

Educating Students in the Computer Age to Be Multilingual by Hand

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Published in NASBE (National Association of State Boards of Education) Commentaries – Vol. 19, No. 1 – March 2013

What does the research evidence show about teaching handwriting? Is printing or cursive writing better? Is keyboarding or handwriting better? Is finger tracing, stylus or keyboarding better for technology tools?

The answers to these timely questions may depend on

- a) the writer's developmental level
- b) the writing task
- c) instructional practices
- d) writers' individual differences.

Here is what the evidence shows.

- a) Writer's developmental level

During early childhood, writing letters improves letter recognition, as shown in brain imaging studies; and **teaching handwriting leads to improved reading**, as shown in instructional studies. But studies also found that when it comes to speed of composition, **handwriting lost its relative advantage over keyboarding during early adolescence**, when imaging shows frontal brain regions support more efficient cross-hand coordination.

- b) Writing tasks

The handwriting advantage in speed was observed only during composing texts. The keyboard had an advantage for writing the alphabet in order. No differences were found in accuracy or time for composing isolated sentences in handwriting and keyboarding. So **handwriting's advantage may be related to sustaining writing for a first draft.** Forming letters stroke by stroke by one hand may draw on different processes than alternating two hands and all fingers to operate a keyboard.

- c) Classroom instruction and home writing activities

Teachers were surveyed at the beginning of a study in which children's writing skills were assessed for five years in a row, beginning in 1st or 3rd grade; and each year parents completed questionnaires about home literacy and educational programs. **Across all grade levels computers were not integrated in the daily instructional program. So, experience may also explain the handwriting advantage before adolescence.** Computers were used mainly at home for homework and computer games.

- d) Individual differences

Nature-nurture interactions result in individual children bringing different learning profiles and experiences to learning to write and writing to learn.

Two controversies remain unresolved:

1. whether two years of **handwriting** instruction in the beginning grades is sufficient
2. whether it is necessary to teach **cursive writing**.

Children encounter manuscript fonts more often than cursive fonts in reading hardcopy books or written texts on their computer, monitors or e-book readers.

Cursive links all the letters within a word with connecting strokes and facilitates attention to all letters in a word; thus it **improves spelling and the speed of writing and reading**.

Teaching BOTH of these handwriting formats **has advantages, including learning to recognize and write letters** despite small variations in letter forms sharing the same name.

Evolution of Common Core Writing Standards

University of Washington research is testing whether individuals learn best to spell and express ideas when using their index finger or a stylus to write in manuscript or cursive or all of these modes. The research questions are:

- 1) **What works for whom and for which writing task?**
- 2) **Do developing writers benefit from being multilingual by hand?**

Here is a brief overview of what research and practice have shown about handwriting instruction related to all aspects that could inform future Common Core standards for writing:

- A) development
- B) tasks
- C) instruction
- D) individual differences

A) Developmental steppingstones

Cross-disciplinary research shows that **handwriting is critical to teach from preschool to high school, but targeted skills for instruction and periodic review change as students develop.**

• **Preschool**

- Strengthen hand muscles by playing with clay or play dough
- Develop fine motor skills by playing with pegboards and stringing beads
- Use fine tip markers or pencils to complete mazes
- Write one's name
- Name alphabet letters in books or other written material
- Connect dots with arrows to form letters.

• **Kindergarten**

- Name and print all lower and upper case letters through:
 - a) observing teacher model letter formation
 - b) tracing over letters with the eraser end of the pencil
 - c) copying from models
 - d) closing eyes and writing letters by pencil or marker from memory.
- Use dominant hand for handwriting and index finger with laptop to form manuscript letters during self-generated composing.

• **First grade**

- Use both modes (handwriting and index finger with laptop) to practice
 - a) writing alphabet from memory in lower-case manuscript letters, always naming them
 - b) adding capital letters to first letter and names in provided sentences
 - c) self-generated composing.
- Graph progress in legibility for both modes: *Can others recognize the letter out of the context of a word?*

• **Second grade**

- Same as First grade, but focus on both legibility and automaticity.
- Graph progress in legibility and times for both modes
 - Write the letter before or after teacher-named letter in both modes (stylus too).

• **Third grade**

- Same as First grade, but teach lower and upper case cursive showing how connecting strokes link letters within words.
- Write lower-case letters alone and in words, with focus on legibility.

• **Fourth grade**

- Same as Second grade, but for lower- and upper-case cursive letters alone and in words.

• **Fifth to eighth grades**

- Introduce keyboard instruction at a time in children's development when the brain most likely supports efficient bimanual coordination
 - Teach children to transition from hunt and peck to touch-typing, so they can get visual feedback about their self-generated writing.
- Repeated instruction and practice across the years may be needed to fully master touch typing.

• **Eighth to twelfth grades**

- Teach strategies for composing using both modes (handwriting is useful for graphic organizers during planning or generating a rough first draft, but technology-supported word processing programs are useful for creating multiple drafts during the revision process)
- Teach listening and note-taking skills for learning from lectures and studying for tests (research shows an advantage for handwriting in this kind of note-taking, but also students benefit from strategies for note-taking when reading source material)
- Keep handwritten and technology-generated products in portfolios. Classmates circle the letters and/or spellings they cannot recognize so the writer gets feedback about which letters or written words others cannot identify. Based on illegible letters, the teacher provides weekly "tune-up" review for those letters.

B) Writing tasks

Initial handwriting instruction should focus on accurate letter formation legible to others, but once legible, **then forming letters automatically** —quickly, with minimal effort **so mental resources can be devoted to generating and translating thoughts into written** spelling, sentence structures, and text organization. Research showed that **automatic alphabet letter writing by hand is the best unique predictor of composition length** (how many words written within a constant time limit).

Another research-supported principle is **following handwriting instruction by instructional activities that use handwriting for other writing tasks** (spelling written words, constructing sentences, and composing text).

One effective, research-supported, strategy is to **teach handwriting at the beginning of lessons as “warm-up”**. The warm-up is then followed by spelling and composing instructional activities.

C) Curriculum and instruction

For success during and after school, **it's necessary teaching students to integrate the levels of language (letters, words, sentences, and text) in writing by hand**. Even, with spell checks, research shows that developing writers need explicit spelling instruction. **Also, handwriting plays an important role in learning math**. However, the Common Core does not sufficiently address writing across the curriculum, especially in regard to handwriting. Also, teachers do not typically get sufficient pre-service preparation in how to teach handwriting, especially for developmental steppingstones, integration with other written language and cognitive tasks across the curriculum, and individual differences.

D) Individual differences

Some students have developmental disabilities, (DDs), which typically have associated motor disorders.

Other typically developing students may have specific learning disabilities such as dysgraphia (impaired handwriting, forming letters by hand, which is not just a motor disorder).

Dysgraphia is treatable, but often computers are used only as accommodations rather than teaching handwriting (which research has shown is effective during early intervention and the later grades) and modes of using computer tools for letter production.

Future Common Core standards should acknowledge these biologically based learning disabilities affecting production of letters or numerals and **need for appropriate specialized instruction for them in general education**.