



Take the Pencil Out of the Process

Leslie Broun

Recently, I delivered a workshop about academic issues and strategies for students who have autism spectrum disorders (ASD) to an audience comprised of both teachers and parents. One section of this workshop discussed the motor planning difficulties experienced by many persons with ASD, focusing particularly on difficulties with printing and handwriting. Upon suggesting the use of the keyboard as a feasible and reasonable alternative to printing, I was taken aback and discouraged by the number of parents who reported that their children were not permitted to use the keyboard for writing tasks, even when that child demonstrated an inability to print either efficiently or legibly. This article is written in response to their dilemma and to the frustration that I have witnessed students experience during the physical act of committing pencil to paper throughout 20 years of working with students who have ASD and other special needs.

In our classrooms, it is not unusual to see students who struggle to produce legible print. In actuality, many students have difficulty with the physical printing and writing processes (which will henceforth be referred to as “handwriting”)—difficulty that is

significant enough to interfere with their academic performance. Sometimes students grow out of this. Sometimes with extra practice, their skills improve. But there is a group of students who do not progress, no matter what intervention is tried. Their handwriting remains ill-formed, and they struggle in the process of its production.

The persistent inability to form letters correctly and quickly is called dysgraphia (printing) or dyscriptia (writing). In the labor-intensive process of producing a written product, a student with dysgraphia may

- Focus more energy on the handwriting process than on thinking about the content and quality of her or his response.
- Write as few words as possible to answer a question so that the handwriting process will be shortened. For example, if a sentence is asked for, a few words may be given; if a

growing body of research has evolved focusing on the motor impairments found in both autism and Asperger's syndrome (AS; Green et al., 2002; Leary & Hill, 1996; Ming, Brimacombe, & Wagner, 2007; Miyahara et al., 1997). Researchers have discovered significant neuroanatomical differences and abnormalities in the cerebellums of persons with ASD, both at the cellular and structural levels—underlying neurological abnormalities that may cause differences in their movements and execution of motor tasks (Allen & Courchesne, 2003; Cattaneo et al., 2007; Nayate, Bradshaw, & Rinehart, 2005; Rodier, 2000). Motor dysfunction is now considered by some researchers (Mayes & Calhoun, 2003; Ming et al.; Smith, 2004) to be a "soft" sign or associated symptom of autism—one that is not required for diagnosis, but one that is highly prevalent across the spectrum.

Two of the primary movement difficulties many individuals with ASD

suggested that this condition may correlate with the anatomical abnormalities present in the cerebellum of individuals with ASD.

When considering a student's use of a keyboard versus using handwriting, teachers must consider that there are neurological abnormalities that may cause a student with ASD to experience difficulty with motor function, including the physical act of handwriting.

Students With ASD and the Handwriting Process

Having to engage in handwriting is the most significant and serious impediment to academic participation for students with autism spectrum disorders in schools in North America today (Dr. Richard Simpson, from a presentation at the ABA Conference on Autism, Boston, February 2007).

Some students with ASD are able to engage in handwriting with fluidity and ease; however, we cannot make the assumption that all students will be able to manipulate handwriting instruments successfully even with intervention and practice. Although it may seem contradictory, many individuals who are not able to print efficiently are able to do other things very well with their hands and fingers, such as play a musical instrument or use building toys, such as Meccano. Teachers should not assume that an individual with efficient fine motor skills for other kinds of activities should be able to develop and refine handwriting skills. Different neural pathways are involved that do not include the movements, positions, and processes involved in manipulating a writing instrument. Henderson and Green (n.d.) stress that even the most gifted students with ASD may not automatically acquire competence in developing handwriting skills. Mayes and Calhoun (2003) found that graphomotor skills were significantly lower for students with ASD regardless of age or IQ, and that this had a serious impact on their written expression. Both studies recommend

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paragraph is requested, the student may produce a sentence or two.

