



WWC Intervention Report

A summary of findings from a systematic review of the evidence



Students With a Specific Learning Disability

November 2017

Self-Regulated Strategy Development

Intervention Description¹

Self-Regulated Strategy Development (SRSD) is an intervention designed to improve students' academic skills through a six-step process that teaches students specific academic strategies and self-regulation skills. The practice is especially appropriate for students with learning disabilities, the focal population of the current report. The intervention begins with teacher direction and ends with students independently applying the strategy, such as planning and organizing ideas before writing an essay. More specifically, the six steps involve the teacher providing background knowledge, discussing the strategy with the student, modeling the strategy, helping the student memorize the strategy, supporting the strategy, and then watching as the student independently performs the strategy. A key part of the process is teaching self-regulation skills, such as goal-setting and self-monitoring, which aim to help students apply the strategy without guidance. The steps can be combined, changed, reordered, or repeated, depending on the needs of the student. The *SRSD* model can be used with students in grades 2 through 12 in individual, small group, or whole classroom settings.

Research²

The What Works Clearinghouse (WWC) identified 10 studies of *SRSD* that both fall within the scope of the Students With a Specific Learning Disability topic area and meet WWC pilot single-case design standards. No studies meet WWC group design standards. No studies meet pilot single-case design standards without reservations, and 10 studies meet pilot single-case design standards with reservations. Together, these studies included 43 children ages 7 to 16 who had a specific learning disability.

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This intervention report presents findings from a systematic review of *SRSD* conducted using the WWC Procedures and Standards Handbook (version 3.0) and the Students With a Specific Learning Disability review protocol (version 3.0).

Threshold to include single-case design evidence in WWC effectiveness ratings

All single-case design experiments presented in the same research article are considered as one study. Results from single-case design studies contribute to the WWC effectiveness rating for an outcome domain only if the studies with outcomes in that domain meet a set of threshold criteria, reflecting replication across different studies, research teams, and cases.

Specifically, these criteria include the following: (1) at least five studies that examine the intervention must meet WWC pilot single-case design standards without reservations or meet WWC pilot single-case design standards with reservations; (2) the single-case design studies must be conducted by at least three different research teams with no overlapping authorship at three different institutions; and (3) the combined number of cases (that is, participants or classrooms) must total at least 20.

For more information, please refer to the Pilot Single-Case Design Standards in Appendix E of the WWC Procedures and Standards Handbook (version 3.0).

The results from single-case design studies affect the WWC effectiveness rating for an outcome domain only if the studies with outcomes in that domain collectively meet a set of threshold criteria. (The text box above describes these criteria.)

The evidence from single-case design studies of *SRSD* on students with a specific learning disability reaches the required threshold to include single-case design evidence in the effectiveness ratings for one outcome domain—writing achievement. The evidence from the single-case design studies for *SRSD* does not reach the threshold to include single-case design evidence in the effectiveness ratings for one outcome domain—math achievement.³ No studies meet standards in the 10 other domains, so this intervention report does not report on the effectiveness of *SRSD* for those domains.⁴ (See the Effectiveness Summary on p. 6 for further description of all domains.)

Effectiveness

Based on evidence from single-case design studies, *SRSD* had potentially positive effects on writing achievement for students with a specific learning disability. The evidence from the single-case design studies for *SRSD* does not reach the threshold to include single-case design evidence in the effectiveness ratings for the math achievement domain.

