



## Dysgraphia: Causes and Treatment

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### INTRODUCTION

Learning disabilities can be caused by a variety of factors including genetic defects, injury, or illness. All of the disabilities have a physical counterpart, meaning they are caused by anomalies in physical structures or biochemistry. Students may be obviously physically disabled, emotionally disturbed, autistic, sensory impaired, or mentally impaired (Clark and Starr 1996, 301). These handicapping conditions present a multitude of challenges to the learning objectives of schools, individuals, and society.

In the words of Samuel T. Orton, "since any disorder in the normal acquisition of spoken or written language serves as a severe hindrance to academic advancement and often also lies at the root of serious emotional disturbances, the studies here recorded may prove of interest to teachers, parents, and physicians . . . (Orton 1937, 12)"

Dysgraphia, handwriting disability, may exist in isolation but more commonly occurs with other learning difficulties, like dyslexia,

aphasia, dyscalculia, and attention deficit disorder with or without hyperactivity. Handwriting disabilities fall under the federal IDEA Individuals with Disabilities in Education Act (amended 1997). Students with handwriting difficulties are eligible for special education services under R340.1713-SLD-Specific Learning Disability in Handwriting. These students are usually placed in categorical classroom programs for Specific Learning Disability, under R340.1747-SLD. Resource room programs at the Elementary level are covered by R340.1749a-ERR, and R340.1749b-SRR-at the Secondary Level.

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Dysgraphic students qualify for the following ancillary and related services: By rule R340.1701b-IVT-Instructional Vocational Training; R340.1701(c): SSW-School Social Worker, PT- Physical Therapy, OT- Occupational Therapy, SP-School Psychologist; R340.1749- TC - Teacher Consultant, and LD - Learning Disabled.

Federal Law PL 94-142 guarantees a free and appropriate public education in the least restrictive environment, nondiscriminatory assessment, and individual education programs for children with disabilities between the ages of 3 and 21 (Clark and Starr 1996, 302). To the maximum extent possible, disabled students are to be educated in regular education classrooms, so that all students reap the academic and social benefits of typical education within a normal yet diverse peer group that represents the dynamic composition of the workplace and the cultural diversity experienced in adulthood.

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## CREATING A SUPPORTIVE CLASSROOM

Teachers, needing to address the academic and emotional needs of all students, must manage the classroom in ways that encourage mutual interest, respect, admiration, encouragement, and support for the needs of each child. Many methods and activities are employed to reach the objectives of each student. The teacher must take care to follow the Individual Education Plan (IEP) devised for special needs students.

A congenial, cooperative atmosphere supports all students. Employ students capable of working (especially disabled students) as peer tutors for weaker students. Provide opportunities for weaker students to help others once they have mastered difficult material. Avoid the "looser syndrome," where certain students are chronically behind, while other students star above the rest. Equalize opportunities for contributions, success, and expertise in the classroom.

Daniel Reschley asserts that if teachers use peer coaching, tutoring, aides and volunteers in the classroom, these special needs students will not need to be "pulled out" for resource room services, where accommodations are typically made in disability areas (O'Neil 1988, 7).

Disabled students were typically *mainstreamed*, meaning they were placed in one or more selected regular classes but left these to attend special education facilities for remedial instruction. Today, the law mandates *inclusion* whenever possible. Now a child must attend the school and classroom he would if not disabled. Special education provisions are made within the regular education

classroom (Clark and Starr 1996, 301). Teachers are to maintain high expectations and standards for each student, while substituting activities that are

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impossible for the disabled, but will achieve the same intellectual, physical, or social goals.