- Become habituated to thinking in as few words as possible so that printed responses may be shortened. This kind of thinking can have a significant and long-term impact on academic achievement by diverting intellectual energy away from creative, imaginative, and well-structured ways of approaching a writing or composition task or communicating their thoughts in writing. Although economy of words is often a desirable literary trait, in the case of dysgraphic students, it goes beyond economy to a paucity of words.

Motor Impairment in Autism

The conceptualization of autism as a movement disorder was brought into public forum in 1995 (Donnellan & Leary, 1995) and since that time, a

experience are hypotonia (low muscle tone and strength) and apraxia (impairment in the ability to execute skilled movements despite having the physical ability and the desire to do so). These two conditions directly affect an individual's ability to use his or her hands and have a significant impact on an individual's ability to hold and use writing implements.

Hans Asperger, in his classic paper defining the syndrome (Asperger, 1944/1991) described four young persons who had significant motor impairments, and in each case he singled out the individual's handwriting, commenting on its poor quality, actually using the word "atrocious" to describe it (Henderson & Green, n.d.). Students with AS are often able to participate well academically, but handwriting issues such as macrographia (larger letter size) can impede progress (Beversdorf et al., 2001). In the research, it is

early substitution of the keyboard for students experiencing difficulty with graphomotor skills.

For a student with ASD, difficulties with handwriting can underscore all areas of academic participation. Classroom behavior may also be affected because of the stress induced by the expectation of written output. Poor behaviors can be the result of the fear and frustration encountered when these students must communicate through handwriting. It often takes great concentration to write legibly and therefore the child's focus is moved from the work to the writing (Winter, 2003). This echoes the research shared by Dr. Marcel Just at the International Meeting for Autism Research in 2006. He reported that when an individual with ASD is presented with multiple tasks (e.g., printing and thinking), a "systems-wide resource constraint" sets in. The available resources (blood and oxygen) for each component task are reduced and the coordination of brain areas decreases. For many students with ASD and other developmental disabilities, intellectual or cognitive processing takes a backseat to the effort involved in the motor planning that must go on in order to put pencil to paper. Thus, the student's quality and quantity of response is diminished.

Teachers must exercise caution in trying to elicit a skill that may never reach a level of proficiency sufficient to enable students to demonstrate what they know or think in an efficient and fluid manner. When a student's struggles with the pencil are interfering with intellectual output, there is an option. Instead of practicing handwriting "longer, harder, and louder," learning to use the keyboard is a sensible and doable alternative to handwriting. For many students with autism, the computer is a comfortable medium—it is visual, and there are systems and operational patterns that make its usage easily understood.

Computers in the Classroom: The Arguments

Many reasons have been cited for not allowing students to have access to a

computer as a writing instrument. Some of these include the following:

- *It's not fair.* All the students won't have access to a computer. This is no doubt true, but ALL of the students don't need one. Fair is not giving everyone the same thing, fair is giving people what they need.
- *It's going to cost too much.* An important factor to consider here is that all that is needed is a word processing program. The student will not need access to the Internet or any other programs, nor will the student need a new computer. An older computer or laptop with word processing capability is all that is necessary. In addition, there are notebook computers available for less than \$400, a sum that is far less daunting than the cost of either a computer or a laptop. Older, secondhand, or less expensive technology offers an affordable way to supply a simple word processing system. Even when parents have offered to supply a computer, it is sometimes refused over the issue of responsibility if it were lost, stolen, or broken. As part of the agreement for its use, parents can accept to supply the computer at their own risk.
- *Being able to print is important.* It is important for an individual to be able to handwrite one's name, address, and telephone number, but with PDAs, Blackberries, and other personal communication devices that are now available, relating to a keyboard is the more important and relevant skill. "Texting" is now part of our culture.
- *I can't take time out to teach someone to type.* The skill of touch typing is developed over time; it is not a starting point, nor is it an immediate goal. Initially, the most important thing is for the student to develop an awareness of the letters on the board and their locations. (See Figure 1). When other students may be practicing printing or writing, or when the student has some free time, practicing with a typing program is useful. Some instruction,

modeling, and demonstration may be necessary, but once the routine is established, students are often able to work independently. In many situations, the assistance of paraprofessionals is available to students who have special needs for part or all of the day. A paraprofessional may be able to support one or more students as they work through the process of learning to use the keyboard, either by providing direct instruction or guiding the students through a typing program.

