Teacher implementation of Self-Regulated Strategy Development with an automated writing evaluation system: Effects on the argumentative writing performance of middle school students[☆],[☆☆]

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ABSTRACT

This study examined the effects of teacher implementation of (1) Self-Regulated Strategy Development (SRSD) instruction or (2) traditional writing instruction, combined with an Automated Writing Evaluation (AWE) system called NC Write, on students' argumentative writing performance. The SRSD model was adapted to a lower-intensity format with the goal of supporting teacher implementation and reducing professional development. This study is the first to examine the effectiveness of an intervention that combined SRSD for writing with an AWE system. Middle school students ($N = 829$) participated in one of three conditions: NC Write + SRSD instruction, NC Write + traditional writing instruction, or a comparison condition. Results of multilevel models showed that students in the NC Write + traditional writing instruction condition produced higher-quality essays than comparison students at posttest. Students in the NC Write + SRSD instruction condition produced posttest essays that were of a higher quality, longer, and included more basic elements of argumentative essays than students in the other two conditions. Social validity data from surveys and interviews showed that students and teachers rated NC Write and SRSD instruction favorably. Overall study results suggest that incorporating AWE into a program of writing instruction supports improvements in students' writing quality. Findings provide initial evidence that when supported by AWE, SRSD may be implemented by teachers at a lower than normal treatment intensity and still have a strong, positive impact on students' writing quality.

1. Introduction

Researchers have noted the importance of writing well for academic success, civic involvement, and participation in a global economy (Graham & Perin, 2007a). However, most U.S. students are not capable writers (Harris & Graham, 2016). For example, the most recent National Assessment of Educational Progress (NAEP) writing assessment results showed the majority of students—approximately 74% in eighth grade and 73% in twelfth grade—performing at the *Below Basic* and *Basic* levels in writing, indicating only partial mastery of the knowledge and skills indicative of proficient writing (National Center for Education Statistics, 2012).

One recommendation for addressing this problem is greater adoption of evidence-based practices for writing instruction (Graham & Harris, 2013; Harris & Graham, 2016). To date, classroom application of effective strategies has been limited (Graham, 2006), and even the most convincing evidence has not translated to practice at scale (Harris & Graham, 2016). One evidence-based practice is Self-Regulated Strategy Development (SRSD) for writing, which has a strong, positive effect on students' writing (Graham & Perin, 2007b), supported by an extensive scientific evidence base.

A second recommendation is more frequent use of classroom-based formative writing assessment (Graham, Hebert, & Harris, 2015). Formative assessments are essential to expose to students the discrepancies between current and desired performance as well as to provide feedback that may be used to reduce those discrepancies (Black & Wiliam,

1998; Hattie & Timperley, 2007). Formative writing assessments that provide students with product and progress feedback have been shown to have a significant, positive impact on students' writing quality (Graham et al., 2015). Technological advancements have allowed formative writing assessment to be supported via Automated Writing Evaluation (AWE) systems, which provide students with automated scores and feedback to writing compositions. The present study examined the effects of an intervention that combined SRSD for writing with the AWE system NC Write.

1.1. Self-Regulated Strategy Development (SRSD)

The SRSD model (Graham & Harris, 1993) was designed to help students develop both the cognitive and self-regulatory skills necessary for proficient performance in an academic domain. SRSD acknowledges skill development as a complex task that affects students' content knowledge, strategic knowledge, and motivation, in line with current theories of learning (Alexander, Graham, & Harris, 1998). Instructional application of the SRSD writing model emphasizes active learning supported by appropriate scaffolds, valuing of writing and the relations between effort and writing quality, and an instructional environment that prioritizes writing by providing numerous nonthreatening writing opportunities, modeling adaptive beliefs, and providing students with feedback. SRSD is characterized as responsive instruction (Harris, Santangelo, & Graham, 2008), as strategies and instructional components are intended to be adapted to meet students' learning needs. Further, SRSD is designed to be criterion-based, in that students demonstrate proficiency with strategy use and self-regulatory procedures at each stage of instruction before proceeding to the next.

The SRSD model for writing includes (1) explicit instruction in genre knowledge and strategies for both genre-specific and general planning and writing; (2) the knowledge needed to use these strategies; and (3) explicit instruction in Self-Regulated Learning (SRL) strategies for regulating strategy use, the writing process, and behavior (Graham, Harris, & McKeown, 2013; Harris & Graham, 2016). The self-regulatory skills targeted by SRSD instruction include goal setting, self-monitoring, self-assessment, self-instruction, self-reinforcement, imagery, and managing the writing environment (Harris, Graham, Mason, & Friedlander, 2008). These self-regulatory skills provide students with tools to help them manage their use of writing strategies and the writing task and allow students to collect evidence of their own writing growth (Harris, Graham, & Mason, 2006).

