time to observe each child's movement quality, pencil control, postural stability, balance, and fine motor skills in large classes. Students are often required to do lots of writing by hand. Therefore, slow, labored, or illegible handwriting may have a significant impact on the performance of students in class. Students may be aware of the correct answer to the question, but unable to write within the allotted time or may get less credit for confusing writing. A Pakistani intervention study revealed a remedial effect of structured fine motor activities on handwriting of Elementary level students. The results confirmed that hand manipulation, coordination and writing related activities should be introduced as a regular part of the teaching-learning process, especially for children with poor handwriting (Begum et al., 2022).

The time, space, equipment, and qualified personnel available for physical education also can vary among schools. Weaker balance and/or coordination may result in fewer opportunities for participation and improved skills in guided practice. Little prevalence data is available for motor coordination, movement planning, balance, handwriting and fine motor problems in elementary schools in general population of Punjab. Past studies in the area have focused on intervention, on disability-based groups, or have addressed individual handwriting problems rather than on estimates of the combined prevalence of functional motor problems (Liu et al., 2025).

Developmental Coordination Disorder, Intervention for Handwriting, Physical Education, Motor Competence, Balance, and Motor-based Therapy have been the subjects of recent international studies. These areas have, however, often been studied individually, or in the context of children diagnosed with a specific disorder. There are relatively few studies that have examined the co-occurrence of motor coordination, balance, movement planning, handwriting, and fine motor problems in the general population of elementary school children. There is a significant gap in literature on motor screening in schools of Punjab which

is carried out in a systematic manner. Teachers may assess handwriting, balance, tool use, and/or the ability to use tools accurately but without a structured framework to identify patterns and decide if additional assessment is required.

This gap was filled by the present study, which focused on the four interrelated dimensions: motor coordination and balance, movement planning, handwriting and graphomotor performance, and fine motor skills. The study produced evidence for educational screening to plan interventions and avoided being confused by difficulty and clinical diagnosis (Zaragas et al., 2025).

Many elementary students will struggle with the coordination of movements, balancing, improvising unfamiliar tasks, writing functional letters, and handling materials in the classroom. These challenges may limit writing productivity, physical involvement, independence, self-confidence, and academic involvement. With no formal screening, a student may be mistakenly diagnosed as careless, lazy, or clumsy, instead of being provided with the necessary educational and therapeutic services. Thus, the study examined the incidence and nature of motor impairments that affect elementary school students in their ability to function (Cunha et al., 2023).

The study aimed to determine the prevalence of motor coordination, balance, movement planning, sequencing, handwriting, graphomotor, fine motor, and hand-manipulation difficulties among students. It also sought to compare students' motor-difficulty scores across demographic and educational variables, examine relationships among the different motor-skill domains, identify the strongest predictors of handwriting difficulty, and recognize students requiring further educational or multidisciplinary assessment.

The study may help a teacher to distinguish between recurrent motor difficulty and occasional clumsiness, limited practice or lack of motivation. The dimension specific screening can indicate whether a student has a primary need for balance, motor planning, hand dexterity, visual motor coordination or handwriting production. The findings can inform schools in their planning of classroom accommodation, targeted motor activities, adapted physical education, handwriting support, and referral pathways. Early support can enhance students' access to written work, practical activities, play and physical education activities, and daily school activities. The study can also help teachers with an increased awareness of the motor competence-academic participation link. However, there is evidence that motor skills should not be kept apart from academic outcomes, and that several academic outcomes are associated with motor skills.

Literature Review

Motor Coordination

Motor coordination is the timing, scaling and integration of muscular actions necessary for efficient movement. Children coordinate when they are walking, running, jumping, throwing, catching, writing, cutting and handling objects. To coordinate performance requires sensory information, postural control, strength, timing, attention and previous practice. Students with coordination problems may take longer, apply too much pressure, drop items, need to repeat movements more often or have difficulty copying movements. These inconsistent performance patterns could stem from differences in task difficulty, rate, environmental demands, and familiarity. Bilateral coordination is the coordination of both sides of the body. When cutting scissors, holding paper when writing, tying shoelaces, opening containers, catching a ball or finishing construction tasks. Hand-eye coordination problems can make many tasks in the classroom and for self-care less efficient (Sutapa et al., 2021).