The Implications of Keyboard Use for Nonverbal Students With Autism

On February 19, 2008, on the ABC Nightly News, a segment entitled "A Child's Voice" was aired. The subject of this segment was a young lady named Carly Fleischmann, who at that time was 13. As a younger child, Carly had been diagnosed with autism and severe developmental delay. She had been schooled in the principles of Applied Behavioral Analysis and had received a great deal of instruction in her young life, but it wasn't until one day when she was at the computer that she surprised her family by independently typing: HELP HURT TEETH. Until that time, her parents had no idea that she was capable of written communication or, as her father says, that she "was an intelligent, articulate, and emotive person." Carly now continues to communicate with family and friends through typing and joins the ever-growing number of persons with autism who are able to clarify and explain their experience.

Amanda Baggs, a woman who is nonverbal and has a significant expression of autism, has prepared a substantial video segment for www.youtube.com entitled "In My Language." In this video, Ms. Baggs demonstrates engagement in her stereotypic, self-stimulatory behaviors—flicking paper, running her fingers under water, humming, and so forth. One's first impression is that this is a person whose degree of disability is such that being literate, let alone possessing a high level of intellectual ability, might not be possible.

Figure 1. Keyboard Bingo



Purpose: to develop letter location skills

Materials: game board, letters (printed on squares of tag board), bingo chips or tiddly winks

Making the game board:

- Take a keyboard to the copy machine, lay it face down and copy it on 11" x 17" paper.
- Trim off all of the extraneous keys and features, leaving only the letter, number, and main function keys.
- Use the enlarge function on the copier and re-copy it on to 11" x 17" paper so that it is reasonable size for a game board.
- Glue this to a piece of tag board and laminate.

Playing the game:

- Place the letters in an opaque bag.
- Have the student put his hand in the bag and withdraw a letter.
- He/she then has to locate the letter on the keyboard and place a bingo chip on it.
- Take turns withdrawing the letters until the keyboard is covered.

However, as Ms. Baggs so ably demonstrates with her voice output computer, her thoughts about autism and her perceptions of the physical world are profound, as are her impressions of how we conceive "normalcy."

The experience of Ms. Baggs also points out the value and possibilities of voice output technology. When an individual with ASD is able to write his or her message and the computer is able to translate it to verbal speech, then another door to communication has been opened. Knowing how to use the keyboard enables students, who have had training in literacy skill development or those who have gained skills

by observation, to communicate more than simple messages about wants and needs.

Although the experience of these individuals has been in the public

Which is more important—being able to print/write the answer or knowing the answer?

eye, it is important to focus on the fact that they have demonstrated an ability to learn and **independently** apply language to their thoughts and experiences in ways that are contrary to what their expressions of autism

might, at first glance, suggest. The keyboard has been the instrument that has enabled them to compose their thoughts in writing and to communicate.

*When I asked him what his life was like before he learned to type, he responded with the word "empty." (Referring to Tito Mukhopadhyay, author of *The Mind Tree* and *How Can I Talk If My Lips Don't Move* [Grandin, 2008, p. 96]).*

Implications of Keyboard Use for Task Performance

Handwriting is not an essential component of literacy. It is actually only an exercise in drawing. It is a manual way of enabling a symbol system that allows thoughts to be expressed in a visual format. When we think about the meaning of literacy, it is the thought process that is the most important element. How that thought is committed to print may vary from one student to another; for example, for some students who have physical disabilities, using their hands may not be possible and voice to print software can be a viable alternative. In the construct of Differentiated Instruction, we are taught to accept different products and different expressions of learning; we are not bound to tradition (i.e., the use of the pencil or pen). Also, following the principles of the Universal Design for Learning, we are guided to allow the use of materials and strategies that promote learning for students of all ability profiles (CEC, 2005).

