A NEURO-PEDAGOGICAL APPROACH TO SUPPORTING READING–SPEECH SKILLS IN CHILDREN AT RISK FOR DYSLEXIA

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Abstract: Children at risk for dyslexia frequently experience persistent difficulties with accurate and fluent word recognition, decoding, spelling, and the coordination of speech production with print processing; these challenges are typically rooted in weaknesses in phonological awareness, rapid automatized naming, verbal working memory, and prosodic control. A neuro-pedagogical approach translates insights from cognitive neuroscience—neuroplasticity, multisensory integration, temporal sampling, and executive control—into precise, classroom-ready routines that strengthen the mapping between phonology and orthography while simultaneously enriching oral language. This manuscript presents a practitioner-oriented, ethically grounded, and data-informed framework built around structured literacy, articulatory-kinesthetic cues, rhythm–prosody scaffolds, targeted naming-speed and working-memory practice, dialogic language enrichment, and tight progress-monitoring loops. A twelve-week, high-frequency intervention design is described with session choreography, materials, dosage, and decision rules, including adaptations for bilingual learners and for students with co-occurring speech-sound or attention difficulties. The approach aims to raise decoding accuracy, oral reading fluency, expressive vocabulary and syntax, and learner self-efficacy while maintaining feasibility for teachers and dignity for students.

Keywords: dyslexia risk; neuro-pedagogy; structured literacy; phonological awareness; rapid automatized naming; verbal working memory; multisensory instruction; prosody; bilingual learners; progress monitoring.

Dyslexia risk is best understood not as a single deficit but as a constellation of language-based vulnerabilities that interfere with the development of an efficient reading system. In early schooling, children who later meet criteria for dyslexia often struggle to consolidate the stable, bidirectional links between speech sounds and graphemes, which undermines the growth of an orthographic lexicon and stalls the transition from deliberate decoding to automatic word recognition. These learners may also present subtle articulation inconsistencies, reduced sensitivity to phonemic contrasts, slower retrieval of familiar symbol names, and a flatter or irregular prosodic profile during oral reading. Because reading is a biologically recent cultural invention that recruits neural circuits originally evolved for auditory–oral language and visual object recognition, instruction must actively engineer the neural bindings that literate adults take for granted. A neuro-pedagogical stance therefore asks what the brain needs in order to learn efficiently and how a teacher can deliver those inputs in ways that are precise, motivating, and sustainable in real classrooms.

The first pillar of such instruction is a structured literacy spine that makes the code transparent and cumulative. Teaching proceeds from awareness of larger sound units to individual phonemes, from common grapheme–phoneme correspondences to more complex patterns, from simple syllable structures to multisyllabic decoding, and from free morphemes to inflectional and derivational morphology. Each new element is explicitly modeled, immediately practiced in production and recognition, and then woven into connected text so that consolidation occurs under conditions that resemble genuine reading. The heart of every lesson is a short, high-

engagement cycle: a brisk review of known correspondences to stimulate retrieval; the teaching of one or two new patterns with clear mouth-shape and sound exemplars; guided word building that forces analytic attention to sequence and position; and application in phrases and sentences where meaning and expression matter. Cumulative practice prevents fragmentation; students revisit old content in new combinations so that interference is managed and generalization is promoted.

Yet a code-focused spine is not enough when the underlying phonological representations are low-resolution or labile. For that reason, the second pillar is multisensory articulatory-kinesthetic encoding. Children learn to feel and see how sounds are made—lip, tongue, teeth, airflow, voicing—and to link those articulatory gestures to letters through synchronized speaking, tracing, and writing. Mirrors and mouth-position cards turn invisible features into teachable objects: a voiceless fricative becomes "lip–teeth, quiet air," a stop becomes "lip-pop" or "tongue-tap." Large-muscle air-writing or finger-tracing amplifies signal salience and creates additional memory traces that support recall under pressure. Importantly, multisensory here is not a loose celebration of variety but a tightly coordinated convergence where each modality carries the same instructional message at the same time, thereby strengthening the neural binding across systems.

