Gender differences in students' self-awareness of their handwriting performance

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© The College of Occupational Therapists Ltd. Submitted: 14 August 2013. Accepted: 6 January 2014. *Introduction:* Self-awareness has been found to be an important factor in individuals' performance in daily activities. Yet, to date, the relationship between this factor and handwriting performance has not been examined. The purpose of this study was to compare the handwriting self-awareness (that is, self-knowledge and on-line awareness) and performance of girls and boys, and to examine the relationship between self-awareness and handwriting performance.

Method: Participants included 86 middle-school students (aged 12–14) enrolled in general education in Israel. A handwriting evaluation assessment was administered along with self-knowledge and on-line awareness questionnaires.

Results: Gender differences were found in relation to students' self-awareness of their handwriting performance. In comparison with girls, boys perceived their handwriting to be faster, even though their actual handwriting performance was slower. Regarding legibility, only boys showed a significant correlation between self-knowledge and performance, while both genders demonstrated significant correlations between on-line awareness and performance.

Conclusion: It appears that students aged 12–14 are only moderately aware of their handwriting performance, yet there are gender differences in relation to this awareness. These findings may assist educators and therapists in teaching, evaluating, and developing interventions to improve handwriting performance.

Introduction

Throughout their school years, students are expected to acquire and use writing skills in almost every facet of their studies, including homework, note-taking, writing assignments, and examinations (Feder and Majnemer 2007). In order to achieve effective and efficient written communication, handwriting must be automatic and legible and must demand minimal effort and attention (Medwell et al 2009). Various researchers have found gender differences in speed and legibility; girls have often been found to write faster and more legibly both in elementary school and in higher grades (for instance, Dorfberger et al 2007, Weintraub et al 2007).

In the past few decades, numerous studies have examined various underlying components of handwriting, including linguistic and sensory-motor factors (for a review see Hoy et al 2011), yet only a few have examined cognitive and meta-cognitive skills in relationship to handwriting performance (for instance, Christensen 2004, Feder and Majnemer 2007, Rosenblum 2013), and none has focused on students' awareness of their handwriting abilities. Toglia (2011) describes self-awareness as a complex multidimensional construct comprised of two distinct but interrelated concepts: selfknowledge and on-line awareness. Self-knowledge is one's understanding of one's own cognitive strengths and limitations in different areas of functioning that exist outside the context of a particular task (Toglia 2011). For example, self-knowledge of handwriting may relate to an individual's perception of his or her ability to write legibly or at a required pace. On-line awareness is the ability to monitor, regulate, and evaluate performance of an activity within a specific context (Toglia 2011). For example, on-line awareness of handwriting relates to an individual's self-evaluation immediately after performing a specific handwriting task. Whereas an individual's on-line awareness may change while performing an activity, self-knowledge is considered to be relatively stable; if change occurs, it does so by a slow process (Toglia 2011).

Recently, a number of researchers have begun to address the issue of self-efficacy in relation to written expression (for instance, Graham et al 2005, Pajares et al 2007). In addition, one study, by Engel-Yeger et al (2009), has examined the relationship between self-efficacy and handwriting. The researchers found that the self-efficacy of proficient secondand third-grade writers was higher than that of their peers with poor handwriting. However, in this study, students' self-efficacy was not compared to their actual performance; thus, there was no evaluation of their self-awareness of their handwriting skills (Toglia 2011).

It should be noted that although the terms *self-efficacy*, *self-awareness*, and *self-knowledge* were developed within different theoretical frameworks, they are often used interchangeably or in overlapping ways. Whereas self-efficacy is commonly used within social psychology frameworks, self-awareness is the term used more often within cognitive psychology literature (Toglia and Kirk 2000). To the best of our knowledge, no study thus far has examined the relation-ship between handwriting and self-awareness.

Study aim and hypothesis

The purpose of this study was to examine 12–14-year-old students' self-awareness of the speed and legibility of their handwriting. To this end, both self-knowledge and on-line awareness were compared with actual handwriting performance. In addition, because prior research has shown that girls' handwriting performance is often better than boys', in this study gender differences in handwriting self-awareness were examined. We hypothesized that girls' self-awareness of their handwriting abilities would be higher than that of their male counterparts.

Method

Participants

One hundred and ten students were initially recruited for this study, of whom 24 were excluded due to meeting one of the following criteria: (a) had not studied in Israel from first grade; (b) had a neurological symptom or physical disability which would affect their handwriting ability; (c) had been receiving special education services; and/or (d) did not complete all of the research assessment tasks (see 'Measures' below). Eventual participants, therefore, comprised 86 seventh-grade students aged from 12 to 14 years (M = 12.98 years; SD = 0.52 years). Students were recruited from various general-education schools in Israel; 73 (85%) were from urban areas and the rest lived in rural areas. Among the participants, 41 (48%) were boys and 77 (90%) were right-handed.