Educators must be careful when evaluating and forming impressions of students who are not able to print legibly.

bly—this includes students who have ASD, as well as students who have learning disabilities and developmental disabilities. When setting tasks and considering how we will evaluate, we can ask ourselves these questions:

Figure 2. Samples of Julia's Work

A

Molly is my best friend.
Molly is my doll.
She has long red hair.

C

My Easter Holiday

I had a nice Easter holiday. The Easter Bunny came and brought me yummy chocolate eggs and a big chocolate Easter Bunny.

I had my birthday on March 28 and I turned 9 years old. I got a toy butterfly. She's a girl. She has green wings with yellow stripes and some blue spots and yellow spots too. My grandma gave me my butterfly.

My other grandma made me people out of wool – two boys and four girls. The boys are wearing hats on their heads. Two girls are wearing hats. Two girls are wearing roses in their hair. They are dancing girls.

I got Mowgli for my birthday too. He is in the Jungle Book movie. He's riding my giraffe to go back to the man village.

I had an ice-cream birthday cake. There were 9 candles on my cake. I had to blow out the candles. I like ice-cream cake. Marc does not like ice-cream cake. He likes chips.

My Easter holiday and my birthday were lots of fun!

B

Shadow Shapes

Molly and Morris are watching T.V. They are watching the D.V.D., "Ice-Age, The Meltdown." It's so funny because the vulture grabbed the acorn because it landed on the vulture's nest.

All of sudden, the light went off. Shadows came on the wall. One was a butterfly and another was a barking dog.

Molly said, "We have to be very quiet because we have to find out where the shadows are coming from." Molly and Morris climbed over the couch and they saw Dad. "I found you," were making the shadows!"

- Is this a fine motor (printing/writing) exercise or an academic task?
- Which is more important—being able to print/write the answer or knowing the answer?

Knowing the answer or being able to communicate thoughts and ideas are the important “products” that we are seeking: The act of handwriting may actually impede a student’s ability to deliver a response or product, particularly in test situations. Technology-based testing can increase the participation of students with disabilities in standardized and teacher-made testing programs (Salend, 2009). Knowing that the keyboard can be used in test situations can significantly reduce a student’s stress and enable her or him to demonstrate learning more thoroughly.

Mayes and Calhoun (2003) stress that the most important accommodation for students with ASD who have difficulties with handwriting is the use of the computer: “The most obvious way to capitalize on the visual strength while circumventing the writing weakness is to teach keyboarding and word processing skills and allow the child to use a computer for written assignments” (p. 77).

In Figure 2 we see the work of Julia, who has a diagnosis of autism and was 8 years old at the time these samples were produced. Realizing the difficulty Julia experienced with the printing process, as demonstrated in Sample A, Julia’s mother convinced the teacher to allow her to use the computer for written work. Shortly thereafter, Julia produced Sample B on the computer and the following April

composed Sample C. This work was done independently and was not edited either by her teacher or by her mother.

Julia’s mother observed and reported on a critical part of the writing process—correction.

When Julia is typing, she sees the words more as a whole and in a context. During the printing process, she sees each letter as a separate entity, each letter involving its own thought process and as a result spelling errors are not seen until the word is printed in its entirety. She is so involved in the physical process that she doesn’t notice her mistakes until she finishes. Then she begins a lengthy erasing and correction process that can be very frustrating. When she works on the computer, she can make instant corrections easily and get on with the content.

(Maureen Bennie, mother of two children with autism and the director of Autism Awareness Centre Inc., personal communication, January 27, 2009).

Starting Points and Strategies

When we consider whether or not it would be appropriate for a student to begin to use a keyboard, there is some information we need to gather:

- Observe and evaluate the student's ability to form letters and numerals. Is this a persistent difficulty and one that does not appear to improve with remediation?
- Ascertain how the student relates to the computer. Does he or she enjoy games and activities?
- Is the student able to match?
- Is the student able to identify letters? This skill is not necessary at the beginning of the process. Learning to use the keyboard can assist in the process.
- Does the student have a sight vocabulary that may include sentence builders, such as: see, look, go, to, have, want, I, the, a, is, here, and so forth. These words can also be taught through the match, select, and name method.

