

# Handwriting Boosts Brain Power and Learning Success

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January 04, 2025

## STORY AT-A-GLANCE

- › Handwriting with a pen or digital pen shows greater learning progress compared to typing, as it enhances memory retention and comprehension through the N400 priming effect, which is a measure of brain activity linked to language processing
- › Positive mood during handwriting activities contributes to better learning outcomes, as it facilitates semantic processing and creates a conducive learning environment
- › Handwriting activates brain regions associated with reading and writing, such as the fusiform gyrus, which is crucial for letter processing and is more engaged during handwriting compared to typing or tracing
- › Early handwriting experience influences brain development in children, recruiting brain areas important for reading acquisition and establishing a neural system that supports ongoing literacy development
- › Practicing handwriting is essential for early reading skills development, as it develops motor and visual processes in children, making it easier for them to recognize and remember letters

While digital tools have become ubiquitous in educational settings, the act of writing by hand offers distinct advantages that typing simply cannot replicate. In fact, it plays a foundational role in cognitive and motor development. It remains a fundamental component in primary school education, serving as a crucial skill that sets the foundation for higher academic development.

Studies have shown that handwriting activates brain regions associated with reading and writing, enhancing learning processes in ways that typing does not. For example, a study published in *Early Education and Development* highlights the significant link between handwriting proficiency and academic performance.<sup>1</sup>

Specifically, children who develop fluent and legible handwriting tend to produce longer texts of higher quality, which directly influences their educational outcomes and self-esteem.<sup>2</sup> But what happens to the brain when these processes are engaged? Here's what researchers sought to answer in another study.

## **Handwriting Activates Cognitive and Emotional Pathways for Better Learning**

A study published in *Frontiers in Human Neuroscience* investigated how different writing tools impact the learning of new words. Specifically, researchers tested three methods – ink pens, digital pens and keyboards. The research focused on both behavioral outcomes and brain activity, aiming to determine which method most effectively enhances memory retention and comprehension.<sup>3</sup>

The study included 33 right-handed native Japanese speakers, aged between 21 and 48, who were divided into groups based on their familiarity with digital pens. This classification allowed the researchers to assess how prior experience with digital handwriting tools influences learning outcomes.<sup>4</sup>

Participants engaged in a 10-minute learning session where they were tasked with memorizing new words using one of the three writing methods. After tests were completed, it was revealed that handwriting, whether with an ink pen or a digital pen, significantly improved the memorization of new words compared to typing on a keyboard.

Specifically, the handwriting groups exhibited a greater N400 priming effect, a measure of brain activity associated with language processing and memory formation.<sup>5</sup>

The research also highlighted the role of mood in learning efficiency. Participants reported a more positive mood during handwriting activities than while typing, regardless of the writing tool used. This positive emotional state is crucial as it facilitates semantic processing – the brain's ability to understand and integrate new information. As a result, the enhanced mood experienced during handwriting likely contributes to the improved learning outcomes observed in the study.<sup>6</sup>

Furthermore, the study examined the impact of familiarity with digital pens on learning effectiveness. It was found that participants who were accustomed to using digital pens showed greater learning benefits when using them compared to typing.

This indicates that familiarity with a writing tool amplifies its advantages further during the learning process. Conversely, those unfamiliar with digital pens still benefited from handwriting with an ink pen, which still led to better learning outcomes than typing.<sup>7</sup>

## **Handwriting Helps Boost Memory Formation**

The study also notes that the physical movements involved in writing by hand engage multiple senses, which in turn reinforce memory retention. Handwriting movements facilitate the recognition of abstract graphic forms, letters and written words, making the learning process more effective. This motor-perception integration ensures that writing is not merely a mechanical task, but a cognitive activity that actively involves the brain in learning.<sup>8</sup>

Moreover, the establishment of neural connections during handwriting plays a pivotal role in memory formation. The increased brain activity observed in the parietal and central regions during handwriting indicates that these areas are engaged in the integration of motor and perceptual processes, which are essential for effective learning and memory retention.<sup>9</sup>

Unlike typing, which often involves repetitive and less varied movements, handwriting requires the complete formation of each letter, thereby engaging the brain deeper. This

engagement explains why handwriting leads to better memorization and understanding of new words compared to typing on a keyboard.