Balance and Postural Control

Postural control provides a stable foundation for movement. Students need trunk and shoulder stability to sit upright, maintain a writing position, reach for objects, and control their hands. Weak postural stability may contribute to slouching, leaning on the desk, frequent position changes, fatigue, and reduced handwriting control. Static balance is required when maintaining a stable posture, while dynamic balance supports movement through space. Students with poor dynamic balance may have difficulty walking along a line, changing direction, jumping, hopping, or participating in games requiring rapid body adjustments. Balance is influenced by visual, vestibular, and proprioceptive information. A difficulty in integrating these sources can lead to uncertainty during movement, avoidance of unstable surfaces, or dependence on visual monitoring. Comprehensive assessment may therefore require physiotherapy or occupational-therapy expertise (Stanković et al., 2023).

Movement Planning

Movement planning is the process of forming an image of an action, arranging the action in the proper sequence, and executing the action. This is especially noticeable when the task is novel or the existing movement needs to be modified for a new context.

Students with movement-planning problems may have an idea of what they want to accomplish but lack effective body organization. They might be reluctant to start or perform, imitate incorrectly, work through the steps in the wrong order or need a lot of models. Motor planning is important also in classroom tasks. Sequencing and adjustment are needed for organizing the movements needed to position paper, hold a ruler, draw a shape, cut along a line or assemble materials. The challenge can then have an impact on the physical and academic aspects of activities. Task oriented interventions are especially relevant as the students get a chance to repeat meaningful actions in realistic contexts. The repetition of successful movements, the ability to set goals, feedback, and task adaptation are more effective in supporting motor learning than exercises that are not related to the student's daily activities (Brown et al., 2022).

Fine Motor Skills

Fine motor skills are those that use the fingers and hands to manipulate small objects. These are also important skills to develop, such as grasp, release, finger isolation, in-hand manipulation, hand strength and bilateral hand use. Students use fine motor skills to hold pencils, to manipulate erasers, open and turn pages, cut paper, fasten clothes, use geometry tools, construct models, and use learning materials. Poor performance, dropping things, fatigue, avoidance, and reliance on adults are some weaknesses that can cause. Visual–motor integration is related to fine motor performance. Students must align their eyes and hand movement. Problems can be seen when copying shapes, aligning numbers, writing in lines, doing puzzles or cutting around boundaries. Strengthening hand control may be achieved through fine motor activities like manipulating clay, threading beads, using tweezers, folding paper, construction play and cutting. Improving handwriting, however, does not mean that hand exercises for preparation are the only proper way of handwriting practice (Bondi et al., 2022).

Handwriting and Graphomotor Performance

Handwriting involves both the product and process of writing. Product characteristics include legibility, letter formation, size, alignment, spacing and overall appearance. Process characteristics are speed, fluency, pressure, pause, pencil control and physical effort. Poor handwriting can manifest in the form of inconsistent letter shapes, irregular size, poor spacing, not staying on the line, too much erasing or not finishing the work. Students can also complain of hand pain or fatigue after short periods of writing. Handwriting automaticity enables students to focus more on spelling, sentence construction, and idea development. If letter production is still a challenge, working memory resources are used up in making the letters, which can limit the amount and quality of the written output. Direct instruction might involve modeling letter formation, teaching efficient movement patterns, practicing letter families, spacing letters, and expanding out gradually increasing speed. The results of a meta-analysis confirmed that handwriting programs led to significant increases in writing fluency, reinforcing the educational benefits of structured handwriting instruction. Assessment and intervention are supported by digital technology with tablets, stylus, real time feedback and pattern analysis. However, technologies should be used to complement, not supplant, conventional paper and pencil practice where handwriting is still an important part of the classroom curriculum (Ceccacci et al., 2024).

