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Children in Primary and Secondary Education Should Continue to be Taught Handwriting in the Digital Age

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Abstract

As more and more new technologies have been introduced to traditional classrooms in schools, handwriting has been overlooked in the digital age. This paper examines the key roles of handwriting in promoting children's brain development, increasing creativity, improving academic writing competence, and providing help for children with learning difficulties to address the importance of handwriting. Based on that, the paper concludes that children in primary and secondary education should continue to be taught handwriting in the digital age. It suggests that appropriate methods of handwriting instruction in the new digital age need to be identified.

Keywords

handwriting, digital age, brain development, creativity and academic writing competence, learning difficulties

1. Introduction

Handwriting, defined as "writing by hand rather than typing or printing" (Collins English Dictionary, 2018), has always been regarded as a basic means of communication and an important skill for human beings. There has been a long history of teaching handwriting. However, as we enter the 21st century, also known as the digital age, handwriting instruction has begun to decline due to rapid technological development. The digital age is a period in human history characterized by the Information Technology Revolution (Castells, 2011). With the advancement of science and technology in this era, new media are increasingly entering the education system. Many schools have set up multimedia classrooms that incorporate a deal of digital educational equipment such as computers, projectors, interactive whiteboard and web-based learning platform (Dongsheng, 2017). As a result, students not only attend classes through new media, but also complete assignments and take exams online. Thus, the advent of digital technology has made it possible for typing on keyboards to replace handwriting in schools.

As students become increasingly reliant on learning through digital devices, some educational reforms in several countries have shifted the focus to teaching keyboarding instead of handwriting instruction in order to adapt to modern means of communication widely used in this new era. The Common Core State Standards (CCSS), adopted by 42 states in America, is an educational initiative that specifies the learning content in English language arts and mathematics for students in primary and secondary education, with the aim of preparing America's students for success in college and future careers (NGA Center and CCSSO, 2018). However, handwriting instruction is not emphasized in the CCSS. According to this initiative, handwriting instruction is no longer mandatory for students beyond the first grade. After this stage, states have the option to maintain handwriting curricula or eliminate them entirely. Alternately, students are expected to become more proficient in keyboard skills. Similarly, schools in Finland are phasing out handwriting curricula in favor of teaching keyboard skills. Since 2016, Finnish school children have started learning how to touch-type and text message , which have become the primary means of communication in modern society, rather than handwriting (BBC Monitoring, 2014). In addition to these two countries, some provinces in Canada, such as Ontario and Quebec, are also following the same trend of gradually removing handwriting instruction from primary school curricula (Mcginn, 2017).

In the current digital age, handwriting instruction is threatened by the application of technology in education. In this context, this essay argues that children in primary and secondary education should continue to be taught handwriting in the digital age, based on the important roles handwriting plays in three different but related aspects.

2. Handwriting Contributes to Children's Brain Development

Learning handwriting plays a significant role in promoting children's brain development. Handwriting is essentially a complex task that requires several component skills, including fine motor control, visual-motor integration, sustained attention and sensory coordination (Feder & Majnemer, 2007). These skills are controlled by the central nervous system in the brain. Therefore, writing by hand is in essence a process involving brain engagement. In this process, increased brain activation can be observed in different regions. James and Engelhardt (2012) demonstrated how different ways of letter perception influenced brain activation by using fMRI (Functional Magnetic Resonance Imaging). Their findings showed that preliterate five-year-old children experienced significant increases in brain activation after writing letters. Comparing their handwriting practice with their typing experience, there was much more activation detected in various regions of the brain. Furthermore, when children in the 5th grade were asked to form new letters based on similar strokes learned from well-practiced letters, those with good handwriting skills engaged fewer brain regions and conserved more energy for completing writing tasks (Berninger, 2012). This finding suggests that children who struggle with handwriting problems are less efficient in activating their brain regions compared to those who are proficient at handwriting. These two studies indicate that the effects of handwriting on brain activation

starts from an early stage of children's growth and can continue if children practice handwriting during the critical periods of education.