Measures

Handwriting Assessment for Middle-School (HAMS)

The HAMS (Weintraub et al 2001) is a standardized evaluation tool for assessing the handwriting quality of middle school (seventh- to ninth-grade) students (see Weintraub et al 2007). The HAMS may be administered individually or in a group setting. In this study, the HAMS was administered to the entire class. The HAMS comprises three tasks: (a) copying, where students are required to copy a passage from a paper in front of them over a period of 10 minutes; (b) taking dictation of an 85-word, 3-minute passage that includes every letter of the Hebrew alphabet (recorded using Windows Media Center and then played back to the students); and (c) expository composition, where students are asked to choose one of three suggested topics and write their opinion on it during a 10-minute period. For this study, only the copying and dictation tasks were considered.

The two primary measures of the HAMS are: (a) writing speed, calculated as the number of letters written per minute, and (b) overall legibility, scored on a 7-point scale (1 = illegible handwriting; 7 = very legible handwriting). Inter-rater reliability of the HAMS is high and statistically significant (p < .05) for all measures (speed: copying r = .99; dictation r = .71; legibility: copying r = .81; dictation r = .78). Construct validity has been established, showing gender differences (Weintraub et al 2007) as well as convergent validity, which was obtained by examining the correlation between the legibility scores of the copying and dictation tasks, as well as the speed scores in the two tasks (r = .83, p < .00 and r = .48, p < .00 respectively).

Self-awareness: Self-Knowledge Handwriting performance (SKnowH) questionnaire

SKnowH (Lahav et al 2007a) measures students' estimations of their overall handwriting performance outside the context of a specific handwriting activity. Participants are asked to rate their handwriting ability in terms of speed and legibility on a 5-point Likert scale (1 = very low; 5 = very high). SKnowH was found to have medium-high internal consistency (α = .75, p < .001).

Self-awareness: On-Line Awareness Handwriting performance (OLAH) questionnaire

OLAH (Lahav et al 2007b) measures students' evaluation of their handwriting performance immediately after performing a specific task. (The HAMS tasks were used for the OLAH assessment in this study.) Students were asked to self-evaluate their performance in terms of speed and legibility using a 5-point scale (1 = very low; 5 = very high). The OLAH was found to have medium internal consistency (α = .63, p < .001).

Procedure

After ethical approval was received from the Ministry of Education in Israel, consent was obtained from school administrators, parents, and students. Students' evaluation was carried out in two phases. In phase 1, the purpose of the study was explained to the students and they were asked to fill out the SKnowH questionnaire. Phase 2 took place between 1-2 weeks later, at which time participants were administered the HAMS and then asked to fill out the OLAH. These two sessions were separated because it was assumed that completing the self-knowledge questionnaire relating to handwriting ability might raise students' awareness of their handwriting abilities, which could, in turn, influence their actual performance. Additionally, the OLAH had to be completed immediately after the handwriting test (HAMS) was performed; thus, these two measures needed to be administered in the same session. The selection of a 1-2 week interval was based on the schools' schedules. All three instruments were administered to all students in the classroom setting. The data were collected by occupational therapy students in their senior year who were trained to administer the handwriting assessments and questionnaires. Scoring of the HAMS was carried out by two pediatric occupational therapists certified in its use.

Data analysis

Statistical analyses were performed using SPSS software. Independent sample t-tests were employed to assess students' actual performance, self-knowledge, and on-line awareness, and to compare gender differences in girls' and boys' actual performance, self-knowledge, and on-line awareness. To examine the correlation between students' self-knowledge (SKnowH) and on-line awareness of their handwriting performance (OLAH), and then between each of these measures and the students' actual handwriting speed and legibility (HAMS), Pearson correlation coefficients were obtained separately for the girls and the boys.

Results

Independent sample t-tests for speed and legibility were conducted to compare handwriting performance and selfawareness between boys and girls. As can be seen in Table 1, the girls wrote significantly (p < .01) faster than the boys, while girls' self-knowledge and on-line awareness of speed was somewhat lower than that of the boys, though the differences here were not statistically significant. In contrast, with regards to legibility, girls' actual performance, self-knowledge, and on-line awareness were all significantly (p < .05) higher than those of the boys. Subsequent analyses were thus conducted separately for boys and girls.

Pearson correlations between students' self-knowledge and on-line awareness (broken down by legibility, speed, and gender) are presented in Table 2. Self-knowledge and on-line awareness were found to be moderately and significantly (p < .05) correlated among both boys and girls with regards to speed (r = .432 and r = .476, respectively) and legibility (r = .479 and r = .546, respectively).

