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The self in self-regulated writing of fourth to ninth graders with dysgraphia

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ABSTRACT

Dysgraphia, a specific learning disability, impairs legible and automatic letter production by hand, which can interfere with written composing. The goal of the current study was not to investigate effective methods for teaching self-regulated writing to students with dysgraphia, but rather to investigate their self that is involved in their self-regulated writing. Students with dysgraphia in grades 4 to 9 (17 males; 3 females, $M = 139.44$ months, $SD = 12.15$) composed six personal narratives about themselves and their relationships with others. Five indicators of self/self-others, informed by Theory of Mind, were coded in the six personal narratives. They also completed normed measures of self-regulation of attention and of written composing. Correlations identified which coded indicators of self/self-others and which measures of attention regulation were significantly related to the same written composing measure to be used as predictors in multiple regressions. Results showed that coded quality of Text Organization (Self Schema in Personal Story) for “My Life Before the School Years” as first predictor AND either Focused or Switching Attention as second predictor jointly accounted for significant variance and each predictor explained unique variance in writing fluency (timed composing). Implications of findings for educational practice and future research are discussed.

KEYWORDS

Attention regulation; dysgraphia; self; theory of mind; written composing

Students in the upper elementary and secondary grades may struggle with writing for many reasons. Some students may have difficulty with integrating writing with reading. Many school assignments require that a student read authors’ texts and write about them. Integrated reading-writing can be challenging if the developing writer is not a proficient reader (Wehmeyer, Shogren, Toste, & Mahal, 2017) or writer. Some students may have difficulty with integrating listening to a teacher’s instruction while writing notes to use in studying for a test or completing a homework assignment. Listening during instruction while note-taking is not the same kind of listening students do during an informal conversation when there is frequent turn-taking. Rather, students must listen to the teacher for long stretches of time; the teacher pauses only to pose a question and give students a turn to answer (Silliman & Scott, 2009; Silliman & Wilkinson, 2015). Some students may have difficulty with the text generation process itself during written composing. For example, they may have difficulty generating a topic (Foxworth, Mason, & Hughes, 2017) or ideas about the topic to develop a text. Even if the teacher provides a topic to write about, they may struggle with

generating a text structure (MacArthur, Philipakos, Graham, & Harris, 2012). For example, for a story narrative, the writer must decide how the story will begin, climax, and end; but for an expository text, the writer must articulate a topic sentence for each paragraph and then elaborate on each topic sentence with details. Also challenging for some students is making decisions during composing about word choice, spelling, morpho-syntactic word structure (e.g., prefixes, inflectional suffixes, and derivational suffixes), and syntactic structure of sentences.

Yet another reason that students may struggle with academic writing tasks is language-related specific learning disabilities (SLDs): dysgraphia, dyslexia, or oral and written language learning disability (OWL LD) (Berninger, Richards, & Abbott, 2015). Dysgraphia is a word of Greek origin meaning condition of impaired *subword* letter production through hand. For students with dysgraphia, both impaired letter production (Wallis, Richards, Boord, Abbott, & Berninger, 2017) and impaired executive functions for attention regulation (Richards, Abbott, & Berninger, 2017; Richards et al., 2017) can interfere with written composing. Dyslexia is a word of Greek origin meaning

the condition of impaired *word* reading and spelling. The impaired spelling can interfere with written composing. OWL LD results from impaired *multi-word* syntax. The impaired syntax may interfere with not only written expression during composing but also oral expression, listening comprehension, and/or reading comprehension. Research has shown that these three SLDs affecting different levels (units) of language (Berninger et al., 2015; Berninger & Wolf, 2016) have different genetic bases (Abbott, Raskind, Matsushita, Richards, Price, & Berninger, 2017), brain bases (e.g., Berninger et al., 2015; Richards et al., 2015), and instructional needs (Berninger & Wolf, 2016). Thus, in the current study, the students with dysgraphia were carefully identified using evidence-based procedures for differential diagnosis of dysgraphia, dyslexia, and OWL LD (see methods).

Role of self in self-regulation of composing

A large body of writing research has shown the effectiveness of explicitly teaching strategies for self-regulating the composing process; students can apply these taught strategies to self-regulate, that is, guide their own writing when composing independently (see Graham, MacArthur, & Fitzgerald, 2013; Rouse & Graham, 2017). However, the goal of the current study was not to investigate self-regulated writing instruction. Rather, the goal was to investigate “the self” in self-regulated composing by coding indicators of self and self-other relationships in students’ independent composing of personal narratives. Both the topics of the personal narratives and the coded indicators of self and self-others in them were informed by Theory of Mind (Frith & Frith, 2010).

Theory of Mind has been applied to research on the cognitive processes of mind (e.g., Shao, Yao, Ceci, & Wang, 2010), the brain bases of developing awareness of self and others (e.g., Liu, Sabbagh, Gehring, & Wellman, 2009), and developmental disabilities such as autism spectrum disorder (Mundy, Sullivan, & Mastergeorge, 2009). According to the Theory of Mind, achieving a sense of self is an important developmental stepping stone in learning to understand the perspectives of others, which may differ from one’s own perspective. Theory of Mind is increasingly being applied to research on writing in children and youth (Davidson & Berninger, 2017) and adults (Panthee & Williamson, 2014) because writers need to write for an audience. Not only might the audience and author have differing perspectives but also audience members might have differing perspectives.