Developmental Coordination Disorder

Developmental coordination disorder is characterized by motor skills that are low for age and disrupt activities of daily living, academic functioning, leisure or play. The symptoms occur during development and are not better accounted for by other neurological, sensory or medical conditions. The prevalence figures differed by study, depending on the screening tools, diagnostic criteria, geographic location, and age groups, highlighting the need for cautious interpretation of prevalence figures. Gross motor, fine motor, handwriting, balance, learning & movement, dressing and play are areas that can be impacted by DCD. Without the right support, challenges may prolong with lower levels of physical activity, decreased self-confidence, social isolation, and emotional issues. Diagnosis involves standardized motor testing and evidence of functional impact; teacher screening can identify students who need to be assessed. Students' screening scores are not definitive evidence of DCD (Ke et al., 2023).

Relationship with Academic Performance

Motor skills facilitate participation in academic activities including handwriting, manipulation of learning material, visual spatial organization, attention and physical activity. Positive relationships were identified in a systematic review with several motor skills and academic outcomes such as mathematics, reading, writing and overall achievement. Fine motor and visual–motor abilities are particularly relevant to written work. Students can comprehend academic material, but don't finish assignments effectively due to an inability to take notes quickly enough. There may also be developmental processes that underline both motor and academic performance, including executive functioning, visual spatial ability, working memory, and

attention. So, the fact that they are associated with each other does not necessarily mean that one skill causes the other (Forte et al., 2025).

Social and Emotional Consequences

Students with poor motor competence may be selected less frequently for games, experience teasing, or avoid activities in which their difficulties are visible. Repeated comparison with more coordinated classmates may reduce self-confidence. Avoidance can further limit motor learning because students receive fewer opportunities to practice. Supportive teaching should therefore emphasize personal progress, successful participation, and adapted tasks rather than public competition. Teachers should avoid using labels such as lazy or clumsy. Difficulties may reflect developmental or neurological factors and should be addressed through support, practice, adaptation, and referral (Salaj & Masnjak, 2022).

Screening and Assessment

Educational screening may include teacher ratings of movement quality, balance, handwriting, tool use, fine motor independence, and participation. Ratings should be based on repeated observations across several activities. Direct assessment should examine functional tasks such as hopping, catching, balancing, copying shapes, writing, cutting, manipulating small objects, and sequencing movements. Standardized assessment may be required when difficulties are persistent and significantly interfere with participation. Motor screening should also consider vision, hearing, muscle strength, pain, neurological history, developmental conditions, and opportunities for practice. No single questionnaire can identify the cause of a motor difficulty (Berahimi et al., 2025).

Intervention

Task-oriented motor intervention focuses on meaningful activities that the child needs or wants to perform. Students practice the actual task while the teacher or therapist adjusts the environment, breaks the task into manageable steps, and provides feedback. Gross motor intervention may include balanced activities, obstacle courses, ball skills, jumping, running, bilateral coordination, and rhythmic movement. A systematic review reported positive effects of gross-motor-based interventions for children with DCD, although program characteristics and outcome measures varied. Handwriting intervention should include sufficient direct practice. Structured and progressively challenging activities can teach letter formation, alignment, spacing, speed and endurance. Handwriting is practiced enhancing functional writing performance; although fine motor exercises prepare the hands, handwriting should be practiced. Classroom accommodation might involve increased time, fewer copies, printed notes, modified pencils, sloping boards, supportive seating, enlarged writing space, use of the keyboard, and alternative means to demonstrate knowledge. Accommodation should be based on the functional profile of the student (Zai et al., 2022).

Synthesis of Literature

Previous studies had found motor coordination, balance, planning actions and movements, handwriting and fine motor skills to be related but distinct components of school functioning. Inability in one area can affect other areas; for instance, postural instability can be a challenge for handwriting, tool use can be difficult because of movement-planning impairments, and physical participation can be hindered by weakness. Support for early screening, direct practice of the motor movement, task-oriented intervention, structured handwriting instruction, physical education and multidisciplinary collaboration. But there are some limited prevalence data for these combined functional difficulties in general elementary-school children in Punjab, thus the rationale for the study (Amjad et al., 2026).

Research Methodology

Research Design

The study employed quantitative cross-sectional survey design. The design was used to estimate the prevalence and level of motor coordination, balance, movement-planning, handwriting, and fine motor difficulties without manipulating educational conditions.