Essential objectives for all students are self-discipline, self-motivation, self-direction, self-help, self-esteem, and independence in thinking and learning. Attitudes and environment play a large part in their development. Clark and Starr recommend several prudent practices:

(1) Communicate and coordinate instruction with special educators. (2) Understand disabilities and student uniquenesses. (3) The classroom should facilitate multiple activities and access to important resources. (4) Understand and accommodate student interests. (5) Avoid insulting assignments. Select activities where success is imminent. (6) Motivate students by connecting the subject with their present and future interests. (7) Make instruction clear, definite, pre-organized, illustrated, and easy to follow. (8) Individualize instruction with peer tutoring, cooperative learning, aids, and volunteer support services. (9) Actively and directly teach facts. Supervise, discuss, and review. (10) Allow accommodations for student disabilities (note taking, writing, etc.) (11) Use contingent (only merited) praise to build self-esteem. (12) Use computer programs for tutorials, discovery, drill, and practice. (13) Use mastery learning experiences. (14) Use films, video, audio, and other multimedia productions. (15) Begin teaching at the student's developmental level (Clark and Starr 1996, 305).

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## THE PHYSIOLOGY OF LANGUAGE FUNCTION

Man is unique in his ability to communicate ideas in symbolic language. This requires that individuals be taught to associate the same symbols with the same ideas. Written communication is "the capacity to understand the written word and to reproduce it." The frontal and parietal lobes of the brain contain the critical areas for spoken and written language (Orton 1937, 13-17).

First, the infant communicates emotions instinctively. As he associates word sounds with objects and ideas and uses this symbolic speech, his dependence on emotional expression is directly reduced. During the first six years of life, he progresses from echolalia (immediate repetition of words heard without understanding), to the use of nouns, then verbs, then sentences, then phrases. By the time he reaches school age, "the normal child has an understanding vocabulary of several thousand words (Orton 1937, 17-20)."

"This forms the foundation on which he must begin, at the age of six . . . to erect an entirely new form of language--reading and writing--if he is to take his place in the literate world. . . . It may therefore be pertinent to inquire whether the cortices of the angular gyrus region have reached a sufficient anatomical or physiological maturity before this period to make reading and writing practicable (Orton 1937, 20)."

By studying brains after injury, scientists have learned the location of specific functions. Partial brain damage has many causes. The most common are oxygen starvation and death of nerve cells due to a blocked artery and growth and pressure from brain tumors. Direct injury can occur through skull piercing wounds [and trauma to the head]. High blood pressure can cause small artery spasms and temporary losses in function (Orton 1937, 21-22).

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"In the normal adult, the various functions that make up the language faculty --speaking, reading, writing--are so closely interlinked both in learning and by usage, that any interference with one seems prone to cause disturbance of the others (Orton 1937, 24)"

"There is no direct relationship between the amount of tissue destroyed and the gravity of the symptoms, as a small lesion in the angular gyrus may give as widespread a language disorder as that which follows one twice its size (Orton 1937, 26)."

Only in man is one brain hemisphere superior and "only in the language faculty and the more intricate manual skills" as regards speech, reading, and writing. All neurologists agree that a lesion in the one dominant brain hemisphere is sufficient to cause disorder of spoken and written language. *Motor agraphia* (handwriting disability), as a syndrome, rarely occurs in isolation because of overlapping of brain lesions and interdependence of functions (Orton 1937, 30-36).

Something can be learned from *alexia* (word blindness). The alexic individual has suddenly lost the ability to read and write due to brain damage of the angular gyrus and immediate environs. He can see words but cannot grasp their meaning. There is no loss in ability to recognize the meaning and implications of objects, pictures, diagrams, etc. Alexia is a "selective loss of capacity to recognize at a glance constellations of printed or written letters." The patient can copy printed and scripted writing but cannot produce original compositions. Writing conforms to the patient's handwriting characteristics before the brain injury (Orton 1937, 37-39).

*Motor Agraphia*, is the loss of writing ability restricted to the expressive or motor function. It is extremely rare "since the critical area for writing is located within a fraction of

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an inch of the centers which control voluntary movement of the lower arm and hand and only a short distance from the motor speech areas." Few lesions are so precisely located so as to inhibit handwriting without also causing some paralysis of the master hand and/or speech disturbance. There are some cases with little or no speech disturbance, no loss in ability to read with understanding, and in which the actual paralysis of the writing hand is insufficient to cause the extensive loss of writing skill or other skills of the hand

(Orton 1937, 44-45).

