The History of Handwriting Instruction in America Since 1900

Elizabeth Seton

Loyola University Maryland

Advanced Studies in Education

ED625.42

Dr. Sharon Dubble

Abstract

Methods of handwriting instruction have changed since 1900. Some changes have come and gone through trial and error, while others have come because of changes in technology, legislation, and leadership. Educators have considered manuscript printing to be more legible, and cursive handwriting to be more fluent. They have debated about the need for cursive handwriting, the form of handwriting best suited for young children, the teaching focus on fluency or legibility for young children, and proprioceptive or visual teaching methods. Publishers considered the profitability of promoting printed handwriting copybooks and workbooks. The shift in handwriting acquisition from a proprioceptive task to a visual task revealed the negative learning effect of copybooks. Handwriting workbooks became popular in the 1930s as states started to adopt specific handwriting curriculum to compensate for the lack of teacher preparation in handwriting. Meanwhile, with the trial and error of different forms of handwriting instruction children grew up with inconsistent teaching, and teachers started teaching forms of handwriting they had not learned. People debated about spending money on educating teachers to teach handwriting when students are using technology to communicate. Debates continue today from a perspective not considered before computer technology revealed the brain functions in manuscript and cursive handwriting in relation to the acquisition of reading and writing legibility and fluency.

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Background

Two Forms of Writing

Two forms of writing, cursive handwriting and manuscript printing, develop from different brain processes (Hellige & Adamson, 2007) expressed in reading and writing: "looking becomes reading; touching becomes writing" (Montessori, 1912, p. 216). Since 1900, educators have debated about handwriting instruction. Traditional handwriting instruction has focused on proprioceptive muscular memory developed through rapid arm movements (Zaner, 1904). Modern handwriting instruction has focused on visual copying (Freeman, 1927). Teachers have debated about the focus of handwriting instruction for young children: fluency before legibility, or legibility before fluency (Bloser, 1929; Zaner-Bloser Company, 1927).

Cursive Handwriting

The right hemisphere of the brain processes cursive handwriting (Hellige & Adamson, 2007). It develops from "early neuro-muscular" (Thomassen & Teulings, 1979, p. 299) control providing "freedom and lightness of movement" (Zaner, 1900, p. 15) for "continuous" (Teulings & Romero, 2003, p. 107) rapid writing requiring fluency. Teachers usually emphasize fluency when teaching cursive handwriting in the primary grades (Bachtenkircher, 1906; Nelson, 2012; Starr, 1900), and fluent legibility when teaching cursive handwriting in the elementary grades (Chartrel & Vinter, 2008; Nelson, 2012; Zaner-Bloser Company, 1927). Methods for teaching cursive handwriting instruction have varied over the years. Most of them focus on a conscious mental process generating thoughts from the brain into unconscious fluent writing stored in muscle memory (Nelson, 2012).

Manuscript Printing

The left hemisphere of the brain processes manuscript printing (Hellige & Adamson, 2007). It develops from a "higher degree of cognitive control" (Thomassen & Teulings, 1979, p. 299) providing "movement that is more firm and sure" (Zaner, 1900, p. 15) for "discontinuous" (Teulings & Romero, 2003, p. 107) careful writing requiring precise eye-hand coordination. Teachers usually emphasize legibility when teaching manuscript printing, using an analytical approach focusing on characteristics of specific strokes and spacing. Methods for teaching manuscript printing have varied over the years. Most of them focus on a conscious visual attention to detail in distinguishing and writing the strokes of letters within guidelines. Some educators believe that manuscript printing is easier for young children to learn, while others believe that cursive handwriting is easier for young children to learn.

Fluency

Fluency occurs when the writer unconsciously remembers letter forms stored in long-term muscle memory while simultaneously processing thoughts directly into handwriting (Shadmehr, 1997). Fluent legibility occurs when the letterforms stored in muscle memory are legible, and written in a rhythmic manner (Nelson & Trafford, 2003). In 1900 a reputable penman stated that handwriting teachers should focus more on legibility than fluency (Zaner, 1900); however, by 1904 he stated that legibility and fluency are equally important in handwriting instruction, and that children ten years old and older could learn to write legibly and fluently (Zaner, 1904). Some educators decided to focus on fluency when teaching handwriting to young children (Bachtenkircher, 1906; Montessori, 1912; Nelson, 2012). These educators believed that a focus on fluency was more important because it developed quick thinking skills,

helped children learn to read and spell, and developed legibility, and aided their learning in all subjects (Starr, 1900).