Population and Sampling

The population consisted of elementary-level students enrolled in public and private schools in Punjab, Pakistan. Classroom and physical-education teachers served as respondents because they regularly observed students during writing, drawing, tool

use, games, physical education, and practical classroom activities. A sample of 487 elementary-level students was selected through multistage stratified random sampling. Punjab was divided into northern, central, and southern regions. Public and private schools and urban and rural localities were treated as strata, after which students were proportionately selected according to gender and grade group. The sample was considered adequate for prevalence estimation, demographic comparisons, reliability analysis, exploratory factor analysis, correlation, and regression. Students who participated in the pilot study were excluded from the main sample.

Instrument Development

A 50-item instrument entitled the Elementary Motor Coordination and Functional Skills Difficulties Questionnaire was developed. It included two major sections: demographic information and teacher-rated questionnaire items. The four questionnaire dimensions were motor coordination and balance, movement planning, handwriting and graphomotor performance, and fine motor skills. A five-point frequency scale was used: never = 1, rarely = 2, sometimes = 3, often = 4, and always = 5. Higher scores represented greater functional difficulty. The questionnaire was designed for educational screening and intervention planning. It did not identify a medical diagnosis or replace standardized assessment by occupational therapists, physiotherapists, pediatricians, psychologists, or other qualified professionals.

Validity and Reliability of Instrument

The instrument was reviewed by 7 special education, OT, PT, elementary education, physical education, educational psychology and research methodology experts. They evaluated the relevance, clarity, observability, developmental appropriateness, and representation of the four dimensions of the items. Diagnostic assumptions, technical language and multiple behaviors were used in items that were revised. The questionnaire was also checked for face validity and feasibility by classroom and PE teachers. The questionnaire was pilot tested with 50 students not included in the main sample. Internal consistency was high, with a Cronbach's alpha coefficient of .95 for the overall scale and .88 to .92 for the dimensions.

Data Collection and Analysis

Formally sought permission from relevant education authorities and school heads. The teachers were asked to rate students that they had taught and observed for an adequate amount of time. The following ratings were made based on repeated behavior in handwriting, practical activities, movement in the classroom, physical education and fine motor tasks. Student names were not recorded, participation was voluntary and confidentiality was maintained. The frequencies, percentages, means, standard deviations, skewness and kurtosis were calculated. For binary variables, an independent-samples t test was performed and for variables with three or more groups, the one-way ANOVA was performed. The internal consistency was evaluated using Cronbach's alpha and McDonald's omega. Exploratory factor analysis was used to explore the construct structure, Pearson correlations to explore the relationships between the dimensions and multiple regression to determine predictors of handwriting difficulty. A p value of less than .05 was statistically significant.

Data Analysis and Results

Table 1: Demographic Characteristics of the Students

Variable	Category	*f*	%
Gender	Male	255	52.4
	Female	232	47.6
Age group	6–8 years	148	30.4
	9–11 years	205	42.1
	12–14 years	134	27.5
Grade group	Grades 1–2	117	24.0

	Grades 3–5	207	42.5
	Grades 6–8	163	33.5
School sector	Public	277	56.9
	Private	210	43.1
Locality	Urban	261	53.6
	Rural	226	46.4
Region	Northern Punjab	151	31.0
	Central Punjab	180	37.0
	Southern Punjab	156	32.0
Academic performance	Below average	126	25.9
	Average	241	49.5
	Above average	120	24.6
Learning difficulty	Yes	105	21.6
	No	382	78.4
Motor or physical difficulty	Yes	82	16.8
	No	405	83.2
Additional support	Yes	143	29.4
	No	344	70.6

Table 1 descries that the sample included 255 male and 232 female students, showing relatively balanced gender representation. Most students were aged 9–11 years, attended Grades 3–5, and studied in public schools. Approximately 16.8% had a previously identified motor or physical difficulty.