As brain activation increases during the process of handwriting, the brain itself get exercised. At the same time, its functions become specialized and strengthened through the use of various handwriting skills which are controlled by different activated brain regions. Early in 2000, Tseng and Chow (2000) revealed that school-age children with slow and normal handwriting speeds engaged different perceptual-motor systems in particular brain functional regions. Although there existed differences in brain activation among these children because of their writing speed, this study demonstrated that handwriting absolutely had an effect on children's brain functioning. In recent years, there has been more and more evidence on the link between handwriting and brain functions. James and Engelhardt (2012) discovered that a reading circuit reoccurred in brain during letter perception only after handwriting, rather than typing. This suggests that writing by hand is crucial for the early recruitment of brain regions involved in letter processing and reading. In another study, researchers investigated the brain's functional connectivity after handwriting experiences. The research showed that handwriting training, as opposed to typing letters, was more effective to stimulate brain activation of preschool children in visual and motor regions and further created functional connectivity between these two kinds of brain regions (Vinci-Booher, James, & James, 2016). In a recent study, Chen et al. (2017) found that long-term Chinese calligraphy training, a traditional art form of handwriting, was closely related to improvements in specific aspects of brain executive functions. In addition, neural networks in related brain regions contributing to functional specialization could be strengthened as well.

In conclusion, handwriting has a significant influence on children's brain development. When writing by hand, there is a clear increase in brain activation in different regions, indicating that the brain is being exercised. Furthermore, a variety of skills applied in course of handwriting stimulate divergent brain functions, which is beneficial for functional specialization. Therefore, handwriting can make great contributions to brain development from these two aspects.

3. Handwriting Supports More Creativity and Develops Academic Writing Competence

Based on its role of promoting brain development, handwriting can also help children develop creativity and academic writing abilities through various aspects, including different compositional skills that are closely associated with their studies. Previous research by Gathercole et al. (2004) highlighted that mastering good handwriting skills allows children to allocate more working memory to higher-level processes such as idea generation, vocabulary selection, text revising, and progress monitoring. Similarly, Christensen (2005) discovered that students who participated in a specific handwriting instruction program produced more creative and well-structured written texts compared to those who did not participate. This improvement was attributed to the development of automaticity in orthographic-motor integration, which aids writers in ideation, text monitoring, and pragmatic awareness. Similarly, another research from the same perspective showed that handwriting automaticity

in letter generation is a significant factor in the composition of children in primary schools (Medwell, Strand, & Wray, 2009). In recent years, a number of studies have suggested that handwriting has a close relationship with children's academic improvements in creativity and writing competence. After studying children from Grade 2, 4 and 6, Berninger (2012) found that students who wrote by hand expressed more ideas with more words and faster speed than the ones using keyboards. Then the subsequent research in which children were given handwriting instruction displayed that students' compositional skills were clearly improved. Moreover, Case-Smith (2012) also clarified that when school-age children became more automatic and proficient at handwriting, they could get inspired more and better transform their ideas in the written form. If children were taught handwriting, they could do better in concentrating, planning and thought organization required for effective composition. In addition, according to James and Engelhardt (2012), handwriting, as a self-generated action, had an important influence on reading fluency and acquisition that could lay a foundation for improvements in writing competence.

Apart from these studies, a survey conducted by Purcell, Buchanan, and Friedrich (2013) involving Advanced Placement and National Writing Project teachers indicated positive effects of handwriting on students compared to the negative impacts of digital tools in secondary education. The survey revealed that approximately ninety-four percent of teachers encouraged students to do some of their writing assignments by hand. While digital technologies have become useful tools in teaching and have shaped student writing in multiple ways, they have also resulted in unintended consequences that may weaken writing competence. Digital tools often lead to shortcuts, such as copying and pasting others' work, and students may pay less attention to careful writing, resulting in more spelling and grammar mistakes. On the contrary, a noticeable phenomenon was observed at the same time. Students did more active creation involving thinking, analyzing, synthesizing and editing in course of handwriting. Besides, the requirement of handwriting for assignments was an effective way to prevent students from direct copy of others' work (Purcell, Buchanan, & Friedrich, 2013).

In conclusion, compared with digital tools used currently in primary and secondary education that do not require handwriting for students, writing by hand continues to be an effective method for students to produce more creativity and better develop academic writing competence. Except for this, it could be counted as a complementary way to effectively offset side-effects caused by educational digital tools.

4. Handwriting Provides Great Help for Children with Learning Difficulties

Handwriting is in nature a complex task depending on amounts of component abilities such as fine motor skills, visual motor integration, visual perception and cognition (National Handwriting Association, 2018). Due to these characteristics, handwriting holds significant importance in occupational therapy for children and young individuals. It can serve as both an assessment tool and an intervention method to assist children in overcoming learning difficulties associated with these skills.