The patient with motor agraphia has difficulty copying. Letters are "tremulous and malformed," yet oral spelling ability is intact. The areas causing motor agraphia are located "in the posterior portions of the second frontal gyrus of the adjacent cortex on the precentral gyrus (Orton 1937, 45)."

Most children carry a genetic predisposition for left or right hemisphere dominance. Pierre Marie found that at birth neither the right or left hemisphere is predestined to control speech- and if one side is damaged, the other takes over completely (Orton 1937, 48).

*Developmental Agraphia* is also known as *special writing disability [or dysgraphia]*, and can be an isolated developmental disorder marked by special difficulty in learning to write, chiefly in forming sequences of letters into words and sentences. Two types are seen. Type One students can form accurate answers and legible letters- but painstakingly slowly, resulting in unfinished work. Type Two students exhibit handwriting of poor quality. Speed varies from slow to adequate, but production is unacceptable and often illegible. Sometimes this problem is caused when left-handed children are trained to use their right hand, usually resulting in slow but legible handwriting (Orton 1937, 99-103, 146).

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Typically, left-handed children first write in mirrored form, thought to be the natural or spontaneous direction for the left-handed. Mirror writing can be successfully and completely reoriented. These students need to position their paper opposite of the paper position used by right-handers to avoid cramped and awkward writing position (Orton 1937, 104-105).

In some cases, students are indifferent in handedness and have below average skill in fine finger and hand movements of both hands. Rarely, these difficulties extend to the learning of new manual manipulations, but are usually restricted to writing movements. Some students are able to draw with skill, but have poor handwriting (Orton 1937, 104, 106).

Another contributing condition is *developmental apraxia*, sometimes called *abnormal clumsiness*. Individuals have difficulty carrying out complex trained motor movements, including handwriting. Motor tests often show a lack of ability in monocular sighting in both eyes, resulting in developmental delays in walking, running, bike riding, shoe tying, etc. as well as difficulty in copying demonstrated hand motions and the motor patterns of sporting games (Orton 1937, 120-121).

Orton found no striking emotional characteristics of students with selective writing disability. Students were ashamed and puzzled by their disability but it remained relatively unexposed. When it leads to failure on examinations and assignments, children develop resentment toward teachers and exhibit frustration. Children with developmental apraxia feel inferior in sporting and motor activities, but most persist to improve their performance and are not totally ostracized from the peer group (Orton 1937, 136, 139).

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## DIAGNOSIS AND TREATMENT

Dysgraphia is the primary problem referred to occupational therapists in the school setting (Fisher, Murray and Bundy 1991). Although most handwriting instruction is the responsibility of teachers, the therapist's role is to determine underlying postural, motor, sensory-integrative, and perceptual deficits (Stevens and Pratt 1989, 321). The OT also analyzes writing readiness skills, and the sensory-

motor, cognitive, psychosocial, and environmental factors that interfere with the development of legible handwriting. The OT provides intervention where appropriate (Schlüssel 1998) by devising exercises to develop necessary skills, providing teachers with strategies to improve classroom performance, and by suggesting supporting home activities (AOT 1998).

The OT will look for prewriting skills, which must be developed before penmanship instruction can begin (Beery 1982b, 1989; Klien 1990). The basic six skills are: (1) Small muscle ability to control the intrinsic muscles of the hand. (2) Visuomotor integration- the ability to skillfully move the hand under guidance of the eyes. (3) The ability to hold writing utensils. (4) Ability to form smooth basic strokes, lines, circles, etc. (5) Perceptual discrimination, recognition and awareness of shapes, forms and letters; and the ability to deduce the movements necessary for making forms. Ability to give precise descriptions of what is seen. (6) Orientation to printed language, including visual analysis of letters and words along with the ability to discriminate between right and left (Lamme 1979).