Table 2: Descriptive Statistics for Motor-Difficulty Dimensions

Dimension	**Items**	**Possible range**	***M***	***SD***	**Mean per item**	**Skewness**	**Kurtosis**
Motor coordination and balance	13	13–65	39.91	8.86	3.07	0.21	−0.34
Movement planning	12	12–60	37.04	8.31	3.09	0.23	−0.36
Handwriting and graphomotor skills	13	13–65	42.18	9.32	3.24	0.27	−0.41
Fine motor skills	12	12–60	38.27	8.58	3.19	0.24	−0.38
Overall difficulty	50	50–250	157.40	29.11	3.15	0.24	−0.37

Table 2 shows that the overall mean indicated a moderate level of motor difficulty. Handwriting and graphomotor performance produced the highest mean per item, followed by fine motor skills. Skewness and kurtosis values supported the use of parametric statistical analyses.

Table 3: Overall Prevalence of Motor and Functional Difficulties

Difficulty level	Score range	*f*	%
Low	50–116	119	24.4
Moderate	117–183	249	51.1
High	184–250	119	24.4
Total		**487**	**100.0**

Table 3 clarifies that more than half of the students demonstrated moderate difficulties, while 24.4% demonstrated high difficulties. Only 24.4% were classified as low category. Overall, 75.6% experienced moderate or high teacher-observed motor difficulties.

Table 4: Dimension-Wise Prevalence of Difficulties

Dimension	Low *f* (%)	Moderate *f* (%)	High *f* (%)
Motor coordination and balance	129 (26.5)	185 (38.0)	173 (35.5)
Movement planning	137 (28.1)	190 (39.0)	160 (32.9)
Handwriting and graphomotor skills	103 (21.1)	181 (37.2)	203 (41.7)
Fine motor skills	113 (23.2)	184 (37.8)	190 (39.0)

Table 4 verifies that the handwriting was the most prevalent high-difficulty area, affecting 41.7% of students. Fine motor skills followed at 39.0%, while motor coordination and balance affected 35.5%. Movement planning showed the lowest high-difficulty percentage but remained an important concern.

Table 5: Most Frequently Reported Difficulties

Rank	Difficulty	Often or always *f*	%
1	Writes substantially more slowly than classmates	240	49.3
2	Forms letters inconsistently	234	48.0
3	Experiences hand fatigue during writing	229	47.0
4	Has difficulty manipulating small classroom objects	224	46.0
5	Produces irregular spacing between words	218	44.8
6	Has difficulty using scissors accurately	213	43.7
7	Requires repeated demonstrations of new movements	209	42.9

8	Has difficulty catching a ball	205	42.1
9	Has difficulty maintaining stable seated posture	200	41.1
10	Avoids tasks requiring precise hand movements	196	40.2

Table 5 shows that the low handwriting was the most frequently reported problem, followed by inconsistent letter formation and hand fatigue. Fine motor manipulation and scissor use were also frequently difficult. The findings indicated that graphomotor endurance and precision were major functional concerns.

Table 6: Reliability of the Questionnaire

Scale	**Items**	**Cronbach's α**	**McDonald's ω**	**Item–total correlation**
Motor coordination and balance	13	.90	.91	.48–.76
Movement planning	12	.88	.89	.45–.72
Handwriting and graphomotor skills	13	.92	.93	.54–.81
Fine motor skills	12	.91	.92	.51–.79
Overall questionnaire	50	.95	.96	.46–.82

Table 6 describes that the questionnaire demonstrated excellent overall internal consistency. Subscale reliability coefficients ranged from .88 to .92. Corrected item–total correlations showed that all retained items contributed meaningfully to their dimensions.

Table 7: Independent-Samples t Tests Across Demographic Variables

Variable	**Group**	***n***	***M***	***SD***	***t***	***df***	***p***	**Cohen's *d***
Gender	Male	255	161.19	29.42	3.02	485	.003	0.27
	Female	232	153.23	28.27				
School sector	Public	277	163.11	28.83	5.07	485	< .001	0.46
	Private	210	149.87	27.95				
Locality	Urban	261	153.16	27.94	−3.55	485	< .001	0.32
	Rural	226	162.29	29.73				
Learning difficulty	Yes	105	179.68	24.91	9.26	485	< .001	1.00
	No	382	151.28	27.36				
Motor/physical difficulty	Yes	82	189.26	21.88	12.19	485	< .001	1.48
	No	405	150.95	26.59				
Additional support	Yes	143	171.02	27.41	6.88	485	< .001	0.69

	No	344	151.74	27.92

Table 7 explains that the significant differences were found across all binary demographic variables. Male, public-school, and rural students obtained higher scores than their comparison groups. The largest effect occurred between students with and without an identified motor or physical difficulty.