In the current study, participants in grades 4 to 9 first participated in an assessment study to evaluate if they met the diagnostic criteria for dysgraphia. If they did, then they participated in a computerized instructional intervention in which they were taught and practiced (a) handwriting using a stylus on an iPad screen, and (b) composing using the iPad keyboard or stylus in different sessions (see methods). In the current study, indicators of self/self-others were coded in the personal narratives students wrote in the first six sessions of the 18-session intervention program described elsewhere (Tanimoto, Thompson, Berninger, Nagy, & Abbott, 2015). Personal narratives are stories about one’s self (one’s personal story) written for others (an audience), which do not have the same goals or even text organization as a traditional narrative story with a setting, characters, plot, and ending (Wallis et al., 2017). The students with dysgraphia wrote one personal narrative on one of these topics in each of the six sessions: (a) their life during the school years, (b) their life before the school years, (c) their envisioned life after the school years, (d) their families in and outside the home, (e) their country and world, and (f) their interests in and out of school.

Five variables were coded in each of the six personal narratives for indicators of *self* or *self in relationship to other*: (a) *text organization for one’s personal life story*, (b) *relationship of one’s self to one’s family*, (c) *activities one engages in outside of school as an indicator of autonomy of the self*, (d) *application of school learning to life activities outside school as an indicator of self in applying learning*, and (e) *relationship of one’s self to other students*. Of interest was which of the five codes in each of the six personal narratives might be correlated with either of two normed measures of written composing used in schools and clinics in the United States. One written composing measure was timed and required generating ideas and syntax from three provided words in each set to construct a sentence. The other written composing measure was untimed and required combining two sentences into one sentence that expressed all the ideas in both sentences, that is, creating the syntax for already generated ideas. Normed measures allow comparison of scores of students with diagnosed dysgraphia with students without dysgraphia of comparable age in the test standardization sample without dysgraphia. In addition to coding five indicators of self/self-other relationships, it was also noted whether any of the students expressed an interest in writing or personal identity as a writer in any of the six personal narratives.

The self is also relevant to the executive functions for *self-regulation* of attention while writing. Thus,

normed measures were also used to assess two kinds of self-regulation of attention – for focused attention (inhibit what is irrelevant and focus on what is relevant) and for switching attention (rapidly name stimuli that alternate in the category to which they belong). Of interest was whether either of these measures of contrasting kinds of self-regulation of attention might be correlated with either of the two normed measures of written composing.

Specific research aims

The *first research aim* was to evaluate whether each of the five coded indicators of self or relationship of self to others in each of the six personal narratives was significantly correlated with one or both of the two normed measures of written composing. The *second research aim* was to evaluate whether each of the normed measures of executive functions for self-regulation of attention (focused attention and switching attention) was significantly correlated with one or both of the two normed measures of written composing. The *third research aim* was to perform multiple regressions, informed by the results for specific aims 1 and 2, to test this hypothesis, informed by Theory of Mind (Frith & Frith, 2010): An *indicator of self or self-other* in a personal narrative as one predictor AND a measure of self-regulation of attention as a second predictor would explain significant variance in a written composing outcome and each predictor would contribute unique variance to the outcome. That is, “the self” in *self-regulated* writing can be understood on the basis of joint and unique contributions of (a) indicators of self and relationship of self to others in personal narratives, and (b) executive functions for self-regulation of attention.

Method

Procedures approved by the Institutional Review Board at the university were used in recruiting the participants in grades 4 to 9 for this research and in conducting the research at the university site. The research was also conducted in compliance with the ethical and professional standards of the American Psychological Association.

Participants in grades 4 to 9 first completed normed measures that were used to diagnose dysgraphia, assess self-regulation of attention, and assess written composing. Those who met the research inclusion criteria for dysgraphia described later in the methods were then invited to participate in a computerized writing program that included a handwriting treatment program

(writing by stylus on an iPad screen) and a written composing program during which they alternated in writing personal narrative compositions by stylus and by keyboard (Tanimoto et al., 2015). The personal narratives completed in the first six sessions of the 18-session program were coded in the current study for indicators of the self and relationship of self to others. The remaining 12 sessions involved expository composing for read or heard texts about content areas of the curriculum.

Assessment including dysgraphia diagnosis

Dysgraphia diagnosis

Parents completed developmental, educational, and medical histories while students completed a diagnostic test battery with two handwriting measures with norms appropriate for students in grades 4 to 9 and measures of oral language, reading, and spelling used for differential diagnosis of dysgraphia, dyslexia, and OWL LD (see Berninger et al., 2015; Berninger & Wolf, 2016).

Parent questionnaire

Only students whose parents reported the following were considered for the diagnosis of dysgraphia:

- handwriting problems since kindergarten when handwriting instruction was first introduced, and
- persisting and current handwriting problems despite intervention in and/or out of school.

If the parents reported problems with oral language during the preschool years, as is a hallmark of OWL LD, or with word reading and spelling during the school years, as is a hallmark of dyslexia, but not with handwriting, the students were not considered further for a diagnosis of dysgraphia.