Problems encountered in course of handwriting can be regarded as a sign of children's learning

difficulty in the early stage. One of learning difficulties associated with handwriting is dyslexia. It causes learning problems in reading, writing and spelling (NHS, 2015). After careful observation and studies of children with normal, at risk or dysgraphic characteristics from grade 2 and 3 within one school year, Overvelde and Hulstijin (2010) concluded that consistently dysgraphic handwriting of children from the early grades could be counted as a diagnosis of dyslexia and referral for therapy. As reported by Montgomery (2012), children's early handwriting assists greatly in identifying dyslexia. He explored the contribution of handwriting to remediation of overcoming dyslexia for children by conducting a detailed case study over 1,000 dyslexics. From scripts of their handwriting, researchers found that although children with dyslexia showed some common knowledge of words, they failed to learn to make symbol-to-sound connections or alphabetic knowledge of words. In addition to lack of ability in this aspect, Montgomery (2012) also made a specific list of key indicators of diagnosing handwriting difficulties resulted from dyslexia. Besides, Brossard-Racine et al. (2012) further illustrated specific quantitative means for therapists to make clinical judgement through evaluating handwriting. Having a totally different character system, Chinese handwriting could also be considered as a useful indicator of dyslexia. Building on results of the study recruiting children from mainstream primary schools, Lam et al. (2011) stated that speed and accuracy of handwriting could reliably discriminate between typical children and the ones with dyslexia. Apart from its role as an indicator, particularly designed handwriting practice could help children overcome difficulties and improve relevant skills in this area. Case-Smith (2002) early investigated the effects of school-based occupational therapy services in which handwriting practice was highlighted most. The results showed obviously that students in the intervention group had significant increases in in-hand manipulation than the ones who did not receive the services. Later, Case-Smith et al. (2014) conducted another study of a similar handwriting program designed for first- grade students. This research further confirmed the effectiveness of handwriting on children to overcome writing difficulties. Moreover, Ohl et al. (2013) ran a program lasting 10 weeks in kindergarten classrooms from elementary schools, in order to study changes of children's handwriting skills from concrete aspects. The findings indicated in details that handwriting could help children improve fine motor and visual-motor skills from a very early stage.

In conclusion, handwriting can serve as a valuable indicator of learning difficulties, enabling educators and therapists to identify and address specific challenges in component skills. By targeting handwriting instruction and interventions, children with learning difficulties can receive the necessary support to develop and improve their skills. Therefore, handwriting plays a crucial role in providing significant help for children facing learning difficulties.

5. Conclusions

In this paper the critical roles of handwriting are discussed from three interrelated perspectives to support the argument that handwriting instruction is supposed to keep its existence in curricula of primary and secondary education. Handwriting in essence is a task comprises a variety of component

skills controlled by different brain regions. Due to its nature, the experience of handwriting directly contributes to brain development, which is crucial for children's overall growth. Additionally, learning handwriting helps children develop the component skills necessary for creativity and academic writing competence. However, some children may face difficulties in learning handwriting, making it an effective indicator and a potential avenue for providing assistance to children with learning difficulties. It is important to note that the effects of handwriting cannot be replaced by digital tools used in modern education. On the contrary, handwriting not only offers unique contributions in the digital age but also serves as a valuable and complementary educational method to counteract the drawbacks of digital tools. Based on these reasons, it is argued that handwriting should continue to be taught to children in primary and secondary education, as its effects begin early in their growth and can be sustained through consistent instruction and practice.

This paper aims to emphasize the importance of handwriting in the digital age and encourage educators to prioritize its instruction. However, it is important to acknowledge the limitations of this paper. Firstly, the significance of handwriting is only explored from three specific perspectives, neglecting other aspects such as its historical and cultural values in education. Secondly, while the focus is primarily on children, handwriting is also essential for adults, and its effects can extend throughout one's lifetime. Therefore, further research is needed to explore these two dimensions in more detail. Considering the importance of handwriting, it is crucial to identify effective methods of teaching handwriting that fully utilize its benefits. Additionally, as new technologies continue to be integrated into education, it becomes pertinent to explore how handwriting can be developed using technological approaches. Finding effective ways to combine handwriting with digital tools will be valuable for educators, as it allows both methods to contribute to the educational process.

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