Validated by Weil and Amundson in 1994, Beery (1982b) believes ability to copy the first 9 geometric forms of the Developmental Test of Visual-Motor Integration (VMI) (Beery, 1982a) determines readiness for handwriting. These nine are a vertical line,

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horizontal line, circle, cross, right oblique line, square, left oblique line, oblique cross (X), and triangle (usually mastered by 5 years 6 months). Unsubstantiated in some studies (Weil and Amundson 1994), Beery (1989) asserts instruction should not begin until mastery of the VMI oblique cross (approx. 4 years 11 months), because it requires drawing of diagonal lines and crossing the midline typical of letter forms.

Klien (1990) lists some different skills necessary for handwriting. (1) The child should have reached the developmental level of constructive play. (2) He must be able to differentiate shapes and sizes. (3) Understand basic abstract concepts. (4) Have good balance to sit independently with arms free. (5) Have shoulder and wrist stability to facilitate distal control of the pencil with a firm but not clamped grasp. (6) Have established dominant writing hand and use nondominant hand to stabilize paper. (7) Have adequate upper body-visual coordination.

Handwriting assessment instruments and therapy programs can be obtained from the Pro-Ed Company of Austin, Texas. Contact them on the Internet at: <http://www.proedinc.com> or at (800) 897-3202. Another excellent source is the Educators Publishing Service of Cambridge, Massachusetts. Contact EPS on the Internet at: <http://www.epsbooks.com> or at (800) 225-5750.

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This author recommends the following thorough testing instruments: [The source for obtaining the items appears in brackets.]

1. Slingerland Screening for the Identification of Language-Learning Strengths and Weaknesses. By Carol Murray. (High School & College Levels). [EPS]
2. Slingerland Screening Tests for Identifying Children with Specific Language Disability. By Beth H. Slingerland. (Grade 1-6). [EPS]
3. The Pediatric Assessment Systems. By Melvin Levine. Neurodevelopmental Examinations. (Preschool, PRE-1, Grades 2-4, Grades 4-10). [EPS]
4. Revised Pre-Reading Screening Procedures to identify first grade academic needs. (Auditory, visual, & kinesthetic ). For students with no introduction to reading. [EPS]
5. Test of Early Written Language (TEWL-2, ages 3-0 to 10-11). By Hresko, Herron, and Peak. [Pro-Ed]
6. Test of Written Language (TOWL-3, ages 7-6 to 17-11). By Hammill and Larson. [Pro-Ed]
7. Test of Written Expression (TOWE, ages 6-6 to 14-11). By McGhee, Bryant, Larsen, and Rivera. [Pro-Ed]

Orton advises professionals diagnosing dysgraphia to perform skill tests on both hands and to get a complete developmental history of handedness and academic performance and details of any special training. If the child is naturally left-handed, begin retraining of the left hand for writing, positioning the top of the paper inclined toward the right.

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## 12.

Determine the easiest and most natural slant by writing samples and exercises where the patient draws a series of short slanted lines and loops on ruled paper in each direction (forward, vertical, and backhand). For maximum success, follow the student's strong directional slant preference in subsequent training (Orton 1937, 179, 181-183).

A profitable method of handwriting instruction is to teach the child the kinesthetic pattern or feel of a letter rather than guiding the child to copy its visual form. The pattern is demonstrated at a distance, and the paper upon which it is reproduced is shielded from easy view. Once the motor pattern is established exercises are done blindfolded or with eyes closed. Eventually, the hand automatically produces the letter's kinesthetic patterns without visual control. Cramped hand position and pencil squeezing disappears (Orton 1937, 183-184).

Sequential forms demand consideration. Even when letters can be formed accurately and quickly in isolation, great difficulty is seen in assembling or sequencing these letters to form words and sentences whether using cursive or manuscript. Copying is easier than taking dictation and propositional writing is hardest of all. Orton recommends exercises that progress through this sequence of easiest to most difficult (Orton 1937, 184-185).