Handwriting measures

Two subtests of the *Detailed Assessment of Speed of Handwriting (DASH)* (Barnett, Henderson, Scheib, & Schulz, 2007) were administered. Students were asked to copy sentences with all the letters of the alphabet under two contrasting instructions – copy in one’s best handwriting and copy in one’s fastest handwriting. For an individual student to be diagnosed with dysgraphia, the average of their scaled scores ($M = 10$, $SD = 3$) for *DASH Copy Best* and for *DASH Copy Fast* had to be below 8 (i.e., the lower limit of the average range) in the low average range or lower. As a group, the students meeting diagnostic criteria for dysgraphia scored, on average, below the lower limit of the average range (8)

in the *low average range* on *DASH Best* ($M = 7.35$ $SD = 3.07$) and in the *below average range* on *DASH Fast* ($M = 5.35$, $SD = 2.46$). That is, even when they tried their best their handwriting was in the low average range and about a standard deviation below the mean. When they tried to write fast, their handwriting was in the below average range and about 1 2/3 standard deviations below the mean. In addition, they did not meet evidence-based criteria for dyslexia or OWL LD on other administered normed measures in the assessment battery.

Attention regulation measures

Self-regulation of attention was assessed because students with dysgraphia often have co-occurring problems with attention even if they do not meet full diagnostic criteria for ADHD (see introduction). *Delis Kaplan Executive Functions D-KEFS Color Word Form Inhibition* (Delis, Kaplan, & Kramer, 2001) was given to assess the self-regulation of focused attention (ability to attend to what is relevant and inhibit what is irrelevant). Based on the classic Stroop task, the task is to read orally a color word in black ink, and then name the ink color for a written word in which the color of the ink conflicts with the color name of the word (e.g., the word red written in green ink). The difference in time for reading the words in black and naming the color of the ink that conflicts with the name of the color word is an index of ability to inhibit irrelevant information and focus attention on task-relevant information. The raw score is converted to a scaled score for age ($M = 10$, $SD = 3$).

Rapid Automatic Switching (RAS) – letters and numerals (Wolf & Denckla, 2005) was given to assess the self-regulation of switching attention. The task is to name alternating lower case printed letters and written numerals arranged in rows. The total score is the time required to name alternating letters and numerals in all the rows. The total score is converted to a standard score for age ($M = 100$ and $SD = 15$). This score is a measure of self-regulation of switching attention from one kind of stimulus to another kind of stimulus.

Written composing measures

Written composing was assessed because dysgraphia often interferes with the development of written composing (see introduction) and each of the three research aims involved assessing relationships with self-regulated written composing. *WJ III Writing Fluency* (Woodcock, McGrew, & Mather, 2001) was given to assess the speed of written composing at the sentence level. The task is to compose as many written sentences as possible within a 7-min time limit for sets of three

provided written words. Each of these three words is to be used without changing them in any way (e.g., adding suffixes). The raw score is converted into a standard score for age ($M = 100$, $SD = 15$). Handwriting quality is not considered in scoring this measure of self-regulation for sustaining timed sentence composing.

Wechsler Individual Achievement Test, 3rd Edition (WIAT III) *Sentence Combining* (Pearson, 2009) was given to assess untimed composing. The task is to combine two provided sentences into one well-written sentence that contains all the ideas in the two separate sentences. The raw score is converted into a standard score for age ($M = 100$, $SD = 15$). Neither handwriting quality nor speed is taken into account in scoring.

Description of final sample

Altogether there were 20 participants who were diagnosed with dysgraphia (17 males, 3 females) and accepted the invitation to participate in the computerized writing instruction program during which they composed personal narratives. Because dysgraphia occurs in both genders, but is known to be more frequent in males, the gender distribution was not surprising. Their mean age was 11 years-7 months or 139.44 months ($SD = 12.15$). Ethnicity was representative of the region in which the research was conducted, primarily European American but a few of mixed ethnicity. However, all were native speakers of English.

Composing personal narratives

Procedures

Only the personal narratives in the first six sessions of the 18-session program were analyzed in the current study. Before the computerized writing program had begun, participants had been randomly assigned to composing personal narratives by stylus initially (first three personal narratives in a row) and then by keyboard (final three personal narratives in a row) on an iPad OR by keyboard initially (first three personal narratives in a row) and then by stylus (final three personal narratives in a row) on an iPad. Thus, for specific personal narratives, the mode of letter production (stylus or keyboard) was balanced across participants – half wrote with stylus and half wrote by the keyboard. Consequently, the findings based on group analyses of all participants for a specific coded indicator of self/self-other in a specific personal narrative are not specific to one of the production modes (stylus or keyboard).

In each of the first six sessions, participants were asked to write a different personal narrative. Topics were

designed to encourage composing about self (the developing writer): “My Autobiography During the School Years,” “My Autobiography Before the School Years,” “My Autobiography After the School Years,” “My Family In and Outside My Home,” “My Country and My World,” and “My Interests In and Out of School.” Participants were given 15 min to compose each personal narrative in each session. However, they needed frequent reminders to stay focused on writing their personal narratives and rarely sustained composing for the full 15 min.

Coding

Two of the authors read each of the personal narratives and proposed criteria for operationalizing variables to code on a scale of 1 to 4 with 1 being low and 4 being high. After discussing the criteria and agreeing on which to use in scoring, each of the two authors independently evaluated each of the personal narratives on each of five codes related to indicators of self and relationship of self to others. For the specific criteria, which are related to an ordinal scale of relative quality judgments rather than a quantitative scale based on a normal distribution of normed measures from standardized testing, see Table 1.

