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The effect of pen and paper or tablet computer on early writing – A pilot study

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ABSTRACT

One consequence of the ongoing controversy on the implementation of digital tools in early writing instruction is a need to investigate the effect of different writing instruction tools such as pen(cil) and paper and tablet computers on early writing. The purpose of this pilot study is to develop a study design and a writing test to investigate the effect of writing instruction tool (tablet computer vs. pen and paper) and test format (digital vs. pen-and-paper) on early writing outcomes. For the writing test, our pilot study shows that pupils assessed by the digital test format wrote faster compared with those assessed by pen-and-paper format, independent of the writing instruction tool. Given the limitations of this pilot study in scope and its quasi-experimental nature, we provide some suggestions for the design of a larger scale study by taking into account the rapid development of the field of early writing instruction.

1. Introduction

In many European countries, in particular the Nordic countries, Information Communication Technologies (ICT) including computers, tablet computers and smartphones are part of the school infrastructure.[1] Use of ICT has become a natural part of teaching and learning at school (Berge, 2014; Liabo, Simon, Tripney, Daniel-Gittens, & Elwick, 2014; Lim & Oakley, 2013) and *digital literacy* is a core element in the national curriculum. In Norway, for example, the latest reform of compulsory education in 2006 – the 'Knowledge Promotion Reform' (*Kunnskapsløftet*) – added digital literacy as one of five core skills, among them reading and writing skills.[2] At the same time, an increasing use of ICT also within reading and writing instruction at elementary level challenges proponents of such traditional learning devices as printed books, paper and pencil (Selwyn, 2012), among them many teachers and parents.

While *digital writing instruction* (synonyms: keyboarding, typing) is gaining in importance at school in many countries, *handwriting instruction, in particular cursive writing instruction,* appears to lose ground, at least in some countries: following the *Common Core Curriculum Standards* 45 states in the United States have removed *cursive writing* and replaced it with keyboard writing (in addition to print writing instruction by using pen and paper), while seven states still favor *cursive writing* instruction.[3] In Finland, from autumn 2016 first-graders will learn both: printing and forming words with upper and lower

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[1] In the Nordic countries, schools are highly equipped with ICT compared with other European countries (European Schoolnet, 2013).

[2] Norwegian Directorate for Education and Training (2012). Framework for Basis Skills.

[3] http://www.nydailynews.com/life-style/states-fight-cursive-classroom-article-1.1518352 [retrieved, September 9th, 2015].

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case letters, and keyboard skills (Søby, 2015). While some countries seem to put a stronger focus on printing letters and keyboard writing, in other countries, however, we can observe another trend. There are indications that in France the current curriculum puts a stronger focus than its predecessor on *cursive* handwriting.[4] To make their argument, educators refer to current research in the field of neuroscience and education that stress the importance of the 'haptics of handwriting' (Mangen & Velay, 2010) for brain development in general, and later academic achievement (e.g. James & Engelhardt, 2012; Longcamp et al., 2008; Longcamp, Zerbato-Poudou, & Velay, 2005), such as reading achievement (Dinehart & Manfra, 2013). To provide another example from the US, North Carolina has returned to cursive writing, defining this as a new mandatory subject, as opposed to those states following the Common Core Standards..[5]

Adhering to the *writing-to-read paradigm,* proponents of writing instruction methods based on digital writing tools (e.g. Graham & Hebert, 2011; Graham & Hebert, 2010; Trageton, 2009) argue that writing is easier for children than reading and should therefore be taught first, and that typing is easier and faster to learn than handwriting (Genlott & Grönlund, 2013; Hultin & Westman, 2013). In particular, for children who are struggling with fine motor skills, this method might reduce frustration in their earlier period of writing instruction (Goldberg, Russell, & Cook, 2003).

In contrast, proponents of traditional, pen-and-paper-based writing instruction methods refer to studies in the field of neuroscience, where studies show a positive association between *hand*writing and activities in certain areas of the brain (brain circuits). Further, there is evidence of a positive relationship between good handwriting skills and further academic outcomes, such as reading (Dinehart & Manfra, 2013), reasoning and memorizing skills (Longcamp et al. 2008; Longcamp et al., 2005; Mangen & Velay, 2010; Olivier & Velay, 2009), also for older student populations. By comparing two groups of university students, one group using pen and paper and another group using a laptop for note-taking, Mueller and Oppenheimer (2014) found that even though laptop use was related to easier and more extensive note-taking, these notes were rather 'non-generative', with little learning outcome. Generative note taking of the group using a pen and paper, on the other hand, was more strongly associated with improved learning (for example summarizing, paraphrasing).

Previous studies in the field of writing primarily focus on older student populations such as university students (Fortunati & Vincent, 2014; Taipale, 2014, 2015), secondary school students (Cheung, 2012; Liabo et al., 2014; Littlejohn, Beetham, & McGill, 2012), or students with learning disabilities (Berninger, Abbott, Augsburger, & Garcia, 2009; Berninger, Nagy, Tanimoto, Thompson, & Abbott, 2015). Studies addressing younger populations, however, are relatively few (e.g. Genlott & Grönlund, 2013; Longcamp et al. 2008). Limiting the scope to early writing instruction among third-graders, the purpose of this pilot study is to develop a study design and a writing test to investigate the effect of writing instruction tool (tablet computer vs. pen and paper) and test format (digital vs. pen-and-paper) on early writing outcomes. Thus, this study might serve as a point of departure for the research community to develop a larger scale study, to add further to the ongoing debate on writing instruction.

In the following background section, we develop our main research questions leading our pilot study by outlining differences related to handwriting and typing, and briefly review existing research on the importance of handwriting skills for academic achievement on the one hand, and research on the potential of digital writing tools for early writing on the other. Second, in the method section we describe the design of our pilot study including the sample, data collection, the writing test developed, and the operationalization of the main outcomes. In the third section, we present the main results of our study. In the concluding section, we discuss the value of our small-scale pilot study, being aware of its main limitations, and give some implications for a future study on a larger scale and taking into account the rapid changes in the field.

2. Background

2.1. Differences between handwriting and typing

Even though the two *modes* of writing, handwriting and typing, serve the same purpose, to communicate, they differ in three aspects related to the tool used (see Mangen & Velay, 2010). First, handwriting is an activity conducted by using *one* hand, while professional typing requires two hands.[6] Second, if using pen and paper, writers are urged to pay higher visual attention to the writing process by leading their attention to the tip of the pen. In contrast, the visual attention of keyboard users, is supposed to be more separated from the 'haptics of writing' process. Thus, for typing, the writing process happens in two distinct spaces, motor (*keyboard*) and visual space (*the screen*). Third, for letter writing, the writer by hand has to form every single letter ('selfmades') on her or his own, while the typist just has to identify letters and press them on the keyboard while writing, because these letters are 'readymades' (Mangen & Velay, 2010).

[4] http://www.theguardian.com/science/2014/dec/16/cognitive-benefits-handwriting-decline-typing [retrieved, September 9th2015)].

[5] Urist, J. (2013, Sept. 3). Learning cursive writing: Is it worthwhile or a waste of time? TODAY Parents. Retrieved from http://www.today.com/parents/learning-cursive-writing-it-worthwhile-or-wasted-time-8C11045379.

[6] One can think of exceptions like 'digital natives' writing sms by using one hand.