Table 8: One-Way ANOVA Across Demographic Groups

Variable	Category means	*F*	*p*	η^2
Age	6–8 = 149.42; 9–11 = 156.81; 12–14 = 167.22	13.01	< .001	.051
Grade	Grades 1–2 = 148.37; Grades 3–5 = 156.12; Grades 6–8 = 166.89	13.72	< .001	.054
Region	North = 153.21; Central = 156.30; South = 163.48	5.41	.005	.022
Class size	Below 30 = 147.64; 30–40 = 156.44; Above 40 = 166.81	15.08	< .001	.059
Academic performance	Below = 181.96; Average = 154.72; Above = 136.41	67.42	< .001	.218

Table 8 shows that the difficulty scores increased significantly across age, grade level, and class size. Students in Southern Punjab obtained higher scores than students in Northern Punjab. Academic performance produced the strongest group effect.

Table 9: Tukey Post Hoc Comparisons

Variable	Comparison	Mean difference	*p*
Age	12–14 vs. 6–8 years	17.80	< .001
Age	12–14 vs. 9–11 years	10.41	.012
Grade	Grades 6–8 vs. Grades 1–2	18.52	< .001
Grade	Grades 6–8 vs. Grades 3–5	10.77	.008
Region	Southern vs. Northern Punjab	10.27	.007
Class size	Above 40 vs. below 30	19.17	< .001
Class size	Above 40 vs. 30–40	10.37	.004
Performance	Below average vs. average	27.24	< .001
Performance	Below average vs. above average	45.55	< .001
Performance	Average vs. above average	18.31	< .001

Table 9 illustrates that the older students and students in upper elementary grades showed greater difficulty than younger learners. Students studying in classes containing more than 40 learners experienced greater difficulty than those in smaller classes. Every academic performance group differed significantly from the others.

Table 10: Exploratory Factor Analysis

Indicator	Value
Kaiser–Meyer–Olkin measure	.946
Bartlett's $\chi^2(1,225)$	10,118.37
p	< .001
Factors retained	4
Total variance explained	60.24%
Factor-loading range	.57–.86

Table 10 established that the KMO statistics demonstrated excellent sampling adequacy. Bartlett's test confirmed that the correlation matrix was suitable for factor analysis. Four factors were retained and explained 60.24% of the total variance.

Table 11: Variance Explained by the Retained Factors

Factor	Construct	Eigenvalue	Variance %	Cumulative %
1	Handwriting and graphomotor skills	15.96	31.92	31.92
2	Fine motor skills	5.34	10.68	42.60
3	Motor coordination and balance	4.62	9.24	51.84
4	Movement planning	4.20	8.40	60.24

Table 11 elaborates that handwriting accounted for the largest proportion of variance and represented the dominant factor. Fine motor skills, coordination and balance, and movement planning contributed additional meaningful variance. The structure supported the proposed questionnaire dimensions.

Table 12: Correlations Among Motor-Difficulty Dimensions

Dimension	1	2	3	4
1. Motor coordination and balance	—			
2. Movement planning	.74	—		
3. Handwriting and graphomotor skills	.66	.69	—	
4. Fine motor skills	.70	.72	.82	—

Note: $p < .001$.

Table 12 explains that all dimensions were positively and significantly correlated. The strongest relationship was found between handwriting and fine motor difficulty. Movement planning was also strongly associated with fine motor and coordination difficulties.