Code 1 – text organization for one’s personal life story

The quality of text organization in telling one’s personal life story was coded as an index of a schema for self, that is, ability to describe one’s self in an insightful, organized way, in contrast, to simply listing information about one’s self.

Code 2 – relationship of one’s self to one’s family

From birth thereafter, the others in one’s family typically play a role in the development of the child’s sense of self. Both the family who live in the home and extended family members who live outside the home may play a role in fostering this sense of self. Thus, mention of the relationship of self to a family member in or out of the home was coded.

Code 3 – activities one engages in outside of school as indicator of the self’s autonomy

During the school-day students’ activities are largely determined by teachers, but outside of school students are more likely to be able to choose activities that reflect the autonomous preferences of their own selves. Thus, mention of the activities a student participated in outside of school was coded.

Table 1. Personal narrative codes with scores and criteria descriptions.

Code	Score	Criteria description
(1) Text Organization for Personal Story	1	Criterion not addressed or very little.
	2	Criterion addressed with a few ideas but lacks organization/elaboration.
	3	Criterion addressed well with multiple ideas and good organization.
	4	Criterion addressed with exemplary content and text organization and description/explanation.
(2) Self and Family	1	Not mentioned at all.
	2	Mentioned one idea.
	3	Mentioned more than one idea but not related explicitly to writer (self).
	4	Mentioned more than one idea and related explicitly to writer (self).
(3) Self-Involvement in After School Activities	1	Not mentioned at all.
	2	Mentioned one idea.
	3	Mentioned more than one idea but not related to development of self (the writer).
	4	Mentioned more than one idea and related to development of self (the writer).
(4) Self-Motivation to Apply School Learning to Life Outside School	1	Not mentioned at all.
	2	Mentioned one idea.
	3	Mentioned more than one idea but not related to development of self (the writer).
	4	Mentioned more than one idea and related to development of self (the writer).
(5) Self and Others Outside the Family (Other Students)	1	Not mentioned at all.
	2	Mentioned one idea.
	3	Mentioned more than one idea but not related explicitly to writer (self).
	4	Mentioned more than one idea and related explicitly to writer (self).

Code 4 – application of school learning to life activities outside school as an indicator of self in applying learning

An important indicator of learning is being able to apply what is learned during the school day to life outside school. The self may play an important role in this application of school learning to life outside the school. Thus, mention of application of what is learned at school to a student’s life outside of school was coded.

Code 5 – relationships of one’s self to other students

According to Theory of Mind (Frith & Frith, 2010), the self plays an important role in developing a sense of other. Students who mention connections to friends or other students in their personal narrative may have a better developed sense of both other and self. Thus,

in the current study indicators of self-other relationships related to friends or other students were coded.

Mean percent agreement for coding the personal narratives was 91.75% ($SD = 6.55$). All coding on which there was disagreement was discussed until consensus was reached. In addition to coding the five variables in Table 1, it was also noted whether any of the students expressed an interest in writing or a personal identity as a writer in any of the six personal narratives.

Data analyses

First, Pearson product-moment correlations were computed between each participant's rating (scale of 1 to 4) on each of the five codes for indicators of self/self-other relationships in each of the six personal narratives and each of the two normed measures of written composing (Research Aim 1). Second, Pearson product-moment correlations were computed between each of the standardized normed measures of self-regulation of attention and each of the normed measures of written composing (Research Aim 2). Finally, the results of these correlations for Research Aims 1 and 2 informed the multiple regressions that were then performed (Research Aim 3). First, correlations that were significant for Research Aim 1 and for Research Aim 2 for the same written composing outcome were identified; there were two that were. Next, the coded indicator of self (in each case code 1 for the second personal narrative) was entered as predictor 1; and one of the attention regulation measures (either focused attention or switching attention) was entered as predictor 2. Each of these predictors had been correlated with the same written composing outcome *WJ III Writing Fluency*. Then, two multiple regressions, with *WJ III Writing Fluency* as the outcome, were performed for these predictors to test the hypothesis that a coded indicator of self and a normed measure of self-regulation of attention would jointly and uniquely explain achievement on the normed measure of timed written composing.

Results

The results for the correlations related to the first specific aim are summarized in Tables 2–7. The results for the correlations related to the second specific aim are summarized in Table 8. Results of the multiple regressions for testing the *a priori* hypothesis that both an “indicator of self” predictor and a “self-regulation of attention” predictor would contribute to a measure of written composing for students with dysgraphia are summarized in Table 9.

Table 2. Descriptive statistics and correlations for 5 codes in personal narrative 1 “My autobiography during the school years” (see Table 1) and 2 normed measures of written composing.

	Mean (SD)	WJ III Writing fluency 98.00 (14.30)	WIAT III Sentence combining 101.60 (13.40)
Code 1	2.00 (1.27)	$r = .46$ $p = .07$	$r = .16$ $p = .55$
Code 2 ^a	1.00 (.00)		
Code 3 ^a	1.00 (.00)		
Code 4 ^a	1.00 (.00)		
Code 5	1.41 (1.00)	$r = .06$ $p = .82$	$r = .05$ $p = .84$

^aCould not compute correlations because no variation in codes – each participant rated 1 on the criteria.