A few children show little improvement with retraining exercises in handwriting. In these cases, it is recommended that the typewriter be employed. During retraining, children should be exempt from all school writing demands so that the effects of the careful practice period are not arrested by the need to write under pressure (Orton 1937, 184-185). In six 2nd, 6th, and 4th grade classrooms studied by McHale and Cermak (1992), 30-60% of classroom activities required fine motor skills, 85% of which were pencil and paper tasks.

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"All young children should have daily lessons. . . . One or two lessons a week are futile and often dangerous. They do not afford opportunity for developing habits" and may plunge the child into deeper discouragement. "Daily lessons are just as indispensable . . . as training in phonics and kinesthetic writing." Lessons should be at least two years in duration to insure substantial and lasting success (Gillingham and Stillman 1964, 22-23)."

First, explain and illustrate the wonder and history of writing. First man saw a need to record information for future reference and used picture scenes. Then whole ideas were represented by one small pictograph, like Egyptian hieroglyphics or sacred carvings in stone. Some hieroglyphics were written on a type of paper called papyrus. Word pictures were modified by lines to expand their meaning and were arranged in a series (sentence style) to convey complete ideas. Three thousand years ago the Chinese simplified pictures into ideograms (Gillingham and Stillman 1964, 25-32).

Writing with ideograms was time consuming and demanded the learning of tens of thousands of symbols. So the alphabetic principle was invented where a symbol stands for each speech sound which in various combinations make up all the words in most languages. For thousands of years, only an elite few learned to read and write. Most kings and queens shamelessly substituted wax seals for their own signatures (Gillingham and Stillman 1964, 31-35).

In the 1600s, education in schools and universities became organized around the printed book (Drucker 1992, 97). By 1852, Massachusetts had the first compulsory school attendance law (Kane 1981, 765-769).

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These laws sought to give every child a chance to be educated, regardless of socioeconomic class. All children were required to attend school between the ages of 6 and 15 or 16.

Several methods of language instruction have been tried. One, the "whole language," seeks to teach children to recognize and associate meaning to whole words. This requires the memorization of between 20,000 and 80,000 word pictures. The other, "the alphabetic or phonological" method teaches the letter symbols and their corresponding sounds and governing rules in their arrangement into syllables and words for meaning, reading and spelling. In comparison, it requires memorization of just hundreds of component phonemes, graphemes, syllable types, prefixes, suffixes, roots, spelling exceptions and rules. For students with poor or inconsistent visual memories, it is the only prudent approach to linguistic training.

As a speech sound is taught with the letter that symbolizes it, direct instruction in the formation of the letter must be included. This is the recommended sequence: teacher demonstrates formation of letter, pupil traces letter, pupil copies letter, pupil produces letter independently, and lastly, pupil produces letter without looking (Gillingham and Stillman 1964, 45).

It is recommended that instruction in printing (manuscript) be eliminated because it affords many opportunities for letter reversals and results in later cursive writing that is sprinkled with persistent printed letterforms. To allow for adequate kinesthetic impression, lined paper should be used with clear guides for height and depth of letters. Letter formation is taught with awareness of directional

sequence. Once formation of letters is mastered, blending them into words for spelling/writing begins. In fact, mastery of letter formation is not established until the student can produce them automatically and accurately without visual guidance (Gillingham and Stillman 1964, 46-49, 345).

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## 15.

Before beginning retraining in penmanship, correct posture and slant. Employ exercises for relaxing the hand and arm and for establishing rhythm before beginning. Teach the child about his proprioceptive sense that allows him to recreate postures and perform precise movements without looking or conscious movement. Because of this sense, he can forget his hand as he writes-confident that it will perform as needed without conscious effort. (Gillingham and Stillman 1964, 342).

Prove this sense to him by having him perform these exercises without looking directly at his paper: Make a pencil dot. Without lifting the pencil, draw a line away from, then back to it. Draw rows of triangles, circles, and squares. Write words or sentences. Reproduce or name the shape the teacher has made by moving his passive hand. Familiarize the student with the writing feats of Hellen Keller who never benefited from seeing letters, but learned to write them by feel (Gillingham and Stillman 1964, 342-343).