## **Handwriting Shapes Children's Brain Better Than Other Methods**

Another study, published in Trends in Neuroscience and Education, explored how different methods of learning letters – handwriting, typing and tracing – affect brain activity in young children who are just beginning to learn to read. Specifically, the research focused on how these different writing practices influence the way children's brains develop connections essential for reading and writing.<sup>10</sup>

The researchers selected 15 children between the ages of 4 years and 2 months to 5 years old. All participants were right-handed and native English speakers from Bloomington, Indiana. The researchers aimed to understand which method of learning best activates the brain regions involved in reading and writing.<sup>11</sup>

Children who practiced handwriting showed increased activity in areas such as the inferior frontal gyrus and the posterior parietal cortex. These regions are known to play a significant role in processing letters and words, which are fundamental skills for reading.<sup>12</sup>

## **The Link Between Reading and Handwriting**

Handwriting practice was also shown to be crucial for developing early reading skills. In essence, the consistent use of handwriting helps establish a neural system that supports ongoing literacy development. As children repeatedly write letters, their brains become more efficient at processing these symbols, laying the groundwork for improved literacy.<sup>13</sup>

The research emphasized that handwriting's unique ability to activate reading-related brain regions sets it apart from other forms of letter learning. Unlike typing, which often involves repetitive and uniform movements, handwriting allows the creation of varied and personalized letter forms. This variability is crucial for children as it enhances their

ability to recognize and understand different instances of the same letter, further strengthening their reading skills.<sup>14</sup>

Delving deeper, the study found that handwriting directly engages the fusiform gyrus, a part of the brain closely associated with recognizing letters and words. In particular, the activation is more pronounced compared to typing or tracing. Essentially, by physically forming each letter, children create more robust connections in their brains, which aids in faster and more accurate reading skills.<sup>15</sup>

Moreover, handwriting involves motor and visual processes working together. When children write letters by hand, their motor cortex — the area responsible for movement — is actively involved. This activity changes how the brain visually processes letters, making it easier for children to recognize and remember them later. The study highlighted that this combination of motor and visual engagement is essential for developing strong reading abilities.<sup>16</sup>

## **Four Keys to Enhance Learning Through Handwriting**

Optimal cellular energy production is essential for improved cognitive function and memory retention. This means that handwriting, when supported by a lifestyle that promotes cellular health, will significantly enhance learning outcomes. Here are four strategies to align handwriting practices with cellular energy optimization:

- 1. Nourish your body with a balanced diet** — Ensure your daily diet has 15% protein, while restricting fats to below 30%. The rest will consist of carbohydrates from ripe fruits and well-cooked, low-oxalate starches.

This ratio supports optimal mitochondrial function and provides the necessary energy for sustained mental activities like handwriting. Avoid processed foods and harmful fats, as these impair cellular function. Foods high in high-fructose corn syrup also increase endotoxin in your gut.

- 2. Maintain gut health to support cognitive function** — A healthy gut microbiome is crucial for nutrient absorption, energy production and overall cellular health.

Incorporate dietary fiber carefully, focusing on whole fruits with pulp and avoiding high-fiber diets that increase endotoxin levels.

I recommend you get around 50 grams of fiber for every 1,000 calories you consume. Make sure to get both types – soluble (dissolves in water) and insoluble (stays intact while moving through the colon) for healthy digestion.

A well-balanced gut reduces inflammation and supports optimal brain function, making the physical act of handwriting more effective in encoding information into memory.

- 3. Boost cellular energy with sunlight exposure** – Sunlight exposure is fundamental for synthesizing vitamin D, an important hormone for optimal cellular health. However, limit peak sun exposure for at least six months until you have eliminated vegetable oils from your diet.

That's because the [linoleic acid \(LA\)](#) embedded in your skin will oxidize when exposed to sunlight. For a more deeper understanding about this topic, as well as other strategies for optimizing vitamin D production, read my article "[Vitamin D Deficiency Complicates Autoimmune Disease.](#)"

Complement sunlight exposure with pharmaceutical-grade methylene blue, available in capsule or tablet form from a compounding pharmacy and used only as prescribed by a health care professional. The recommended dose is 5 milligrams once a day for most adults. This adjunct helps enhance mitochondrial function by acting as a powerful electron acceptor that temporarily removes the bottleneck created by faulty metabolism.

- 4. Practice your handwriting consistently** – Establish a daily writing routine to keep your body-mind connection sharp. For best results, allocate time each day for meaningful writing tasks while ensuring you receive adequate nutrition, hydration and stress management.

Children will also benefit from practicing their handwriting to help improve their fine motor skills and mental acuity. For a deeper dive into this topic, read my article, [“Develop Your Child’s Mind-Body Connection via Handwriting.”](#) There, I also discuss 10 helpful tips to develop your child’s handwriting in fun, engaging ways.

## Sources and References

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