Table 3. Descriptive statistics and correlations for 5 codes in personal narrative 2 “My autobiography before the school years” (see Table 1) and 2 normed measures of written composing.

	M (SD)	WJ III Writing fluency 98.00 (14.30)	WIAT III Sentence combining 101.60 (13.40)
Code 1	2.50 (1.22)	$r = .63$ $p = .02$	$r = .56$ $p = .04$
Code 2	1.43 (.94)	$r = .33$ $p = .25$	$r = .54$ $p = .05$
Code 3 ^a	1.00 (.00)		
Code 4 ^a	1.00 (.00)		
Code 5	1.79 (1.05)	$r = -.14$ $p = .63$	$r = .14$ $p = .64$

^aCould not compute correlations because no variation in codes – each participant rated 1 on the criteria.

Table 4. Descriptive statistics and correlations for 5 codes in personal narrative 3 “My autobiography envisioned after the school years” (see Table 1) and 2 normed measures of written composing.

	M (SD)	WJ III Writing fluency 98.00 (14.30)	WIAT III Sentence combining 101.60 (13.40)
Code 1	1.89 (1.13)	$r = .33$ $p = .18$	$r = .23$ $p = .35$
Code 2	1.06 (.24)	$r = .18$ $p = .48$	$r = .44$ $p = .07$
Code 3	1.06 (.24)	$r = -.34$ $p = .16$	$r = -.11$ $p = .66$
Code 4 ^a	1.00 (.00)		
Code 5	1.11 (.32)	$r = .19$ $p = .44$	$r = .07$ $p = .78$

^aCould not compute correlations because no variation in codes – each participant rated 1 on the criteria.

First specific aim

For the first personal narrative “My (Autobiography During the School Years)”, none of the five codes was correlated at $p \leq .05$ with a written composing measure (see Table 2). For the second personal narrative (Autobiography Before the School Years), Code 1 (text organization for personal story) was correlated with both measures of written composing; and Code 2 (relationship of self to others in one's family) was correlated with the written composing measure for sentence combining (see Table 3). For the fifth personal narrative (“My Country and World”), Code 5 (Self and Others Outside the Family, including Other Students)

Table 5. Descriptive statistics and correlations for 5 codes in personal narrative 4 “My family in and out of home” (see Table 1) and 2 normed measures of written composing.

	M (SD)	WJ III writing fluency 98.00 (14.30)	WIAT III sentence combining 101.60 (13.40)
Code 1	1.32 (.75)	$r = -.05$ $p = .85$	$r = -.06$ $p = .82$
Code 2	2.95 (1.27)	$r = .41$ $p = .08$	$r = .33$ $p = .17$
Code 3	1.11 (.46)	$r = -.04$ $p = .88$	$r = -.10$ $p = .68$
Code 4 ^a	1.00 (.00)		
Code 5	1.26 (.81)	$r = .03$ $p = .90$	$r = -.38$ $p = .11$

^aCould not compute correlations because no variation in codes – each participant rated 1 on the criteria.

Table 6. Descriptive statistics and correlations for 5 codes in personal narrative 5 “My country and world” (see Table 1) and 2 normed measures of written composing.

	M (SD)	WJ III Writing fluency 98.00 (14.30)	WIAT III Sentence combining 101.60 (13.40)
Code 1	1.13 (.52)	$r = -.13$ $p = .64$	$r = .07$ $p = .82$
Code 2	1.13 (.35)	$r = .02$ $p = .95$	$r = -.36$ $p = .19$
Code 3 ^a	1.00 (.00)		
Code 4 ^a	1.00 (.00)		
Code 5	1.13 (.35)	$r = -.05$ $p = .86$	$r = -.59$ $p = .02$

^aCould not compute correlations because no variation in codes – each participant rated 1 on the criteria.

Table 7. Descriptive statistics and correlations for 5 codes in “my personal narrative 6 My interests” (see Table 1) and 2 normed measures of written composing.

	M (SD)	WJ III Writing fluency 98.00 (14.30)	WIAT III Sentence combining 101.60 (13.40)
Code 1	1.84 (.90)	$r = .27$ $p = .26$	$r = .07$ $p = .77$
Code 2 ^a	1.00 (.00)		
Code 3	2.05 (1.13)	$r = .07$ $p = .78$	$r = -.42$ $p = .08$
Code 4	1.05 (.23)	$r = -.33$ $p = .16$	$r = -.14$ $p = .57$
Code 5	1.58 (1.17)	$r = -.001$ $p = .99$	$r = -.08$ $p = .74$

^aCould not compute correlations because no variation in codes – each participant rated 1 on the criteria.

was correlated with *WIAT III* Sentence Combining (see Table 6). Thus, four coded indicators of self/self-others were correlated with a written composing outcome.

For the third personal narrative (envisioned “My Autobiography After the School Years”) (see Table 4), the fourth personal narrative (“My Family In and Outside My Home”) (see Table 5), and the sixth personal narrative (“My Interests In and Out of School”) (see Table 7), none of the five codes was correlated with either of the two normed measures of written composing. However, four correlations were marginally significant: Code 1 (text organization personal story) for first personal narrative (“My Autobiography During the School Years”) and *WJ III* Writing Fluency (see Table 2); Code 2 (relationship of

Table 8. Correlations between two normed measures of attention regulation and two normed measures of written composing.