While the student is producing the letter from memory, he alternates between saying the letter name or producing the letter sound reinforcing associations for reading and spelling. Daily output is scrutinized and discussed by teacher and pupil. Troublesome letters are chosen for special practice. Throughout instruction speed is not emphasized, and is not desirable unless excellent form is maintained (Gillingham and Stillman 1964, 345-348).

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## 16.

For complete multisensory handwriting programs with instructions, this author recommends choosing from the following:

(1) Manual for Learning to Use Manuscript Handwriting and Manual for Learning to Use Cursive Handwriting. By Beth H. Slingerland and Marty S. Aho. (Grades K-3) [EPS]

(2) The Gillingham Manual: Remedial Training for Students with Specific Disability in Reading, Spelling and Penmanship. By Anna Gillingham and Bessie W. Stillman. (K-Adult). [EPS]

(3) A Multi-Sensory Approach to Language Arts for Specific Language Disability Children. By Beth H. Slingerland. (Elementary). [EPS]

(4) Language Tool Kit. By Paula D. Rome and Jean S. Osman. (Grades 1-3). [EPS]

(5) Recipe for Reading. By Nina Traub with ` Frances Bloom. [EPS]

(6) Tactile-Kinesthetic Writing Program for Teaching Cursive Skills. With raised line materials and raised vertical grid lines for spacing guidance and feedback. By Karen Griffin and Diane Williamson.

## INSTRUCTIONAL METHODS FOR WRITTEN COMPOSITION

When composition begins, it is essential to connect the mechanics of writing whole words and sentences to the idea of conveying meaning for the purpose of communicating. Penmanship skills worked on alone can isolate children from themselves and the learning and communication process unless students are driven by the desire to master the task in order to show what they know and as a means to express their needs and interests to other people. By teaching writing as a process followed to efficiently convey meaningful information, preoccupation with form and mechanics takes a backseat to the ideas being communicated (Graves 1985).

"Immersion in reading and writing, informal methods of instruction, and 'teachable moments' do not provide all children with the level of explicit instruction, practice, and feedback they need to master critical skills and strategies. . . . Students who struggle with pronounced learning difficulties or disabilities . . . require more extensive, structured, and explicit instruction in the skills and strategies critical to literacy (Schlüssel 1998)." (Harris, Schmidt and Graham 1997; Brown and Campione 1990; Englert et al. 1991; Graham and Harris 1994; Harris and Graham 1996b; Wong et al. 1994).

Studies show that until 5th grade children do not develop sentence sense- understanding of the form and use of sentences. Until the thoughts are naturally written in one continuous run on sentence (Graves 1985).

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18.

Donald Graves describes the reaction of students when given a blank page and prompted to write:

That clean white piece of paper is like a mirror. When I put words on the page, I construct an image of myself on that whiteness. I may not like my spelling, handwriting, choice of words, aesthetics, or general cleanliness of the page. Until I can begin to capture what I want to say, I have to be willing to accept imperfection and ambiguity. If I arrive at the blank page with a writing history filled with problems, I am already predisposed to run from what I see. I try to hide my paper, throw it away, or mumble to myself, "This is stupid." But with every dangerous, demanding situation, there is an opportunity to learn.

Teachers who follow and accompany children as they compose help them to deal with what they see on the page. The reason writing helps children with learning disabilities is that they do far more than learn to write: They learn to come to terms with a new image of themselves as thinkers- thinkers with a message to convey to the world (Graves 1985).

Teachers intervene in the writing process in many ways that communicate to children that they are incapable of handling the act of composition themselves. As teachers supply topics and starter phrases, it is implied that children come to the task with empty heads. Initial focus on proper form and mechanics further reinforces feelings of incompetence. While prepared materials are used to reduce writer stress and uncertainty, they create a dependency on others for ideas and direction and rob the child of the opportunity for resourcefulness (Graves 1985).

Avoid the temptation to regularly and subtly communicate writing as a form of punishment. In the past, writing got the reputation as an unpleasant activity when teachers forced students to write "x number of times" misspelled words, statements of regret, and promises of better behavior (Graves 1985).