Six stages of SRSD instruction provide a set of general guidelines for instruction, and the stages can be modified or revisited as needed (Harris et al., 2008; Harris, Graham, & Mason, 2003). Scaffolded support is faded across the stages of instruction in a gradual release of responsibility, so that students apply a strategy independently by the end of instruction. SRSD instruction encourages the maintenance and generalization of writing and self-regulatory strategies in a number of ways, such as by having students identify opportunities to use strategies in other settings and evaluate the success of strategy use (Harris et al., 2008).

To date more than 100 research studies have been conducted to examine the impacts of SRSD writing instruction. Research examining implementation of SRSD for writing has shown significant improvements in writing performance of elementary and middle school students (Festas et al., 2015; Graham & Harris, 2003; Harris et al., 2006), high school students (Jacobson & Reid, 2012), and adults (Berry & Mason, 2012). SRSD has been shown to be effective for a wide range of students, from gifted writers (Albertson & Billingsley, 1997) to students with cognitive or behavioral and emotional disorders (Asaro-Saddler, 2014; Ennis, Jolivette, Terry, Fredrick, & Alberto, 2015). Significant gains resulting from SRSD instruction have been documented in the areas of (1) writing quality, (2) writing knowledge, (3) writing self-efficacy, (4) approach to writing, and (5) inclusion of genre elements (Harris, Graham, Brindle, & Sandmel, 2009). From a meta-analysis of

SRSD studies, Graham and Harris (2003) reported average weighted effect sizes at posttest associated with SRSD middle school interventions of 1.21 for writing quality ($n = 3$), 2.15 for elements ($n = 2$), and 2.10 for length ($n = 3$) (see also, Graham, 2006; Graham & Perin, 2007b; Graham, McKeown, Kiuhara, & Harris, 2012).

While the SRSD writing model has been successfully implemented in a variety of instructional contexts, the vast majority of SRSD research has examined small group or one-on-one settings. Further, SRSD instruction in almost all studies has been administered by researchers or tutors. Only three published studies were identified (De La Paz & Graham, 2002; Festas et al., 2015; Wong, Hoskyn, Jai, Ellis, & Watson, 2008) that involved classwide teacher implementation of SRSD to middle school students in multiple schools. Teacher implementation of SRSD has followed substantial upfront investment (i.e., 12–14 h over two days) in practice-based professional development (PBPD) (Festas et al., 2015; Harris et al., 2012; McKeown et al., 2016).

Furthermore, the extant SRSD research has examined SRSD instruction administered for 20–45 min at a treatment intensity of three to five days per week, finding that most students develop proficiency after 8–12 lessons (Harris et al., 2008; Harris, Graham, & Santangelo, 2013). Recently, Ennis et al. (2015) used a piecewise hierarchical linear model (HLM) to investigate teacher implementation of SRSD on the writing performance of 44 secondary students with emotional and behavioral disorders in a residential setting. Teacher professional development took the form of a two-hour training followed by a one-hour practice and question session. SRSD was administered for 50-min lessons, two days per week, for eight weeks—a lower treatment intensity than previously investigated. HLM results showed significant weekly average gains in correct word sequences (11.28), essay elements (0.51), and essay quality (0.61) during the intervention compared to baseline. These results give impetus to further research examining the effects of teacher-implemented SRSD at lower treatment intensities and under conditions of reduced professional development.

1.2. Automated Writing Evaluation (AWE)

AWE systems combine automated essay scoring with automated feedback (Grimes & Warschauer, 2010) to provide students cycles of writing practice and formative feedback while reducing demands on teachers. In general, AWE systems employ statistical models based on human evaluations of writing to mimic the scoring of humans in assigning scores and providing feedback. Using techniques such as natural language processing and Latent Semantic Analysis (Landauer, Foltz, & Laham, 1998), AWE systems parse and examine human-scored training essays for variables reflecting intrinsic characteristics of writing quality. Based on findings, statistical models are produced and applied to predict scores for untrained essays. Previous studies have shown AWE systems can be as reliable as or more reliable than multiple human raters in assigning scores. For example, Shermis, Garvan, and Diao (2008) report exact and adjacent rates achieved by AWE systems with the scores of human raters in the mid-80s and mid- to high-90s, respectively, which slightly exceeds the agreement rates achieved by experienced human scorers.

Despite the demonstrated efficiency and criterion validity of AWE systems, a number of criticisms have been raised. AWE systems have been faulted for measuring a restricted writing construct, in particular for assessing text quality rather than writing ability (Deane, 2013). This leaves AWE systems susceptible to gaming (Bejar, Flor, Futagi, & Ramineni, 2014; Higgins & Heilman, 2014). Another concern is that AWE systems could replace teachers as feedback agents, compromising the social nature of writing (Conference on College Composition and Communication, 2014; National Council of Teachers of English, 2013).

The present study involved the AWE system NC Write. NC Write is part of a family of products from Measurement Incorporated that includes PEG Writing, PEG Writing Scholar, Utah Compose, and the Educational Record Bureau's Writing Practice Program. These products