Legibility

A focus on legibility in itself requires precise eye-hand coordination guided by visual perception. Visual perception interprets letterforms visually and stores them in short-term visual memory. Visual-motor coordination interprets visually perceived letterforms stored in visual memory and generates the visual feedback output in handwriting. Some educators decided to focus on legibility when teaching handwriting to young children (Freeman, 1927; Zaner & Bloser, 1908). They believed that legibility was more important than fluency. Others believed that the child's intense focus on writing legibly impaired fluency and reading, as well as thinking. These educators believed that legibility would develop gradually as the child matured and refined the fine motor skills.

Muscle Memory

A focus on fluency diverges in two perspectives about where in the body fluency originates. Some people have believed children can learn to write fluently using only visual perception, while others have insisted that muscle memory is necessary to automate the handwriting process to the point of fluency (Nelson & Trafford, 2003). The process of developing fluency begins with the gross motor movements practiced in air writing, and repeated in a rhythmic manner that focuses the writer's conscious attention on the rhythm. This focus on rhythm allows the short-term memory letterform to flow unconsciously into the muscular memory (Chartrel & Vinter, 2008). The sensory exterior feeling of the shape of the letter, exteroceptive proprioception, interprets letterforms kinesthetically and stores them in long-term muscle memory (Bara & Gentaz, 2011; Montessori, 1912). The sensory interior feeling of a

muscle memory of the letter form, interoceptive proprioception, interprets kinesthetically perceived letter forms stored in muscle memory and generates the kinesthetic feedback output in handwriting (Bara & Gentaz, 2011;).

Handwriting Instruction Affects Fluency

The type of handwriting instruction and practice affects the development of fluency. When the child is consciously aware of his active movement, his body movements do not develop as fluently as when he is unconsciously aware of his active movement (Wanrooy, 2007). Independent handwriting practice, such as tracing dotted lines in the shape of a letter or visually copying perfectly formed letters, focuses the child's attention internally on the eye-hand coordination process required for precise movements. The focus in independent handwriting practice is on perfect legibility, not on fluency (Sovik & Teulings, 1983). A child's time taken to look repeatedly at the visual form of the letter or word hampers the development of fluency (Chartrel & Vinter, 2008).

Goal-Directed Movement

When the child focuses on reaching a goal (Wanrooy, 2007), and voicing a rhythmic chant (Nelson, 2012), then the short-term letter memory flows fluently into the long-term unconscious muscle memory (Teulings & Romero, 2003). Directed handwriting practice focuses the child's attention externally on reaching a goal by voicing rhythmic words while writing letters. When the child is not relying on visual memory, the memory comes from muscular memory, which increases fluency (Chartrel & Vinter, 2008). Rhythmic directed handwriting lessons help keep the child's attention by focusing on the goal of maintaining speed with the rhythm. In addition, the child focuses on the starting and ending points of the letter strokes, as well as the direction of the strokes.

Handwriting Instruction Affects Legibility

Directed multi-sensorial handwriting practice leads to a rapid increase in fluent legibility (Chartrel & Vinter, 2008). Independent handwriting practice, in the form of tracing dotted lines or copying perfectly formed letters, impairs the development of fluency by preventing the conscious visual memory of the letter from flowing unconsciously to the muscle memory. (Overvelde & Hulstijn, 2011). The child's acquisition of a muscle memory of letter formation is apparent when he is able to say the rhythmic words as he writes the letter (Nelson & Trafford, 2003). Legibility develops as a result of fluency, and large handwriting forms and corrects a more legible memory (Phillips, Ogeil, & Best, 2009).

Rhythm

In directed handwriting instruction, the rhythmic nature of stroke descriptions induces the child to move, and helps maintain the attention to handwriting (Nelson & Trafford, 2003). Directed handwriting instruction not only improves fluency by forming a muscle memory of the letters, it also improves legibility by imprinting the form of the letter into the muscle memory (Nelson & Trafford, 2003). When focusing on fluency, writing speed increases automatically without sacrificing legibility (Sovik & Teulings, 1983; Vinter & Chartrel, 2008).

