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The effect of a touch-typing program on keyboarding skills of higher education students with and without learning disabilities

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ABSTRACT

This study examined the effect of a touch-typing instructional program on keyboarding skills of higher education students. One group included students with developmental learning disabilities (LD, $n = 44$), consisting of students with reading and/or handwriting difficulties. The second group included normally achieving students (NA, $n = 30$). The main goal of the program was to increase keyboarding speed while maintaining accuracy. The program included 14 bi-weekly touch-typing lessons, using the "Easy-Fingers" software (Weigelt Marom & Weintraub, 2010a), that combines a touch-typing instructional program and a keystroke logging program, to document the time and accuracy of each typed key. The effect of the program was examined by comparing keyboarding skills between the beginning (pre-test), the end of the program (post-test) and 3 months after termination of the program (long-term). Results showed that at the end of the program, keyboarding speed of the NA students decreased while the speed of the students with LD somewhat increased. In the long-term evaluation, both groups significantly improved their speed compared to pre-test. In both cases high accuracy (above 95%) was maintained. These results suggest that touch-typing instruction may benefit students in general, and more specific, students with LD studying in higher education, which often use computers in order to circumvent their handwriting difficulties.

1. Introduction

The increase of students with specific learning disabilities (LD) studying in higher-education institutes calls for a better understanding of the type of support these students require, to achieve their higher-education academic goals. By definition, students with LD encounter difficulties with academic skills such as reading, written expression and mathematics (American Psychiatric Association [APA], 2013). One of the means that has been found to assist students with LD is the use of digital devices (Seale, 2014) and specifically computers. By using various computer software (e.g., word processor and spell checkers), students with LD may circumvent aspects of their disabilities, such as writing and organization difficulties (Batorowicz, Missiuna, & Pollock, 2012; Lindstrom, 2007; MacArthur, 2009). Moreover, students with LD are often allowed to

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use computers while taking exams, to accommodate for their writing difficulties (MacArthur, 2009). In addition, there is evidence showing that word-processing may have an advantage over handwriting while writing a composition (Berger & Lewandowski, 2013; Lovett, Lewandowski, Berger, & Gathje, 2010). However, efficient use of word processing software requires proficient keyboarding (Connelly, Gee, & Walsh, 2007). Yet to date, there is little evidence as to the process by which higher-education students with LD become proficient typists, and whether this process is similar or different between students with and without LD.

1.1. Keyboarding proficiency of student with learning disabilities

Keyboarding is a complex task that requires the orchestration of sensory-motor, linguistic and cognitive skills (Grabowski, 2008; Preminger, Weiss, & Weintraub, 2004; Weintraub, Gilmour-Grill, & Weiss, 2010). Proficient keyboarding is usually demonstrated by the typist's keyboarding efficiency. Efficient keyboarding is the result of the transaction among several factors including typing speed, the number of errors and corrections committed while typing, as well as the amount of attention and motor effort excreted by the typist (Rieger, 2004; Soukoreff, 2010). Often, efficient keyboarding is judged in comparison to handwriting. It is expected that keyboarding will be at least as fast as handwriting (Freeman, MacKinnon, & Miller, 2005). Yet, studies have shown that many students are unskilled typists (Lubbe, Monteith, & Mentz, 2006), and often, their handwriting is more efficient than their keyboarding (Berninger, Abbott, Augsburger, & Garcia, 2009; Connelly et al., 2007).

Non-proficient keyboarding skills may adversely affect the academic performance of students, in general, and specifically those with LD. For example, students with LD may continually need to correct keyboarding errors due to language or motor difficulties, and as a result, their keyboarding speed may be impeded (Berninger et al., 2009). In addition, they may need to allocate their attention to the keyboarding process (e.g., search for keys), and therefore focus less on higher cognitive processes of writing such as generating, planning and organizing ideas and revising the text. As a result the written outputs of non-proficient typists may be of lower quality (Christensen, 2004; Rieger, 2004).

Inefficient keyboarding among students with LD may be due to their deficits. Yet, it may also be related to the fact that keyboarding is not always taught and practiced within the school setting (Trubek, 2011). Thus, perhaps, over the years, due to lack of proper instruction, students have adopted various forms of keyboarding which are not always efficient (Grabowski, 2008). Therefore, one may postulate that systematic keyboarding instruction may improve the keyboarding proficiency of students in general (Britten, 1988), and specifically of those with LD.

1.2. Touch-typing acquisition

Keyboarding acquisition is a complex motor learning process. It requires on-going learning of many sequences. One of the ways to become an efficient typist is to learn 'touch-typing'. Touch-typing is based on the use of both hands and all the fingers in a specific manner, mostly using kinesthetic rather than visual feedback (Freeman et al., 2005). As in acquisition of many skills, touch-typing requires explicit instruction and much practice (Rieger, 2007). However, touch-typing is believed to be more efficient than other typing methods (such as "hunt-and-peck"), specifically when the typists are able to look at the monitor while typing, rather than at the keyboard (Johansson, Wengelin, Johansson, & Holmqvist, 2009; Yechiam, Erev, Yehene, & Gopher, 2003).

Based on the basic principles of motor learning, West (cited in Sormunen, 1993) described three phases of keyboarding acquisition. In the first, the 'Cognitive phase', different keystrokes and movement patterns are learnt, while relying on declarative mediation and visual feedback of the keyboard. In the second, the 'Associative phase', the keystrokes and movement patterns acquired, become more internalized, and the typists rely more on kinesthetic feedback (rather than visual feedback). Finally, in the 'Automatic phase', the typists rely primarily on kinesthetic feedback, and are less affected by external processes occurring in parallel. In this stage, the typists invest minimal cognitive effort (attention) in the keyboarding process itself (Grabowski, 2008). The transition to the 'Automatic phase' varies, and depends on the type and complexity of the motor task as well as on the consistency of the task environment. According to Logan (1988), skill acquisition begins with a general algorithm process, that with experience, gradually "speeds-up" and transits into a memory-based process, which reflects the automatization of the skill.

Only few studies examined the efficacy of keyboarding acquisition in improving individuals' skills. Most studies focused on children in elementary school and were conducted early on. The results of these studies showed an improvement in keyboarding skills immediately following an instructional program (Britten, 1988; Nichols, 1995; Sormunen, 1988, 1993). Similar results were reported in a study among higher education students (Yechiam et al., 2003). Alongside these results, absence of sufficient practice following the program led to a significant decrease in keyboarding speed, both among children (Freeman et al., 2005) and among higher education students (Yechiam et al., 2003). This may reflect the complexity of acquiring keyboarding skills. However, the results related to higher-education students may also reflect the fact that most students in the higher-education level have been keyboarding for many years, usually using well established individual typing styles and methods (Grabowski, 2008). Therefore, while learning to touch-type, they are actually learning new (different) motor patterns to perform an activity that they have already acquired (i.e., keyboarding). This process requires a recalibration of neural networks and control (Bastian, 2008), and thus may be more time consuming.