Because timing and rhythm govern how the auditory system samples speech, the third pillar emphasizes rhythm–prosody supports that regulate pacing, chunking, and expression. Syllable clapping, metronome-paced phrase reading, and chant-based rehearsal stabilize temporal alignment between eyes and voice; phrase boundaries are marked visually to cue prosodic grouping; and echo and choral reading develop intonation contours that, in turn, scaffold comprehension and memory. A steady beat reduces erratic pausing and encourages smooth blending, while readers' theater offers a socially meaningful venue to practice expression without the cognitive burden of novel decoding. As fluency grows, metronome constraints are faded and students learn to vary prosody to match syntax and discourse intent.

A fourth pillar targets the speed of lexical access. Rapid automatized naming is not improved by haphazard speed drills but by carefully designed, brief sprints in which accuracy is anchored first and speed is shaped gradually with immediate feedback. Rotating grids of letters, digits, and simple objects—organized to minimize anticipatory scanning—challenge students to retrieve and articulate quickly while maintaining precision. Time-to-beat goals are individual and framed as personal bests rather than social comparisons to avoid shame and performance anxiety. Lexical access is further strengthened by semantic category naming, morphological families, and picture naming paradigms that encourage the efficient organization of the mental lexicon.

A fifth pillar addresses verbal working memory and the management of cognitive load. Dyslexia-risk learners benefit when teachers externalize steps and provide rehearsal structures that keep fragile representations available long enough to be manipulated. Chunking into onset–rime units, cumulative blending routines, and whisper-rehearsal before output reduce the burden on internal storage. Sentence repetition activities begin with short, rhythmic utterances and are gradually lengthened and syntactically enriched; children learn to mark stress patterns and clause boundaries with gesture or finger taps. Visual task boards that display a stable sequence—look, point, say, blend, write, check—allow attention to settle into a predictable rhythm, freeing resources for precision.

All of these pillars rest on a rich oral-language environment. Dialogic reading practices invite students to complete, recall, explain, and connect what they hear; teachers recast immature forms into mature ones without interrupting the flow of meaning. Narrative retell routines—supported by icons for character, setting, problem, attempt, and resolution—move from oral to dictated to independent written retells so that structural knowledge of stories is internalized. Vocabulary instruction prioritizes high-utility words, multiple encounters across contexts, and morphological transparency that aids both comprehension and decoding. Because language is the substrate upon which literacy is built, gains in decoding are protected and extended when oral language advances in tandem.

A practical neuro-pedagogical program succeeds or fails on the strength of its progress-monitoring and decision rules. Weekly probes of decoding accuracy using pattern-aligned nonwords and one-minute oral reading fluency on controlled passages provide sensitive indicators of growth. Teachers record words correct per minute, error types, and self-corrections; they chart the data with aim lines and annotate the graph when instruction changes. Brief RAN timings—letters or digits for thirty seconds—are treated as warm-up information rather than high-stakes metrics. Decision rules are simple: a flat trend across three consecutive data points calls for intensification by increasing session length, shrinking group size, or adding daily precision micro-practices; a strong upward trend justifies maintaining the plan while gradually sampling more complex patterns. The goal is not to label children but to engineer a responsive environment in which instruction and data speak to one another.

Feasibility depends on dosage and choreography more than on exotic materials. Short, frequent sessions—five times per week for twenty-five to thirty minutes—produce more robust consolidation than infrequent longer blocks because neuroplastic changes require distributed activation and sleep-mediated consolidation. A typical week might include four core skill sessions and one day that combines brief curriculum-based measures with dialogic language work. Within sessions, the tempo remains brisk, error correction is immediate and kind, and success experiences are engineered early to build momentum. Materials remain simple: letter tiles, mirrors, mouth cards, finger-tapping charts, a portable metronome, decodable texts, and story-grammar icons. Optional technology can augment but should not replace teacher mediation; text-to-speech tools are used to model prosody or to preview vocabulary, not to bypass decoding practice.