Independent Handwriting Practice

Independent handwriting practice produces a temporary improvement in legibility caused by precise eye-hand coordination; however, it does not change the muscle memory previously formed from less legible handwriting (Nelson & Trafford, 2003). The level of focus on attention to detail in eye-hand coordination required in independent handwriting practice hampers the development of fluency (Tucha & Lange, 2004). Tracing letters prevents the letterform from imprinting in muscle memory.

Motor Learning versus Visual Learning

Until businesses started using typewriters, handwriting instruction focused on the fluent rapid arm movements required for employment. When businesses started using typewriters rather than penmen, educators questioned the necessity of focusing on rapid movement in handwriting, and started to focus more on legibility when teaching children to write. This visual focus on legibility, along with the reduced focus on fluency and speed, caused a widespread perceptual shift in handwriting instruction from motor learning to visual learning.

Discussion and Analysis

Vertical versus Slanted Writing

In 1900, educators debated about using vertical script writing instead of slanted script writing (Hiser, 1900). Some were against vertical script writing, saying it would reduce fluency, while others supported it saying it would increase legibility (Hiser, 1900). A handwriting educator disagreed with using vertical writing, noting that when students started writing vertically, their writing naturally progressed to right slant or left slant as they developed fluency (Hiser, 1900). By the end of the school year, administrators dropped vertical writing in New York schools because cursive handwriting produced the fluent legible writing required for employment (Jasper, 1900). Many people sent letters to newspapers showing support for this action (Jasper, 1900). In September 1900, however, the school year started with an effort to teach vertical script by analyzing similarities and differences among the letter shapes (Starkey, 1900). The administrators apparently had more control over this decision than the teachers and the public. Some teachers must have been frustrated over their lack of control over this decision, especially if they did not know how to teach vertical writing. Students must have been frustrated too, by learning one form one year and another form the next year.

Dissatisfaction with Vertical Script

Teachers who taught vertical script focused on comparing the shape of the letters, and did not emphasize body position or movement (Starkey, 1900). This handwriting instruction resulted in the development of slow speed and tight hand (Starkey, 1900). Teachers thought the student's recognition of slowness would provide the motivation to do movement exercises (Hiser, 1900). By 1904 reputable penmen expressed disfavor of vertical writing and copybooks, noting that the increased emphasis on legibility limited the development of fluency and caused tight hand muscles (Zaner, 1904). At least one city decided to stop teaching the slow copybook method, and to return to teaching arm movements for cursive writing in all grades (Zaner & Bloser, 1906). Penmen and others noticed that when teachers stopped teaching vertical script writing, children no longer developed poor hand and finger control and grip (Zaner & Bloser, 1906).

Handwriting Supervisors

Handwriting supervisors visited classrooms regularly to help untrained teachers teach cursive handwriting using arm movements rather than the finger movements used in vertical writing (R. Nelson, personal communication, July 24, 2012; Zaner & Bloser, 1910). They visited every class to check the progress of the students, and give instruction to the teacher when necessary (Zaner & Bloser, 1911). Some teachers found their suggestions to be very helpful, while others took a break outside the classroom. The handwriting supervisor's job was not to teach the class; it was to provide guidance and instruction to the teacher. The handwriting supervisor also made sure the children were progressing adequately in their handwriting. Sometimes they gave the teacher little awards when the students did good work; however, when they didn't believe the teacher earned the award, the principal of the school was often unhappy (R. Nelson, personal communication, July 24, 2012). Eventually, as handwriting workbooks

became more readily available, the job of the principal took over the job of the handwriting supervisor. If the administrators had provided handwriting education training for the teachers, supervision would not have been necessary.