If the student consistently demonstrates difficulty with forming letters and numerals, demonstrates interest in the computer and possesses the skills mentioned in the previous list, then he or she is ready to begin to learn to use a keyboard. The following strategies can guide and assist the learning process:

- Letter location skills can be developed through the use of a game, such as Keyboard Bingo. (See Figure 1 for directions.)
- Initially, the student may need some hand-over-hand guidance to hit a key; however, this kind of physical prompt must be withdrawn as quickly as possible—as soon as the student even attempts to do this independently (usually within minutes).

William

In the fall of 2007, William, a nonverbal student with ASD in Grade 3, was added to my caseload. As his resource teacher, I was invited to a meeting of all relevant school personnel and his parents to discuss what would happen in the eventuality of one of his "episodes."

William was able to match and sort, he loved Disney characters and enjoyed the primary computer programs, *Millie's Math House* and *Bailey's Book House*. He was not able to manipulate a pencil and could only form a few letters despite years of practice. Because he was able to match, I decided to introduce the sight word recognition program outlined in *Literacy Skill Development for Students with Special Learning Needs* (Broun & Oelwein, 2007) and used the *match, select, and name* method to build vocabulary, so effective with students who are visual learners. Vocabulary was based on his interests. He was captivated by the process, and his sight vocabulary grew rapidly.

Because he displayed interest in the computer, on one of my visits I opened Microsoft Word and set up a page with the Arial font set at size 48. I took a flash card with his name printed on it to the computer. I then typed his name on the keyboard (in lower case) so that he could observe my actions. I did this several times, pointing to the screen and showing him the cause and effect nature of what I was doing. Finally, I gestured to him, took his hand and led it to the keyboard. William looked at me tentatively, looked at the flash card and at the screen, looked for "w" and hit the key. It was a magic moment. He then found the other letters of his name. I showed him how to use the "Enter" key to start a new line so that he could "undertype," just as another child would underprint.

From that moment forward, as soon as William arrived in the classroom in the mornings, he would gather his words, books, and other print materials, choose words and type them on the computer. He would print them out one word at a time using a vast quantity of paper; however, we all acknowledged that this was a small price to pay for his rapidly increasing skills.

By the end of the school year, William knew many computer functions and how to access many of his special interest Web sites (e.g. www.pbs.com, www.Ford.com, etc.). On the computer, he was able to compose short books about his interests and import pictures to illustrate them. His days were absorbed by reading and writing using the keyboard.

At the end of the school year, his mother and I reflected on that first meeting and the issue of his "episodes." In the whole of the school year, William had not had even one behavioral incident. The frustrations of not being able to use a pencil nor communicate verbally were now secondary to his complete engagement in learning and literacy. —L. Broun, 2008

- The student then needs to observe the cause and effect relationship between hitting a key and the image of the letter arriving on the computer screen. This may need to be demonstrated several times.
- Just as in William's story (See Box, "William"), demonstrate to the student the relationship between a word printed on a card or page and the same word printed on the computer screen.
- Words can also be typed on the computer screen for the student to type below, just as one would print below an example.
- Use the Arial font or a similarly simple, clear font (Acrey, Johnstone, & Milligan, 2005). Font size depends on the age and skills of the student. The younger or less experienced the student, the larger the font.
- The vocabulary for keyboarding should match what the student is being taught so that he or she has an immediate understanding and use for the words. This would be the case for both verbal and nonverbal students.