	M (SD)	WJ III Writing fluency 98.00 (14.30)	WIAT III Sentence combining 101.60 (13.40)
Focused attention			
D-KEFS Inhibition	10.26 (3.62)	$r = .56$ $p = .01$	$r = .41$ $p = .08$
Switching attention			
Wolf & Denckla RAS	108.20 (9.18)	$r = .75$ $p < .001$	$r = .36$ $p = .12$

Table 9. Significant multiple regressions informed by the theory of mind (Frith & Frith, 2010) and significant positive correlations between codes for Personal Narrative (PN) and normed measures of written composing (in Tables 2–7) and a normed measure of attention regulation and normed measures of written composing (in Table 8).

	Standardized coefficient beta	t	p
I. Regression for predictors PN2Code1 and D-KEFS inhibition and outcome <i>WJ III Writing Fluency</i> $F(2,12) = 8.51$, $p = .007$			
PN2Code1	.484	2.48	.032
D-KEFS Inhibition	.552	2.83	.018
II. Regression for predictors PN2Code1 and <i>Wolf and Denckla RAS</i> and outcome <i>WJ III Writing Fluency</i> $F(2,13) = 22.59$, $p < .001$			
PN2Code1	.395	2.78	.018
Wolf and Denckla RAS	.681	4.79	.001

self to others in one’s family) for third personal narrative (“My Autobiography After the School Years” as envisioned by the developing writer) and *WIAT III* Sentence Combining (see Table 4); Code 2 (relationship of self to others in the family) in the fourth personal narrative (“My Family In and Outside the Home”) and *WJ III* Writing Fluency (see Table 5); and Code 3 (self-involvement in after school activities) in sixth personal narrative (“My Interests”) and *WJ III* Writing Fluency (see Table 7). These marginally significant correlations may have been significant at conventional levels if the sample size was larger.

The relatively few significant correlations between indicators of self in personal narratives and normed measures of written composing may also be due to lack of variation (each participant rated 1, the lowest score) for specific codes on specific personal narratives. For personal narrative 1, there was no variation for Codes 2, 3, and 4 (see Table 2). For personal narratives 2 and 5, there was no variation for Codes 3 and 4 (see Tables 3 and 6). For personal narratives 3 and 4, there was no variation for Code 4 (see Tables 4 and 5). For personal narrative 6, there was no variation for Code 2 (see Table 7). If the students wrote the personal narratives after completing the writing instruction program instead of at the

beginning of it, there may have been more variation for these codes. The lack of significant correlations in Tables 2–7 may also have been related to the different measurement scale properties for the variables entered into the correlations. The indicators of self/self-others in personal narratives employed an ordinal scale in which 1 is the lowest-ranking score and 4 is the highest-ranking score. Self-regulation of attention (focused and switching) and written composing were assessed with normed measures that yield quantitative standard scores yoked to the normal distribution.

Note that although the participants scored on average in the low average range (defined as scaled score of 7 to 6) or below average range (defined as scaled score of 5 or below) on the normed handwriting measures used in diagnosing dysgraphia, on average they scored in the average range (defined as standard score of 90 to 109) on both measures of written composing (see Tables 2–8). Thus, despite their impairments in letter production, the students in grades 4 to 9 with diagnosed dysgraphia had, on average, average ability for written composing, at least for sentence construction. However, if they had not been impaired in handwriting, their written composing may have been in the above average or superior or higher ranges commensurate with the oral language and cognitive (intellectual) abilities of some of the participants.

Second specific aim

As shown in Table 8, both the normed measure for self-regulation of focused attention (*D-KEFS Inhibition*) and the normed measure for self-regulation of switching attention (*Wolf & Denckla RAS*) were significantly correlated with one of the normed measures of written composing (*WJ III Writing Fluency*). Neither of the attention regulation measures was significantly correlated with the other written composing measure (*WIAT III Sentence Combining*). Self-regulation of attention may be related more to the fluency of composing when there are time limits than to integrating ideas in two sentences into one sentence when there are no time limits. However, the correlation between *D-KEFS Inhibition* and *WIAT III Sentence Combining* was marginally significant.

Third specific aim

Predictors and written composing outcomes for the multiple regressions were selected based on the following results. One of the five codes for indicator of self (quality of text organization) in one personal narrative

(“My Autobiography Before the School Years”) and each of the two normed measures of self-regulation of attention (focused attention and switching attention) were correlated with the same normed measure of written composing, *WJ III Writing Fluency*. Thus, two multiple regressions could be conducted (see Table 9). For both multiple regressions, the first predictor was quality of text organization in “My Autobiography Before the School Years.” The multiple regressions contrasted in which normed measure of attention regulation was entered as the second predictor – focused attention or switching attention. As shown in Table 9, both multiple regressions accounted for significant variance in the written composing outcome; and each of the two predictors explained unique variance in the written composing outcome. Thus, there was support for the tested hypothesis that an indicator of self/self-other and a measure of self-regulation of attention would be related jointly and uniquely to a measure of written composing.

Interest in writing and identity as a writer

Frequencies were tallied for the number of times *an interest in writing* was mentioned in any of the six personal narratives. Only one student expressed an interest in writing and only once in the personal narrative on My Interests In and Out of School.