Cursive Handwriting in All Grades

Prior to 1927, most public schools taught cursive handwriting in all grades. Teachers emphasized development of fluency through repetitious handwriting exercises, letter writing, and word writing on the blackboard (Starr, 1900). Teachers taught all students cursive handwriting on the blackboard, encouraging them to use their arm muscles freely and rapidly, starting with writing exercises to prepare the child for writing large letters (Starr, 1900). The handwriting lessons helped students form a muscle memory of letter shapes, as well as a habit of fluency and quick thinking in writing (Starr, 1900). Some teachers also used sensorial methods to help children learn letterforms, such as sewing the form of the letter (Starr, 1900), and using their fingers to feel and trace sandpaper letters (Montessori, 1912). Teachers erased the letters and words on the blackboard before allowing the children to write them on paper because copying hampered memorization of spelling words (Starr, 1900). After the children were able to write well and fluently on the blackboard, the teacher introduced them to writing on paper with a single base line, allowing freedom of movement for large letters and fluency (Starr, 1900). The teacher focused on developing habits of quick thinking, as well as the proper manner of holding the ink pen and positioning the body when writing (Starr, 1900). By the end of that year, however, education supervisors proposed the advantages of a copybook, primarily because it displayed a perfect model rather than the imperfections in a teacher's handwriting, and that it displayed both a baseline and a middle line as guidelines for writing (Hiser, 1900). Penmen determined that the copybook method, which they compared to drawing, was not effective

because it taught only the visual form of the letter, without a lesson to help the student acquire a muscular memory of it (Zaner & Bloser, 1909). It seems that there was a lack of fair processes for determining what and how to teach handwriting in schools. The teacher should have had more control over this decision-making process. It is possible that the general role of women at that time had a restrictive effect on what female teachers could and could not do with their students.

Testing Manuscript Printing

From 1925 to 1927, there were several reports about the research on manuscript printing. One report written by supervisor of handwriting in the St. Louis schools detailed the advantages and disadvantages of manuscript printing. It explained that continuing to include handwriting as a separate subject in schools was increasingly difficult due to the time demands of other subjects (Walker, 1927). The report concluded with the recommendation that all St. Louis schools teach cursive handwriting in all grades (Walker, 1927). The report listed the following advantages of manuscript printing: easily learned; easily taught; easily read; compact; same form as book printing; less tiring to write (Walker, 1927). It listed the following disadvantages of manuscript printing: develops a slow writing habit; does not allow both fluency and legibility; forms illegible letters if not carefully written; delays cursive handwriting; prevents young children from learning and reading cursive handwriting (Walker, 1927). This handwriting supervisor was also concerned that learning manuscript printing first would make it more difficult for the child to learn cursive handwriting because the child would have to change the following habits learned from manuscript writing: stop gripping the pen tightly, stop pressing the pen heavily on the paper, change body position, learn to turn paper to the correct position aligned to the arms rather than table, and learn to slant and connect letters to develop habit of fluent quick thinking

(Walker, 1927). Despite this handwriting supervisor's recommendation, manuscript printing was adopted for teaching in all Grade 1 classes in all St. Louis schools in 1927 (Walker, 1927). There was apparently quite a bit of disagreement among educators about whether or not to teach manuscript printing. Who should decide what form of handwriting to teach in public schools?

Handwriting Workbooks

In 1927, Zaner-Bloser published Correlated Handwriting, a cursive handwriting curriculum for Grade 1 through Grade 6 (Zaner-Bloser Company, 1927). In 1928 this curriculum was adopted for public schools by at least eight states (Zaner-Bloser Company, 1929), and other states adopted it by 1943 (Beale, 1945). The lessons presented a more analytical approach to teaching cursive writing, with a focus on legibility of form, rather than the traditional focus on fluency and movement in Grade 1 (Freeman, 1927). Educators recommended larger letters than those in the handwriting workbooks (Freeman, 1927). Some handwriting teachers disagreed with small line spacing for Grade 1 and Grade 2 because it caused poor habits of hand control to develop, such as cramped hand and finger writing, and it hampered fluency (Bloser, 1919; Bloser, 1929). Many handwriting teachers wanted young children to write large letters on the blackboard and on unlined paper to develop fluency, as well as to form legible memories of letters (Bloser, 1919). When children use gross motor muscles to write large letters, the letterform image stored in muscle memory is more legible. The lessons in the Correlated Curriculum attempted to aid fluency by correlating the handwriting lesson with other subjects (Freeman, 1927). By 1934, manuscript printing workbooks were available for Grade 1 (Beale, 1945). Many states purchased them because teachers did not know how to teach manuscript printing (Zaner-Bloser Company, 1929). Some educators may have been disappointed that handwriting workbooks continued to have small line spacing.