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19.

The ideal classroom is a highly structured, predictable classroom that almost runs itself. The organized teacher has established regular times for daily writing. Children learn to exercise choice for their topics, content, drafts, final copy, and for executing class decisions. Predictably, the teacher moves among the children, listening to intentions, worries, and concerns, facilitating independent problem solving (Graves 1985).

The classroom is collaborative in planning and evaluating student efforts and progress. Students write for real audiences and purposes. Several opportunities exist for extended writing: writing workshops, peer collaboration, mini-lessons, modeling, sharing, and classroom dialogue. Students come to see writing as a process that is difficult and frustrating at times, "yet a challenging and enjoyable vehicle for learning and self-expression (Harris, Schmidt, and Graham 1997)."

Teachers need to first believe that children "know important information, then work overtime to confirm for the child the importance of that information. The children see their teachers write; they see and hear them struggle for meaning on an easel or overhead projector as they compose before them. The children become apprentices to the use of words (Harris, Schmidt, and Graham 1997)."

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The teacher demonstrates the writing process by calling attention to the way she must gather information before learning from her students the many essential things they have to teach her. Through the process of questioning and investigation, she finds out what they know and what they need to know and records these things in writing to help her organize the information and decide on a plan

of action (Harris, Schmidt, and Graham 1997).

The teacher models how to use writing strategies to arrive at a finished work. She thinks aloud as she works. Students participate by helping her as she plans, makes notes, and writes a first draft. Together they accept and reject possible ideas to support the premises and continue to modify the plan. The first draft is reread and revised. Self-instruction strategies are articulated, especially the questions asked to clarify problems, definitions, planning, self-evaluation, and self-reinforcement. Adherence to the process is acknowledged throughout, and success is attributed to working through the process (Harris and Graham 1997).

According to the national average, American students write just once every 8 days. But for sufficient writing development to occur, writing must be done daily, minimally 4 days a week, for 30 minutes each day (Graves 1985).

Children read their work and revise it. Then it is read to the teacher, and then to the class. The class and teacher do not administer praise during this process, rather they mirror the authors thoughts in his own words to convey what they understand he has communicated. Each asks clarifying questions that result in further revisions as the writer becomes more aware of the discrepancy between his text and his actual intentions (Graves 1985).

Teachers work to develop a writing area of topical expertise for each child, collect each child's writing papers in a binder, and publish some in hard cover or durable form (Graves 1985). The practice of daily journal writing exercises student recording of personal thoughts for personal purposes, and demonstrates the accumulative historical perspective afforded by collections of thoughts over time.

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21.

Children are taught the ingredients of a good story: SPACE, an acronym for Setting, Purpose, Action, Conclusion, and Emotions (Harris and Graham 1997), along with answering the basic questions: who, what, when, where, why, and how.

The self-regulation, self-development (SRSD) model uses both self-regulation and specific writing strategies. The six SRSD stages are (1) Develop background knowledge on the idea being considered. (2) Discuss it in student-teacher conference and with the group. (3) Modeling of writing process by the teacher. (4) Memorize the strategies like TREE, and SPACE, and the 5 Ws+how?. (5) Support the idea, and (6) Independently perform the writing exercise by using the strategies learned. When a student has mastered a stage, he may "skip it or act as a resource for other students who need this stage (Harris and Graham 1997)."

Students are given a checklist of elements in a writing strategy. They must ask: "Who will read this and why am I writing it?" Then students use the TREE, noting in sentence form, Topic, Reasons, Examination of reasons, and Ending. Next, students are encouraged to elaborate on these thoughts with speech and in writing (Harris and Graham 1997).

Once the key ideas are recorded and arranged in logical order, attention is turned to form and mechanics to make the piece meet

reader expectations so as to be easily understood to convey the meaning that the writer intended, and thus contain the power to change the thinking of another.

Children discover that written words espouse an authority and permanence that oral expression does not. While oral expression requires the speaker and audience to be present, written expression communicates without the author's physical presence, and at the reader's convenience (Graves 1985).