Frequencies were also tallied for the number of times an identity as a writer was mentioned in any of the six personal narratives. One student expressed identity as a writer four times in the Autobiography During the School Years. One student expressed identity as a writer once in the envisioned Autobiography After the School Years. Another student expressed identity as a writer twice in that same personal narrative for “My Autobiography After the School Years.”

Thus, despite dysgraphia, some students expressed an interest and identity as a writer. Of note, for the codes in the personal narrative on My Interests In and Out of School, two of the correlations with *WJ III Writing Fluency* and three correlations with *WIAT III Sentence Combining* were negative for the students with dysgraphia. All other correlations in the results were positive.

Discussion

Summary of findings and their significance

First research aim

Only four significant correlations were found between indicators of self/self-others and a written composing measure:

- a. Code 1 (Text Organization for Personal Story) in “My Autobiography Before the School Years” was correlated with both *WJ III Writing Fluency* and *WIAT III Sentence Combining*. See Table 3.
- b. Code 2 (Self and Family) in “My Autobiography Before the School Years” was correlated with *WIAT III Sentence Combining*. See Table 3.
- c. Code 5 (Self and Others Outside the Family, including other students) in “My Country and World” and *WIAT III Sentence Combining*. See Table 6.

Text Organization for one’s personal story may have been correlated with two written composing measures because it reflects the degree to which a schema for self has developed. For example, consider this comparison of Code 1 rated a 2 versus Code 1 rated a 3 (see Table 1) in “My Autobiography Before the School Years.” The second one is not only longer but also provides more elaboration of the ideas and a more detailed personal story and glimpse into the self that composed the personal narrative. *Note:* neither personal narrative was edited by the researchers for spelling or grammar.

Code 1 Rated 2: “Before I entered to school I was happy I didnt have to worry about grades or expect I couldnt get to play I had peace and freedom I had a friend Used to live in near work then we moved here we got a new house because our old one was too close to the street”

Code 1 Rated 3: “Basically the whole first seven years, I was babysat by my Aunt Linda, who had a condo. She would come over before my parents left for work, and leave when they came home. During that time of my life I was able to sleep in and chill out, and I never had any real commitments. I didnt know it then, but I was living the high life, able to do whatever I pleased. I took walks daily and would go to the community center near my house for something called ‘little gym,’ which included a bouncy house so of course, I loved it. I would frequently go to my cousins, emily and lauren’s house because they were my closest friends at the time. I remember hating the fact I had to take a nap, but now I can’t see why I would hate them. If we were allowed to nap during school in 7th grade, I would be ecstatic.”

None of the correlations were positive and significant at conventional levels between an indicator of self in the personal narrative for “My Autobiography During the School Years” and written composing. Research has documented the emotional struggles students with dysgraphia face during the school years (Nielsen et al., 2017). These emotional struggles may interfere with developing a sense of self that

becomes involved in self-regulation of written composing during the school years. Three of the correlations may have been with the personal narrative for “My Autobiography Before the School Years” because, for students with dysgraphia, their sense of self may be more based on their life before they entered school and felt successful than with their lives during the school years when they have struggled with handwriting and may not feel successful.

However, despite emotional problems students with dysgraphia may develop, they may also develop self-other relationships that facilitate their written composing. Both Code 1 rated 2 and Code 1 rated 3 in the personal stories during the preschool years mentioned friends. Also, one of the significant correlations was with written composing and a coded indicator of self-other relationships (Code 5) in the personal narrative for “My Country and World”. Thus, consistent with the Theory of Mind (Frith & Frith, 2010), dysgraphia may not exert a negative influence on self-other relationships. There was also other evidence that the relationships of self and others (Code 2 Self and Family in Autobiography Before the School Years) were correlated with written composing during the school years (*WIAT III Sentence Combining*) (see Table 3). This writing measure does not require idea generation, but rather reorganization of ideas generated by others into a syntactic structure that expresses those ideas. Relationships between family and writing were also observed during the school years by Alston-Abel and Berninger (2017).

Second research aim

Both measures of self-regulation of attention (focused attention and switching attention) were related to written composing when sentences had to be composed under timed conditions (*WJ III Writing Fluency*). See Table 8. Self-regulation of attention during composing may be especially important when a writing task has time constraints. Also, attention regulation may be important in the self-regulation of written composing even if a student has not been diagnosed with ADHD as was the case for many students in this study.

Third research aim

Only two sets of predictors met the criteria for use in the multiple regressions: a specific coded indicator of self/self-other and a specific attention regulation measure correlated with the same written composing measure. When the same normed written composing measure (*WJ III Writing Fluency*) was kept constant, and code 1 (text organization of personal story) in My Autobiography Before the School Years was one

predictor and focused attention or switching attention was the second predictor, the multiple regression accounted for significant variance in writing fluency and each predictor explained unique variance in writing fluency. See Table 9. The tested *a priori* hypothesis was confirmed that both an indicator of self/self-other in a personal narrative and an attention self-regulation measure contribute to understanding “the self” in self-regulated written composing.

Limitations

Participating students in the current study ranged in grade level from 4th to 9th. Use of normed measures based on ages found in grades 4 to 9 for attention regulation and written composing controlled for differences in ages on these measures. However, the study design was not able to take into account the developmental changes in writing skills from middle childhood in upper elementary school to early adolescence in middle school. The sample size of 20 was relatively small but did have sufficient power to detect (a) four significant positive correlations between contrasting measures of the self and written composing, and (b) identify predictors related to the self that explained joint and unique variance in a written composing outcome in two multiple regressions. The focus was on dysgraphia only rather than a comparison of dysgraphia with other specific learning disabilities or typical writing.