Importance of Ergonomic Body, Arm, and Hand Position

Penmanship teachers emphasized the importance of the position of the body (Vogan, 1926). They told students to sit up straight and place both feet on the floor under the table (Stein, 1906), and to not to lean on the table or wrinkle clothes (Stein, 1906). Ergonomic body position is still important today (Smith-Zuzovsky & Exner, 2004). Penmen have described how to hold a pen. Penmen have advised not allowing the hand to rest on its side. Holding it upright, with the back of the hand facing the ceiling, positions the wrist in a neutral position (Doner, 1905). Today we know that this neutral position helps prevent Carpal Tunnel syndrome when writing as well as when keyboarding (Logitech, 2012). The arm and paper position differs for right-handed people and left-handed people. The right-handed student slants the paper towards the right, and the left-handed student turns the paper the left (Vogan, 1926). In 1927, when administrators introduced manuscript printing, teachers taught students to align the paper to the edge of the table just like the position of a book when reading. This reading position caused problems for all students, especially for left-handed students (Little, 1942). When a person centers the paper in front of the body, the arm and hand have to cross the body midline to write on the opposite side of the paper (Smits-Engelsman, Swinnen, & Duysens, 2004). Children have more difficulties writing on the part of the vertical paper on the opposite side of the body midline (Smits-Engelsman et al., 2004). It is easier for people to write legibly when the paper is aligned to the arm rather than to the table.

Effective High School Handwriting Instruction

In 1905 a high school penmanship teacher defined a method for teaching handwriting, stating that penmanship instruction in high school was necessary, and that cursive handwriting instruction in grade school was essential (Doner, 1905). Before starting to teach the letters, he

emphasized correct body position, arm position, hand position, and pen position; he checked on these positions continually through the first few lessons (Doner, 1905). He presented his method for teaching penmanship in a logical manner, introducing lower case letters, then upper case letters, in groups with similar strokes so students could see the similarities and differences among the letters. First, he taught the isolated letter, and then the letter joined to others, and finally, that letter within a word (Doner, 1905). He taught numerals in the same manner, in groups of four, starting with the numeral one, and comparing each numeral to the numeral one (Doner, 1905). After writing the numerals on a horizontal line, the students wrote them in vertical columns (Doner, 1905). He directed attention to the form of the letter, and then to a variety of movement exercises related to that letter (Doner, 1905). He hoped that all teachers would require the best handwriting all the time so students would develop better handwriting habits (Doner, 1905).

Effective Handwriting Instruction in the Primary Grades

In 1906, a Penmanship Supervisor advised teachers how to start teaching handwriting to Grade 1 children (Bachtenkircher, 1906). Teachers did not allow children to write in small letters, because they did not want to hamper the child's developing fluency (Bachtenkircher, 1906). Teachers maintained the children's attention to write large letters on the blackboard by speaking rhythmic words to encourage continual movement (Bachtenkircher, 1906). Teachers taught children to hold chalk correctly for blackboard writing, holding one end under the hand rather than between the thumb and pointer finger (Bachtenkircher, 1906). Children lined up facing the blackboard, then the teacher stepped in front of them and wrote large ovals (about a foot in diameter), both counterclockwise and clockwise, moving with the whole arm movement to the rhythmic sound of her voice (Bachtenkircher, 1906). The children copied her arm

motions, moving the arm in the air behind her while holding chalk properly (Bachtenkircher, 1906). With the children still moving their arms to the sound of the teacher's rhythmic voice, teacher stepped back behind them to observe the fluency and rhythm in their arm movements, while continuing to voice the rhythmic directions (Bachtenkircher, 1906). The children's handwriting exercises at the blackboard continued with the children pretending to write on the blackboard, chalk correctly positioned in hand, while the teacher voiced the rhythmic strokes (Bachtenkircher, 1906). Then, at the sound of the teacher's rhythmic voice saying the signal to move, the children all stepped forward to touch their chalk to the blackboard and start writing, without interrupting their rhythmic air writing (Bachtenkircher, 1906). The teacher focused on fluency when supervising the writing on the blackboard, encouraging children to use free arm movements to write large letters (Bachtenkircher, 1906). She continued these rhythmic air-writing exercises for six weeks before introducing letters, and then started to teach lower case cursive writing (Bachtenkircher, 1906). During the first four months of school, these children wrote only on the chalkboard to form a muscle memory of letter formation (Arnold, 1924). It was not until after they could write fluently on the chalkboard that the teacher introduced them for the first time to writing with a pencil at a desk (Arnold, 1924). By the time the child started writing with pencil and paper, he already had formed a muscle memory of correct letter formation (Starr, 1900).