The correlation between students' handwriting performance (speed and legibility) and their self-knowledge and on-line awareness was analysed separately for girls and for

Table 1. Comparison of handwriting performance (speed and legibility), self-knowledge, and on-line awareness among seventh-grade boys and girls

5	Girls $(n = 45)$	Boys $(n = 41)$		
	M (SD)	M (SD)	t	р
Speed	. ,	. ,		•
Performance	90.36 (15.34)	80.50 (18.36)	2.711	.008
Self-knowledge	3.91 (0.63)	4.00 (0.74)	-0.599	.551
On-line awareness	3.67 (0.88)	3.78 (0.94)	0.582	.562
Legibility				
Performance	5.44 (1.08)	4.28 (1.15)	4.842	.000
Self-knowledge	4.22 (0.80)	3.54 (0.95)	3.639	.000
On-line awareness	3.80 (0.79)	3.34 (1.02)	2.353	.021

Table 2. Correlation between self-knowledge and on-line awareness relating to handwriting speed and legibility of seventh-grade girls and boys

	Girls (n = 45)	Boys (n = 41)
Speed	.476*	.432*
Legibility	.546*	.479*
*p < .01		

р < .01

Table 3. Correlations between self-knowledge, on-line awareness, and handwriting performance of seventh-grade students

Handwriting performance	Girls (n = 45)	Boys (n = 41)
Speed		
Self-knowledge	.513*	.447*
On-line awareness	.598*	.272
Legibility		
Self-knowledge	.252	.478*
On-line awareness	.387*	.485*
* **		

*p < .01

boys (see Table 3). With regards to speed, a statistically significant (p < .05) moderate correlation was found between self-knowledge and actual performance among both girls and boys (r = .513 and r = .447, respectively), yet the correlation between on-line awareness and performance was significant only among the girls (r = .598). The correlations for legibility differed slightly; a moderate and significant correlation between self-knowledge and actual performance was found among the boys only (r = .478), while significant (p < .05) moderate correlations between on-line awareness and actual performance were found for both girls and boys (r = .387 and r = .485, respectively).

A different perspective on Table 3 shows that among the girls the correlations between handwriting performance (both speed and legibility) and on-line awareness (r = .598 and r = .387, respectively, both p < .05) were higher than the correlations between girls' speed and legibility and their self-knowledge (r = .513 and r = .252, respectively, both p < .05). In contrast, among the boys, the correlation of speed and on-line awareness was lower than the correlation between speed and self-knowledge (r = .272, p > .05, and r = .447, p < .05, respectively), while the correlations between handwriting legibility and on-line awareness or self-knowledge were very similar (r = .485 and r = .478, respectively, both p < .05).

Discussion and implications

Individuals' self-awareness of their performance is believed to be an important factor contributing to their ability to improve their functioning and participation in daily activities (Katz et al 2011). To date, to the best of our knowledge, no other studies have examined students' self-awareness (that is, selfknowledge and on-line awareness) of their handwriting performance. To address this gap, this study focused on handwriting self-awareness among students aged 12–14 years. In addition to soliciting the students' beliefs about their handwriting abilities, the present study also examined the relationship between these beliefs and the students' handwriting performance (speed and legibility), which yielded knowledge about these students' awareness of their handwriting skills.

First, to establish that self-awareness relating to handwriting performance comprises the two major concepts described by Toglia (2011), the relationship between self-knowledge and on-line awareness was examined. Our results showed medium statistically significant correlations between selfknowledge and on-line awareness of handwriting speed and legibility, for each gender separately. These findings are inconsistent with the results of Goverover et al (2007) that assessed the awareness of adults with traumatic brain injury (TBI) during IADL task performance and functional performance. These researchers found no relationship between selfknowledge and on-line awareness. Based on their results, Goverover et al (2007) concluded that general awareness and on-line awareness can be dissociated from each other. Perhaps the difference in these two studies' results is due to the different study populations; perhaps, as a consequence of their injury, the TBI participants were less aware of their performance as compared to normative adolescents.

The results of this study also revealed some gender differences in students' awareness of their handwriting performance; overall, boys perceived their handwriting to be faster than did the girls even though the boys' actual performance was slower than that of the girls. This may indicate that the boys were not sufficiently aware of their writing speed, and thus over-estimated it. One possible explanation for the gender difference in writing speed may be explained by gender psychology. Specifically, various researchers have noted that judgement of handwriting samples is subject to gender bias (Greifender et al 2011, Klein and Taub 2005). Writing speed may be associated with strength as well as achievement, traits that are often referred to as masculine (Heilman 2012). This common stereotype may have led the boys to believe that they wrote quickly (as compared with the girls' self-belief), even though in fact the girls wrote faster. This issue needs to be pursued further as it may have implications in handwriting instruction and intervention.