Future research directions relevant to psychological and educational practice

Nevertheless, the current study will hopefully stimulate future research that may overcome the limitations of this initial exploratory study of the multiple aspects of self/self-others in self-regulation of writing. To begin with, “the self” in self-regulation of writing of students with and without dysgraphia could be assessed at specific grade levels and analyzed within and across grade levels (e.g., upper elementary 4th and 5th, early middle school 6th and 7th, and upper-middle school and transition to high school 8th and 9th). Such an approach would likely provide deeper insights into the development of a sense of self in self-regulation. Future research might also compare students with diagnosed dysgraphia to other kinds of specific learning disabilities such as dyslexia and OWL LD (see introduction) as well as typical controls matched on age or grade levels. Future research might also evaluate whether marginally significant correlations in the current study (see results for Research Aim 1) might be significant at

conventional levels with larger samples. Use of larger samples might also identify more relationships between (a) different kinds of indicators of self or relationship of self to others in personal narratives AND different kinds of normed measures of written compositions; and (b) different kinds of coded indicators of self/self-others in personal narratives AND performance on other kinds of writing tasks students are expected to complete at school but are not assessed on normed tests (e.g., book reports, science or social studies reports, creative writing, etc.).

Future research on “the self” in self-regulated writing might also employ intervention paradigms. The current study could not evaluate intervention effects because the personal narratives were analyzed when only one-third of the lessons had been completed, not the entire instructional program. Effectiveness of intervention could be evaluated in future research on the basis of improvement from before to after intervention on ratings on specific coded indicators of self/self-other relationships on specific personal narratives related to the intervention. For example, effectiveness of an intervention designed to give struggling writers with dysgraphia hope that they can overcome it (see Berninger & Wolf, 2016) could be evaluated based on improvement on each of the five codes in Table 1 for “My Autobiography during the School Years” and envisioned “My Autobiography After the School Years.” Future intervention studies could also be evaluated on the basis of increased observed variation (all students are rated above 1 on a specific code for a specific personal narrative).

Future research could compare the effects of use iPads for Art (see Dunn & Miller, 2016), along with writing personal narratives, to writing personal narratives alone to determine whether use of nonverbal as well as verbal strategies might be more effective than verbal strategies alone in developing the sense of self in self-regulated writing; and if so, whether that is due to the nonverbal strategies like art increasing engagement in the creativity of the writing process. Also, future research might evaluate the effectiveness of a writing intervention tailored to the assessed interests of individual students with dysgraphia (Abbott et al., 2017). Increased mention of interest in writing or identity as a writer in My Interests In and Out of School or any of the personal narratives would show whether the intervention improved interest in or identity with writing.

Finally, interventions could be designed for teaching strategies for self-regulation of focused and switching attention during various writing skills (e.g., transcribing in handwriting and spelling, translating cognition into language, and self-monitoring) that contribute to the

process and product for written composing. Effectiveness of the interventions could be evaluated based on improvement in clinical measures of executive functions for self-regulating attention and also the clinical observation of students with dysgraphia engaged in the written composing process. See Arfé, Dockrell, and Berninger (2015) and Fayol, Alamargot, and Berninger (2012).

Conclusions with focus on educational applications

Assessment

For students in grades 4 to 9 who were diagnosed with dysgraphia, the *self* in self-regulated writing for written compositional fluency can be assessed in the clinic and classroom on the basis of multiple indicators:

- a. *Writing personal narratives* about themselves and their relationships to others (family members, other students, and friends);
- b. Observed *indicators of self and self-other relationships* in the student's personal story about themselves and their relationships with others (e.g., Before the School Years); and
- c. Normed measures of self-regulation of attention for focused attention and for switching attention.

To summarize, including personal narratives coded for indicators of self and relationship of self to others, along with normed clinical measures of executive functions for self-regulation of attention, can provide insight into the self of the writer and provide clues for how instruction might be individually tailored for specific students with dysgraphia.

Instruction

In an era when the evidence is clear that struggling writers benefit from teacher-guided, explicit instruction (Rouse & Graham, 2017), it is also important to nurture the sense of self and relationship of self to others of developing writers so they can engage their selves during their independent, self-regulated writing. Doing so is especially important for learning to write in academic register, which requires self-regulation of integrated reading-writing and integrated listening-writing (see introduction).

Despite weaknesses in handwriting, students with dysgraphia may have strengths in other cognitive and linguistic processes of writing. Engaging their self in self-regulation through a sense of their personal story, their relationships to others, their engagement in their learning, their interest in writing, and their identity as a writer are some of the ways that students with dysgraphia may potentially develop their strengths in the cognitive and linguistic processes of written composing.

On the one hand, students with dysgraphia benefit from instruction in handwriting and keyboarding and the skills involved in composing sentences and texts (Berninger & Wolf, 2016). On the other hand, students with dysgraphia benefit from teachers who not only provide evidence-based, explicit writing instruction but who are also sensitive to the selves of the students they teach to write. That is, exemplary writing teachers are tuned into the person who does the writing (the writer) and tailor writing activities to those developing selves.

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