Table 1. Summary of findings from single-case studies⁵

Outcome domain	Number of studies	Number of research teams	Number of cases ^a	Rating of effectiveness	Percentage of SCD experiments demonstrating a positive effect (#)	Percentage of SCD experiments demonstrating a negative effect (#)
Writing achievement	9	3	37	Potentially positive effects	88% (15/17)	0% (0/17)
Math achievement	1	1	3	na	na	na

Table Notes: In single-case design research, a case, such as a student or classroom, is the unit of intervention administration and data analysis. An experiment examines a single outcome measure repeatedly within and across different phases defined by the presence or absence of the intervention. There might be multiple experiments for a case if more than one outcome is examined, for example. All experiments within a research article are considered as one single-case design study. For the math achievement domain, the rating of effectiveness and percentage of single-case design experiments demonstrating a positive or negative effect are not applicable (na) because the studies with outcomes in this domain do not meet the threshold criteria to include single-case design evidence in the effectiveness ratings. SCD = single-case design.

^a In this intervention report, three cases represented classrooms with two students each. The rest of the cases were single students. Therefore, the writing achievement domain included a total of 40 students.

Intervention Information

Background

SRSD is an academic practice developed by Karen Harris and Steven Graham in the early 1980s for teaching writing and other related skills to young students with learning difficulties. The practice has evolved over time and can now be used with students in grades 2 through 12 across multiple content areas, and in individual, small group, or whole classroom settings. Although *SRSD* can be used with all students, it is especially appropriate for students with learning disabilities, the focal population of the current report. Students learn specific strategies for carrying out tasks, such as writing essays or completing math problems, and learn procedures for regulating the use of the strategies they have learned, such as goal-setting and self-monitoring. Free *SRSD* materials are available through thinkSRSD (www.thinksrsd.com), an online resource developed to help school districts and educators implement *SRSD* in the classroom. Lesson plans for many of the *SRSD* strategies are also available in Harris, K. R., Graham, S., Mason, L., and Friedlander, B. (2008). *Powerful writing strategies for all students*. Baltimore, MD: Brookes.

Intervention details

SRSD is an academic practice that involves teachers' use of explicit instruction to teach students concrete strategies to improve writing and other academic skills. Strategies vary depending on the content area as well as the age and needs of the student. For example, teachers might introduce individual students to a specific strategy that will help them plan and brainstorm ideas for writing a story. Teachers often provide the students with mnemonic devices to ensure they remember to include all required steps or elements when carrying out the strategy. Teachers instruct students on how to monitor and evaluate their use of the strategy through self-regulation, and then model both the use of the strategy and self-regulation skills. They then ensure that students have memorized the strategy and can apply it correctly on their own.

Lessons generally occur at least three times a week, and usually last 20 to 60 minutes. *SRSD* instruction typically includes the following six stages that can be reordered, combined, changed, and repeated, depending on students' needs:

1. *Develop background knowledge*. The teacher identifies skill deficits and helps students develop the prerequisite skills needed to understand, learn, and apply the strategy.
2. *Discuss the strategy*. The teacher and students discuss the students' performance to identify areas for improvement and help motivate the students to use the strategy. Students might also identify one or more areas in which they seek to improve and learn how to monitor progress. The teacher introduces the strategies and the rationale for each step, often using a mnemonic device to help students remember each component.
3. *Model the strategy*. The teacher models the strategy as many times as necessary, using a think-aloud process and voicing positive self-statements. The teacher and students discuss the advantages and challenges of the strategy and think about possible ways to improve the strategy. Teachers often introduce goal-setting concepts, and students can set individual targets to improve on baseline performance.
4. *Memorize the strategy*. Students use mnemonic devices to memorize the steps required to apply the strategy. Students can paraphrase steps, and the teacher can use prompts for students who struggle.
5. *Support the strategy*. Students gradually take responsibility for applying the strategy. The teacher provides support that is tailored to the needs of the student, provides frequent constructive feedback, and offers positive reinforcement. Teachers can also engage other classmates by organizing peer groups to help promote strategy use outside of *SRSD* instruction. For example, classmates within a peer group can share how they make decisions while writing.

6. *Independent performance.* Students consistently and effectively use a strategy, often in multiple settings and with different tasks. Students learn how using the strategy improves their performance and how to modify the strategy as appropriate.