Sensorial Sandpaper Letters

In 1912, Maria Montessori started teaching sensorial methods in Italy (Montessori, 1912). Word of her teachings reached America shortly afterward. She criticized teaching young children to write in capital manuscript letters, saying that it focused too much on "geometry" (Montessori, 1912, p. 206), and "straight lines and acute angles" (Montessori, 1912, p. 209). She

said the child should start with the easier strokes in cursive writing (Montessori, 1912). She focused on fluency to encourage the child to develop the ability to express himself in writing (Montessori, 1912). Her method of teaching cursive handwriting to young children included providing sandpaper letters for the children to trace (Montessori, 1912). Thus began the practice of children tracing letters. Tracing letters in the direction of writing strokes prepares the child for writing (Montessori, 1912). Tracing sandpaper letters with the finger differs from drawing letter shapes on top of dotted lines because the sense of touch felt in the fingers helps impress a muscle memory.

Writing on the Blackboard in Grade 1 and Grade 2

In 1906, the Supervisor of Penmanship in Public Schools taught teachers how to teach handwriting to primary grade children using rapid large arm movements on the blackboard to create a muscular memory of letterforms (Bachtenkircher, 1906). He advised continuing motion exercises while introducing specific letters, starting with lower case cursive letters (Bachtenkircher, 1906). Handwriting supervisors or teachers introduced capital letters as they were needed in writing work (Bachtenkircher, 1906), or in groups of similar strokes. The motion exercises progressed in type of stroke, along with the introduction of letters having the same stroke (Bachtenkircher, 1906). The teacher modeled saying stroke descriptions in a rhythmic manner as she wrote them on the blackboard (Bachtenkircher, 1906). The teacher modeled careful spacing as she wrote letters on the blackboard (Bachtenkircher, 1906). Many teachers taught exercises before teaching the corresponding letter (Bachtenkircher, 1906).

These Grade 1 children learned to read as they learned to write, absorbing the sound and form of the letter simultaneously (Bachtenkircher, 1906). In Grade 2, these children continued the exercises they had learned in Grade 1, writing at the blackboard in large strokes

(Bachtenkircher, 1906). By this time, most of them had formed a muscle memory (Bachtenkircher, 1906). The teacher continued to model good handwriting on the blackboard, while the children wrote the same letters in the air, on the blackboard, or on paper (Bachtenkircher, 1906). Writing on a vertical surface is very good for small children because the wrist remains in the neutral position, and the hands are not cramped. Today's students can write on a chalkboard, a marker board, or a Smart board. Perhaps the modern Smartboard will someday record data such as their fluency rate.

Grade 3: Writing at a Desk

After two years of writing large letters on the blackboard, the Grade 3 teacher focused on teaching the child correct arm position and paper position at the desk (Bachtenkircher, 1906). In the first six to eight weeks, these students practiced lateral direction exercises (pivoting the arm back and forth at the resting elbow) at the desk without using a pencil, with specific focus on proper body position (Bachtenkircher, 1906). Teachers focused on this lateral direction to develop the children's elbow movements for handwriting (Bachtenkircher, 1906). By the time the students started writing at a desk with an ink pen and paper, they had developed good posture habits as well as effective arm muscles.

Effective Arm Movement Writing

The children continued to practice fluent legible handwriting within the context of written assignments in other subjects (Bachtenkircher, 1906). In 1908 The Business Educator stated that this "Arm Movement Writing" method of teaching young children cursive writing was the best handwriting instruction method in the previous 50 years (Zaner & Bloser, 1908, p. 73). Penmanship teachers were pleased with this method because it formed a muscle memory of legible letters, and it instilled good writing habits. Others debated about the necessity of making

the children work their muscles, considering that typewriters were becoming more popular. Businesses, however, wanted to hire penmen who could write quickly and legibly.