Classrooms are social worlds, and motivation matters. A mastery climate that honors personal growth rather than rank-order comparison protects self-efficacy. Students track their own progress with graphs and celebrate personal bests; teachers frame challenges with language that externalizes difficulty ("the code is tricky, so we'll use special tools") and emphasizes controllable strategies ("slow is smooth; smooth becomes fast"). Choice is leveraged judiciously—students may select between two decodable topics or pick the role they perform in readers' theater—so that autonomy is preserved without sacrificing the cumulative sequence that learning the code requires.

Because many at-risk learners live at the intersection of multiple needs, collaboration with speech-language pathologists and special educators is not optional. Weekly ten-minute team huddles align articulation targets with the decoding sequence, ensure that error-correction scripts are shared across contexts, and prevent the confusion that arises when specialists and classroom teachers pull in different directions. Screening for persistent nonword repetition

weakness or atypical resonance triggers referral pathways that coexist with classroom intervention rather than delaying it. Where attention regulation is a barrier, teachers provide clear goal cues, short work intervals, and movement-based transitions that reset arousal without derailing momentum.

Equity considerations surface most strongly for bilingual and multilingual learners. Contrastive analysis between the phoneme inventories and orthographic conventions of the home language and the school language identifies where explicit instruction is needed and where transfer can be leveraged. Transparent orthographies confer advantages in consistency that must be carefully bridged when learners encounter English's many-to-many mappings; irregular words are taught as morphophonemic families rather than as unanalyzable exceptions. Assessment fairness is guarded by including language-reduced tasks such as digit RAN and by permitting code-switching during narrative retells to reveal macro-structure knowledge that might be masked by lexical gaps. Families are partners rather than passive recipients; home practice guidelines honor linguistic resources in the household and avoid deficit framings.

Sustainability emerges when schools adopt light-lift teacher training and simple fidelity checks rather than elaborate, brittle programs. Three short professional-learning modules—phonology and orthography essentials, prosody and connected text, and data-based decision-making—equip teachers to run the routines with confidence. A ten-item fidelity rubric observed biweekly keeps pacing, explicit modeling, cumulative review, and corrective feedback in healthy balance; feedback is formative and supportive rather than punitive. Scheduling solutions embed micro-routines inside literacy stations so that frequency stays high without extending the school day, and administrators protect the daily slot as instructional "critical infrastructure."

Ethics require that interventions lift while they label as little as possible. Data are kept private; public displays show growth rather than raw scores. Language is chosen with care; students are not "low readers" but "learners training a new code." When progress stalls, responsibility shifts to the system to intensify instruction rather than to the child to try harder alone. Teachers guard their own wellbeing by relying on reusable materials, predictable lesson arcs, and shared planning; emotional labor is acknowledged and distributed across the team.

Limitations are real: attendance variability, comorbid attention or language disorders, and the constraints of crowded timetables complicate implementation. Nonetheless, the combination of structured literacy, articulatory-kinesthetic cues, rhythm–prosody work, targeted naming-speed and working-memory practice, and rich oral-language engagement—delivered in short, frequent doses with responsive progress-monitoring—constitutes a pragmatic, humane, and neuro-sensible approach to supporting children at risk for dyslexia. Future refinements should compare dosage patterns, test automated prosody-feedback tools, and explore family-delivered micro-sessions nudged by simple mobile reminders. For now, schools can act: assemble the modest materials, schedule the daily block, train the staff in a handful of precise routines, and let data guide the next right step. When instruction is aligned with how the brain learns, decoding becomes more accurate, oral reading becomes smoother and more expressive, spoken language gains depth and flexibility, and children experience themselves as competent learners whose effort predictably produces growth.

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