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## CONCLUSION

Study into handwriting difficulties has been ongoing since the 1800s. Neurologists, doctors, and educators have inquired into the causes of specific disability in handwriting, hoping to pinpoint the areas of the brain controlling this function and the neurological and environmental factors influencing handwriting performance. The basic discoveries and visual, auditory and kinesthetic phonological teaching techniques pioneered by Samuel Orton and colleagues have stood the test of time.

These methods have been successfully remediating those with disabilities in reading, spelling, and penmanship for over 70 years. In the 1920s, Dr. Orton formulated the three-pathway approach to learning, while director of the Iowa State Psychopathic Hospital. In the 1930s and '40s, a strong research foundation was laid and many adaptations of the basic methods were elaborated through the work of Samuel and June Orton, Dr. Paul Dosier, Anna Gillingham, Bessie Stillman, Beth Slingerland, and Paula Dosier Rome. Their techniques, known in the field as the Orton-Gillingham Method, are the basis of all multisensory remedial programs for specific language disabilities (Rome and Osman 1985, 1-6).

At least 10% of the general population has some difficulty acquiring written language skills (Rome and Osman 1985, 6). Usually these difficulties are linked to brain lesions, visuomotor, and orientation difficulties. Diligent individualized multi-sensory training techniques eventually result in adequate letter formation.

Handwriting disability has undergone many changes in nomenclature over the years. Some synonyms include: motor agraphia, developmental motor agraphia, special writing disability, specific handwriting disability, specific learning disability in handwriting, and more recently, dysgraphia

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Recommended diagnosis and practices follow the research basis of the Orton-Gillingham tradition, and should be undertaken by skilled educators, neurologists, occupational therapists or others who have specific and sufficient training and experience in her instructional techniques. Professional training programs in the Orton-Gillingham Method are also available through Educators Publishing Service.

While the arduous task of daily multisensory instruction in penmanship continues for a two-year period, technology should be employed to get the student through daily handwriting demands. Have a fellow student, other aid, or parent fill in school worksheets after the child has dictated the answers, and/or allow oral exams. Teach keyboarding skills using interesting interactive typing software programs for children.

Employ computer programs that immediately translate dictation into a microphone to text on the screen. These programs range in price from \$90. - \$190. Each allows dictation directly into word processing programs where voice command editing or keyboard-mouse editing takes place. They are faster than typing, easy to voice train, and have recognition vocabularies between 20,000 and 90,000 words, with the capacity to create and recognize up to 60,000 word custom user vocabularies. Some allow recording onto portable devices. Most can play back dictation, and can read aloud text on the screen.

Three options are available for PC users: IBM ViaVoice Gold is \$145. Dragon NaturallySpeaking is \$90. and NaturallySpeaking Preferred 3.0 is \$165. Macintosh users can order Dragon PowerSecretary PE for Microsoft Word for \$190. These programs and further details are available from PC Mall and MacMall on the Internet at <http://www.pcmall.com> and <http://www.macmall.com> or by calling (888) 425-6255. This Creative Computers Company also has several typing tutor titles available for PC and Macintosh computers. When ordering software, always tell the agent the make and operating system of the computer to be used.

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24.

On the home front, sports, games, and everyday activities help children improve many of the skills involved in handwriting. To improve motor control, require the use of silverware with proper grip. Any activities involving hand-eye coordination are helpful- cutting, crafting, cooking, baking, etc. To improve visual memory, teach card games, marbles and jacks, and engage in hand sports- using large then smaller balls. Use dictation or a computer for homework assignments when a child's poor muscle strength and low endurance cannot sustain written work despite high intelligence. Encourage letter writing to family and friends (AOT 1998).

By employing the best researched and proven methods and adaptive technology, dysgraphic individuals have a fighting chance to master handwriting, spelling, and composition skills. There has never been a better time for a child to succeed with a handwriting disability, given all the inexpensive technology and knowledge that is readily available.

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