Contemporary Significance

Teachers Need Handwriting Instruction

Teachers have been speaking stroke descriptions while writing since before 1900; however, teachers have told children to be quiet while writing (Edel, 1925). This is significant because the muscle memory of the letter imprints when the child is simultaneously writing, speaking, and listening. Therefore, while some teachers have experienced success with handwriting instruction, others have not understood why their instruction has not been successful. Educators have not determined and defined the characteristics of effective handwriting instruction. Handwriting instruction competency is not a requirement for a teaching credential. Administrators are not required to provide handwriting instruction to teachers.

Directed Simultaneous Multi-sensorial Handwriting Instruction

In 1912, Maria Montessori taught teachers how to present sandpaper letters to young children, showing children how to trace sandpaper letters while saying the sound of the letter (Montessori, 1912). The use of three senses simultaneously, listening, talking, and touching, aids formation of muscular memory (Montessori, 1912). Today we know that the child's ability to speak while writing indicates formation of muscular memory of letterform (R. Nelson, personal communication, July 24, 2012).

Effective Handwriting Instruction

Peterson Directed Handwriting has been using effective multi-sensorial handwriting instruction methods since 1908. Teachers use music and/or rhythmic chant to elicit the students' cooperation during air writing and finger tracing. Teachers tell the students to say the rhythmic

words as they write. After air writing and finger tracing while chanting stroke descriptions or counting, students write on paper while chanting. In the last step of the lesson, the student writes with eyes closed. This method has been effective for treating dysgraphia, as evidenced by an immediate change in legibility (R. Nelson, personal communication, July 24, 2012).

Grade 1 Children Learn Fluent Cursive Writing in Four Months

Earlier in this century, the commonly used method of handwriting assessment was dictation. There were no visual representations of letters on walls, workbooks, or desks. In January 1924, Grade 1 children were able to write cursive words after only four months of handwriting education. With only ten minutes per day of formal handwriting instruction, followed by writing activities within the context of school lessons, these children were writing words fluently on the chalkboard at a rate of 40 letters per minute (Arnold, 1924). This Grade 1 cursive handwriting fluency assessment consisted of a list of 18 - 20 short words containing all the letters of the alphabet. Teachers dictated the words, which the children wrote on paper in cursive writing in two minutes. This was a rate of about 40 letters per minute, which is the rate at which fluency is attained (Rose, 2004). Ten years later, in 1934, the Grade 1 manuscript printing fluency assessment test showed a rate of 20 letters per minute - half the speed of the 1924 test. Teachers did not expect children to write at the fluent level of 40 letters per minute until they were in Grade 3 (Guequierre, 1934).

Handwriting Assessment

In the days of ink pens and inkwells, the pen itself provided the immediate feedback for fluency by depositing blotches of ink on paper whenever the writer paused while writing (Nelson, 2012). Today teachers can track fluency by giving regularly scheduled fluency tests to track the number of legible letters written per minute (http://peterson-

handwriting.com/Publications/PDF_versions/Track_Fluency.pdf) (Nelson, 2012). Today teachers can use digital tablets and digital pens with handwriting software to record specific handwriting characteristics indicating fluency, as well as other characteristics of handwriting (http://www.neuroscript.net/scriptalyzer.php.) (Teulings & Romero, 2003).

Self-assessment

There are several ways to evaluate legibility in student's work. One way is to look only at the letter tops (http://www.peterson-handwriting.com/EndorsementProg/LetterTopsEval.pdf) (Nelson, 2012). Another way of assessing legibility is with a scoring rubric containing specific handwriting characteristics such as form, slant, and size. When students evaluate their own handwriting, they become aware of needed improvements. Handwriting workbooks may include self-evaluation checklist with questions designed to make the student pay attention to form, size, spacing, slant, and other characteristics. Today's students can make their own evaluation scale (Peterson Handwriting, 2007).