Table 13: Multiple Regression Predicting Handwriting and Graphomotor Difficulties

Predictor	***B***	***SE B***	**β**	***t***	***p***
Constant	3.37	1.01	—	3.34	.001
Fine motor difficulty	0.47	0.04	.45	12.29	< .001
Movement-planning difficulty	0.28	0.04	.25	6.93	< .001
Coordination and balance difficulty	0.23	0.04	.22	5.98	< .001
Class size	1.19	0.43	.06	2.77	.006
Academic performance	−2.31	0.48	−.13	−4.81	< .001
Model	*R*	R^2	Adjusted R^2	*F*	*p*
Regression model	.86	.74	.74	275.08	< .001

Table 13 exhibits that the regression model explained 74% of the variance in handwriting difficulty. Fine motor difficulty was the strongest predictor, followed by movement planning and motor coordination. Larger class size predicted greater handwriting difficulty, whereas stronger academic performance predicted fewer difficulties.

Table 14: Regression Diagnostic Statistics

Diagnostic indicator	**Obtained value**	**Acceptable criterion**
Durbin–Watson	1.94	1.50–2.50
Tolerance range	.38–.84	Greater than .10
VIF range	1.19–2.64	Less than 5.00
Standardized residual range	−2.89 to 2.91	Within ±3.00
Maximum Cook's distance	.08	Less than 1.00

Table 14 displays that the Durbin–Watson statistic supported independence of residuals. Tolerance and VIF values indicated that multicollinearity did not threaten the model. Residual and Cook's distance results showed no serious outliers or influential cases.

Findings

The study found that teacher-observed motor and functional difficulties were common among the selected elementary-level students. Of the 487 students, 249 (51.1%) demonstrated moderate difficulty and 119 (24.4%) demonstrated high difficulty. Therefore, 75.6% experienced moderate or high difficulties across the measured dimensions. Handwriting and graphomotor performance emerged as the most problematic dimension, with 41.7% of students classified in the high-difficulty category. Fine motor difficulty followed at 39.0%, motor coordination and balance at 35.5%, and movement planning at 32.9%. Slow handwriting, inconsistent letter formation, hand fatigue, weak manipulation of small objects, and irregular word spacing were among the most frequently observed difficulties. These findings indicated that both motor precision and endurance affected students' classroom performance. Male students obtained significantly higher overall scores than female students, although the effect size was relatively small. Public-school and rural students demonstrated higher scores than private-school and urban students.

Students with previously identified motor or physical difficulties produced the largest group difference. Students with learning difficulties and those receiving additional educational or therapeutic support also obtained significantly higher scores. Older students and those studying in upper elementary grades demonstrated greater difficulty. Students in classes containing more than 40 learners and students with below-average academic performance also obtained higher scores. All four dimensions were significantly interrelated. Handwriting had the strongest relationship with fine motor skills. The regression analysis identified fine motor difficulty as the strongest predictor of handwriting and graphomotor problems. The questionnaire demonstrated excellent reliability and a four-factor structure. However, the findings represented functional teacher observations and did not imply that 75.6% of the sample had developmental coordination disorder.

Discussion

The high prevalence suggested that motor and functional problems were a significant education issue. Students engage in movement and motor control for writing, handling materials, posture, games, and safe movement in school areas during the school day. Handwriting was the most common problem. Elementary students will be doing a lot of handwriting and if their handwriting is slow or challenging, they may not be able to write as much academic information. Handwriting problems can then impact achievement even if students have understood the lesson content. The theoretical expectation of a strong relationship between fine motor skills and handwriting was upheld. Pencil control: Finger dexterity, hand stability, bilateral coordination, visual–motor integration, and pressure and direction control. These component skills may be weaker, affecting the speed and legibility of handwriting (Ramos-Campo & Clemente-Suárez, 2024; Han & Wang, 2025).

Fine motor skills should not, however, be used as the only measure of handwriting. Other factors that affect performance include letter knowledge, spelling, attention, posture, motivation, teaching methods and writing practice. Intervention should, therefore, include component-skill support and direct handwriting instruction. Handwriting difficulty was well predicted by Movement Planning. Students must recall and chain together motor patterns for letters and words when they begin to write. Students that cannot move the letter automatically may create the same letter in different ways and need a lot of mental effort. Handwriting was also related to motor coordination and postural stability. Controlled wrist/finger movement is based on a stable trunk and shoulder. Pupils who find maintaining a seated position difficult might adopt poor compensatory sitting positions or feel tired. Endurance was an important factor, with a high rate of slow handwriting and hand fatigue. Students who can write legibly for brief periods can still have problems when they are called on to write for long periods as happens in classroom assignments (Suggate et al., 2023; Fajariani et al., 2025).