The results of this study also showed that the correlations between handwriting performance and on-line awareness were higher than the correlations between performance and selfknowledge (except among boys in relation to speed). These results may indicate that, overall, students aged 12–14 years were not sufficiently aware of their handwriting performance. The students either over- or under-estimated their handwriting abilities; that is, they often perceived their writing speed to be slower or faster than it actually was, or felt that their handwriting was illegible where in reality it was legible. Interestingly, after performing a writing task, students' awareness of their performance increased. Age is one possible explanation for the merely moderate correlations between self-knowledge of handwriting and actual performance. Burnett and Blakemore (2009) noted that the network of brain regions involved in self-awareness develops during adolescence. In light of this, perhaps these networks were not sufficiently developed in this study's participants, rendering their self-knowledge of their handwriting performance relatively low. To the best of our knowledge, there is no literature examining self-awareness in terms of handwriting performance specifically among adolescents, which suggests that this issue too needs to be further explored.

Moreover, the differences found in the participants' awareness of their handwriting abilities prior to (self-knowledge) and following (on-line awareness) the performance of a task may not be surprising, given the differences between the two concepts of self-awareness. While self-knowledge involves self-judgement about an individual's abilities and limitations, external to the context of a particular task (as in the question 'is my handwriting legible?'; Toglia 2011), on-line awareness refers to a specific activity that has just been performed (as in the question 'was my handwriting in this task legible?'; Toglia and Kirk 2000). The higher correlations between performance and on-line awareness may indicate that performing specific handwriting tasks helped to make the students somewhat more aware of their handwriting abilities, and thus more accurate in evaluating their performance.

These results may also reflect students' ability to be flexible in their evaluation of their handwriting performance; that is, to change their evaluation (after performing handwriting tasks). These findings are congruent with the assertion by Toglia and Kirk (2000), that self-knowledge is relatively stable and changes slowly with experience; in contrast with on-line awareness, which can change following performance of an activity (Toglia and Kirk 2000). In other words, performing a handwriting activity may provide individuals with important feedback, which may, in turn, influence their self-perceptions and beliefs about their handwriting performance (Toglia 2011) and thus assist in increasing their awareness of their abilities.

Limitations and future research

This study was based on a relatively small sample and refers to a specific age group (students aged 12–14 years). It is important that this study be replicated with wider age ranges. In addition, even though collecting data within the students' natural learning environment may have enhanced the ecological validity of the study's results, the social context of the classroom setting may have affected participants' handwriting performance and influenced their self-awareness. Furthermore, this study related to Hebrew handwriting. Although there are universal measures for handwriting across different languages, such as measures of speed or legibility, it is important to replicate this study in other languages in order to establish whether the written language influences students' self-awareness of their writing performance. Finally, it is recommended that this study be repeated among students with handwriting difficulties, whose results can then be compared to a normative sample.

Implications for occupational therapy practice

This study provides preliminary results regarding students' handwriting self-awareness, an area that has not previously been examined. From a clinical perspective it appears that the SKnowH (Lahav et al 2007a), as a measure of handwriting self-knowledge, and the OLAH (Lahav et al 2007b), as a measure of on-line awareness, may be useful for evaluating students' perceptions of their handwriting capacities. Moreover, comparing the information obtained using these questionnaires with students' actual performance may enhance students' and therapists' understanding of students' awareness of their handwriting abilities. This knowledge may assist therapists and students in improving students' handwriting performance (Cermak and Maeir 2011). Finally, given the gender differences that were found in students' self-awareness of their handwriting performance, it appears that boys are at greater risk of not being sufficiently aware of their writing speed. Thus, during evaluation of handwriting ability and intervention, it is important to consider gender differences not only in handwriting performance but also in students' self-awareness.

Conclusion

These research findings highlight the importance of evaluating handwriting self-awareness as a basis for planning handwriting intervention. By using tools such as SKnowH and OLAH questionnaires (Lahav et al 2007a, 2007b), and comparing them to actual handwriting performance, occupational therapists can obtain useful data about students' selfawareness and their handwriting skills. Moreover, distinguishing between self-knowledge and on-line awareness among boys and girls may help occupational therapists to understand and interpret evaluation findings, leading to more effective intervention and therefore better writing performance.

Key findings

 Boys perceived their handwriting to be faster than did girls although their actual handwriting performance was slower than that of the girls.
Only boys showed a significant correlation between self-knowledge and handwriting legibility performance.

What the study has added

This study's findings highlight the importance of evaluating handwriting self-awareness (self-knowledge and on-line awareness) as a basis for planning handwriting intervention.

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