Figure 3. Online Keyboarding Sites, Reviews, and Resources

1. www.superkids.com/aweb/pages/reviews/typing
This site offers a good review of many typing programs appropriate for a range of school-age children, including a review of my personal favorite: Adventures in Typing with Timon and Pumbaa, Disney, approximately \$10.00, usually available on-line.
2. <http://typing-for-kids-software-review.toptenreviews.com/>
This site also offers a good review of ten popular typing programs for children.
3. <http://files.uberdownloads.com/apps/tuxtyping/index.php>
This site provides a free download of a typing tutor program that is very visually attractive and engaging, particularly for younger children.
4. <http://alison.com/courses/Touch-Typing-Training>
This site provides a free online course that is engaging and appropriate for older students.
5. www.kidsdomain.com/brain/computer/type.html
This site provides an entertaining introductory program for letter location and introductory keyboarding skills.
6. www.bbc.co.uk/schools/typing/
This site offers levels of typing instruction, visuals are attractive, audio is entertaining (imagine a Scottish goat as the instructor) and it offers both visual and auditory reinforcement. Great site!

- Single words should progress to short phrases or sentences. Sentences to be copied can be prepared on strips of paper, on file cards or directly on the computer screen. Typing single words can include practicing a weekly spelling list.
- Assuming that sentence construction with flash cards and/or sentence strips would be part of daily literacy instruction, familiarity with language patterns would complement sentence construction on the computer. When the student has reached the point of copying sentences with regularity, “fill-in-the-blanks” and cloze exercises can become part of the routine, gradually leaving out more and more words.
- When the student’s vocabulary has reached the point where he or she would be able to create a good variety of sentences, particularly about his or her family and personal interests, the student must be given freedom and encouragement to work independently.

- Instruction must also include learning how to use the functions of the keyboard—the enter key, the space bar, and the shift key being the essentials. Demonstration is usually the most effective way to teach their function.
- Access to Web sites and Google Images must be carefully monitored, but these sites can provide valuable visual enhancements to the student’s interest in writing (copyrights to be checked for usage). Learning to use the “copy” and “paste” functions will enable the student to illustrate thoughts and stories.
- A keyboarding program can be introduced to enable the student to develop touch-typing skills. For many students, this would be a long-term project. It would be important for this activity to be stress-free and for the typing program to match the age and ability level of the student (see Figure 3).

Moving Forward

As early as 1984, computers were considered as a writing medium for students with learning disabilities (Kerch-

ner & Kistinger, 1984), and research has been continuing to address the use of the computer for the writing needs of students with learning disabilities (Graham, 1990; McArthur, 1996, 2000; McArthur & Graham, 1987; McNaughton, Hughes, & Ofiesh, 1997). There is also a large body of literature on the use of assistive technology for students with disabilities. At present, however, there are few studies that specifically discuss the handwriting issues of students with ASD (Beversdorf et al., 2001; Henderson & Green, n.d.; Mayes & Calhoun, 2003). As well as the growing body of neurological research on motor impairments in ASD, there are also important anecdotal reports from persons with ASD about the value of having an alternative to the pencil. In a call to research, I would urge the academic community to look seriously at this critical issue. I would also urge teachers not to wait, but rather to allow and encourage these students to use the keyboard as their primary writing instrument **now**. Take the pencil out of the process and see what happens. Through the implementation of this alternate strategy for expression, many students may experience significant improvement in their ability to compose and communicate their thoughts, as well as in their behavior and in their overall outlook on learning and coming to school. Keyboarding is a critical life skill, and in education, the focus must be on the skills that will serve our students well now and in their future.

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- TEACHING Exceptional Children, Vol. 42, No. 1, pp. 14–21.
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Dr. Candace Hicks shows Aaron Rogers, distance student, different types of hearing aids.

DISTANCE LEARNING IN SPECIAL EDUCATION

Master of Education in Special Education Choose an emphasis in: <ul style="list-style-type: none"> • Visual Impairment • Dual Sensory Impairment • Orientation and Mobility • Educational Diagnostician • Generic Special Education • Deaf and Hard of Hearing 	Certificate Preparation Programs <ul style="list-style-type: none"> • Visual Impairment • Orientation and Mobility • Educational Diagnostician • Generic Special Education • Deaf and Hard of Hearing 	Certificate Programs <ul style="list-style-type: none"> • Autism • Dual Sensory Impairment
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*Some programs require weekend or on-campus visits