Peer Review at the Blackboard

Writing on a classroom chalkboard is one good way to have peer evaluation. Teachers have noticed the positive effect of the peer evaluation when students write on a chalkboard (Bachtenkircher, 1906). Teachers can use an evaluation rubric, or write a note on each assignment submitted in all subjects. They can also comment on legibility of letters and words written on the chalkboard. Today classrooms may have a Smartboard instead of a chalkboard. Students write more legibly when their peers observe their writing. Teachers can use a digital tablet and pen to record the writing, and then show the student's progress in legibility and fluency on a graph (Teulings & Romero, 2003). The graphing activity is time-efficient because it integrates with mathematics curriculum.

Effective Handwriting Instruction Today

In a recent handwriting conference, the following handwriting instruction methods were determined to be effective: dynamic letter models, verbal stroke descriptions, self-assessment, individual goal setting, legible fluent handwriting in all subjects, immediate feedback, activities to develop eye-hand coordination, and sensorial handwriting activities such as writing in finger paint and sand (Case-Smith, 2012). Since 1900, teachers have found ways of teaching effective handwriting lessons. Some of today's teachers still use the same instructional methods from previous generations, such as rhythmic stroke descriptions, air writing, finger tracing, self-evaluation, peer evaluation, and teacher-evaluation. Other teachers make very little effort to teach or assess handwriting. There is less emphasis on handwriting instruction today because students are using computers. Today's teachers should consider other beneficial effects of handwriting instruction, such as the function of the brain in the development of reading and writing. Today's teachers should consider using modern digital tables and digital pens as handwriting evaluation tools, as well as teaching tools. Digital tablets and handwriting software are revealing details about handwriting that teachers have never been able to see, such as pen pressure and pauses in writing. In the future it may be able to detect the unique characteristics of writing disabilities. Children's handwriting e-workbooks are now available in digital format, enabling teachers to record progress in a modern way (Peterson Directed Handwriting, 2007).

Handwriting Develops the Child's Brain

Looking at the experiences of handwriting teachers in comparison to the accomplishments of students over time leads one to suspect that some teachers have not been teaching handwriting in the most effective manner. Considering the current evidence showing how the brain processes handwriting (Teulings & Romero, 2003; Thomassen & Teulings, 1979),

and how children are responding to current handwriting instruction (Bara & Gentaz, 2011; Chartrel & Vinter, 2008), it seems prudent to investigate further the necessity of teaching handwriting in order to help students develop reading and writing fluency (Case-Smith, 2012). Researchers can help illustrate the advantages of teaching cursive handwriting.

Writing Assessment Today: Digital Tablets for Cursive Handwriting

Handwriting instruction, methods, and assessment have always been a concern for educators. Today, even though handwriting instruction is less common in schools, it is still important for developing fluency and legibility. Starting in the year 2019, Grade 4 students will complete the National Assessment of Educational Progress writing assessment on a computer rather than on paper (The Associated Press, 2009). Children can benefit from doing their writing assessment test on a digital tablet, with a digital pen. Not only would their writing be more fluent, but also teachers would be able to use the handwriting software to detect specific handwriting difficulties. An additional consideration is that children with dysgraphia and other conditions often reverse letters when keyboarding, but not when writing in cursive handwriting. The linked letters in cursive handwriting aid memory of word form (Teulings & Romero, 2003). Today scientists are able to identify people who have Parkinson's disease simply by looking at the handwriting software analysis of their signature on a digital tablet. In the future, teachers may be able to screen children for possible learning disabilities by looking at the computer analysis of their handwriting on a digital tablet. This view into the child's brain is apparent in handwriting, but not in keyboard. Teachers could use handwriting analysis software to verify each child's identity. This ability to identify a student by the handwriting would help prevent cheating on exams. Fluency in writing occurs with quick thinking, which can help develop critical thinkers for the leaders of the next generation. To help young children develop fluency,

it is important to pay attention to handwriting instruction. One way to develop fluent legibility in young children is to teach cursive handwriting before manuscript printing. The focus on fluency leads to improved legibility as fine motor control gradually improves.

The role of technological advances has certainly affected legislative and administrative decisions about handwriting education. The time has come to pay attention to the scientific evidence presented with the use of digital tablets, digital pens, and fMRI brain scan images that identify how the brain processes handwriting. More that eighty years ago administrators decided to replace cursive handwriting instruction with manuscript printing instruction in the primary grades. Today administrators can make their own decisions, based on current scientific evidence, regarding handwriting instruction for children and teachers.

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