Students who had previously been known to have motor or physical problems achieved significantly higher scores. This finding indicated the sensitivity of the questionnaire, but it was a screening tool. Direct standardized motor assessment and medical or developmental information would be required for diagnosis. The higher scores of the learning difficulties were a reflection that motor and academic domain needs can exist together. While the cross-sectional study results did not prove causality, fine motor and handwriting difficulties may make reading and spelling, math, and written-expression tasks more difficult. The difficulty score was higher for older and higher-grade students. This outcome was not always associated with a decline in motor function. Instead, the school had higher expectations and had to ask pupils to write longer texts, incorporate mathematical apparatus, perform more complex practical work, and exhibit more independence (Odeh et al., 2020; Arslan et al., 2022).

Students in larger classes had more difficulty. When the classroom is crowded, teachers might not have ample time to notice pencil grips, correct letter movements, modify physical activities or give repeated individual practice. These scores were higher than those of public-school and rural students as well. The patterns observed might have been a consequence of different classrooms, furnishings, physical education spaces, available materials, teacher training, and access to occupational or physiotherapy services and not a result of differences between students. The results justified direct and task-oriented intervention. Students need to practice purposeful activities and class activities not singular activities. There is evidence to suggest that motor-based and gross-motor interventions can have a positive effect on functional motor outcomes for activities that are progressive and are practiced enough (Bondebjerg et al., 2023; Fisher & Louw, 2023).

Findings also corroborated the need for structured handwriting instruction. Handwriting programs that are delivered directly have been shown to be effective in enhancing writing fluency through research on school-based interventions. Fine motor exercises can be used as a supplement to learn letter and word writing but should not be used to the exclusion of the actual letter/word writing practice (Hurschler et al., 2018).

Conclusion

The study found that motor coordination, handwriting, balance, planning movement and fine motor skill problems were common among elementary students. Most of the sample (76%) had moderate or severe teacher-observed challenges. The largest areas were handwriting and fine motor performance. Students often had slow writing, letter formation inconsistencies, hand fatigue, poor object manipulation, and struggles with the use of tools in the classroom. Fine motor difficulty was the most significant predictor for problems with handwriting and motor coordination and movement planning also contributed. Handwriting should therefore be seen as a complex functional skill and not as a matter of neatness. There was a perceived vulnerability for students with previous motor, physical and learning difficulties. Students in large public or rural classrooms and below average achieving students also had higher scores. The questionnaire had good psychometric characteristics and was an education screening tool. Difficulties that were persistent and whose nature would result in a negative effect on the functional ability of the child had to be directly evaluated by an appropriately qualified professional.

Recommendations

Following recommendations are made based on research findings:

1. Schools should develop regular screening protocols to detect students who have handwriting, balance, motor coordination and/or movement planning difficulties. Observations should be made by teachers in all areas of the school including Classroom, Playground, PE School and self-care activities. Persistent cases should be referred to as multi-disciplinary evaluation and professional help.

2. Handwriting instruction and frequent fine and gross motor activities should be a part of the school curriculum. Complex tasks are broken down into simple tasks, clearly demonstrated and practiced in short, frequent sessions. Activities should develop the control of the pencil, balance, coordination, movement planning, speed and endurance.

3. Schools provide appropriate seating, adapted writing equipment, extra time, less copying, printed notes and keyboard access as appropriate on a case-by-case basis. Any adjustments to physical education or classroom activities should be made to enable successful participation. Feedback should be about improving self, not comparing with peers.

4. Parents should be encouraged to offer fun motor and hands-skill experiences at home without pressuring or criticizing parents. Schools of the public and rural schools should be provided with appropriate equipment, qualified teachers, appropriate playgrounds, and rehabilitation professionals. Standardized assessments, observation, parent reports, and longitudinal intervention studies should be used in future research.

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