During the instructional process, the teacher gradually transfers responsibility for implementing the strategy to students, until the students can adequately perform the tasks without support. After the *SRSD* training period has ended, students demonstrate how to use the skills they learned on their own. Teachers and researchers measure the impact of the *SRSD* intervention during this post-training phase, after implementing the full *SRSD* intervention. They often also measure the long-term impacts of *SRSD* during later maintenance phases to determine whether effects were sustained over time.

Cost

SRSD is a set of practices, not a product that can be purchased. An online resource, thinkSRSD (www.thinksrsd.com), provides free materials designed to help school districts and educators implement *SRSD* in the classroom. In addition, as of November 2017, professional development on the use of *SRSD* is available through thinkSRSD and ranges in price from \$100 for online courses to \$495 for in-person courses. Additional information about school-wide costs of teacher training or implementation of *SRSD* is not available.

Research Summary

The WWC identified two eligible group design studies and 14 eligible single-case design studies that investigated the effects of *SRSD* on students with a specific learning disability. An additional 115 studies were identified but do not meet WWC eligibility criteria (see the Glossary of Terms in this document for a definition of this term and other commonly used research terms) for review in this topic area. Citations for all 131 studies are in the References section, which begins on p. 7.

The WWC reviewed the two group design studies against group design standards. No studies meet group design standards with or without reservations.

The WWC reviewed the 14 single-case design studies against pilot single-case design standards. No studies meet pilot single-case design standards without reservations, and 10 studies meet pilot single-case design standards with reservations. This report summarizes those 10 studies. The remaining four studies do not meet pilot single-case design standards.

Nine of the 10 studies that meet pilot single-case design standards with reservations have at least one outcome in a domain that reaches the threshold for including single-case design evidence in the effectiveness ratings. Appendices A–C describe the details of these studies. The remaining study that meets WWC pilot single-case design standards with reservations has outcomes only in a domain that does not reach the threshold for including single-case design evidence in the effectiveness ratings in this report; more details on this study are available in Appendix D.⁶

Summary of studies meeting WWC pilot single-case design standards without reservations

No studies of *SRSD* meet WWC single-case design standards without reservations.

Summary of studies meeting WWC pilot single-case design standards with reservations

Ten studies have experiments that meet WWC pilot single-case design standards with reservations.⁷ These experiments investigated the effects of *SRSD* on writing and math achievement outcomes. The experiments included students ages 7 to 16 with a specific learning disability. Appendices A–D describe the details of these studies.

Table 2. Scope of reviewed research

Grades	2–10
Delivery method	Individual
Intervention type	Practice

Effectiveness Summary

The WWC review of *SRS*D for the Students With a Specific Learning Disability topic area includes student outcomes in 12 domains: alphabets, comprehension, general reading achievement, math achievement, problem behavior, reading fluency, school engagement, science achievement, self-determination, social-emotional competence, social studies achievement, and writing achievement. The 10 studies of *SRS*D that met WWC pilot single-case design standards reported findings in two of the 12 domains: (a) writing achievement and (b) math achievement. Effectiveness ratings of *SRS*D for the Students With a Specific Learning Disability topic area are presented for one of the two domains (writing achievement). The findings from the math achievement domain do not meet the threshold to include single-case design evidence in the effectiveness ratings in this report.⁸ For a more detailed description of the rating of effectiveness for single-case design studies and extent of evidence criteria, see the WWC Rating Criteria that starts on p. 39.

Summary of effectiveness for the writing achievement domain

Table 3. Rating of effectiveness for single-case design studies for the writing achievement domain

Rating of effectiveness	Criteria met
Potentially positive effects <i>Strong evidence of a positive effect with no overriding contrary evidence.</i>	Across the 17 single-case design experiments for the <i>writing achievement</i> domain, 15 experiments (88%) documented a positive effect, and 0 experiments documented a negative effect. All 15 of these single-case design experiments met WWC pilot SCD standards with reservations; because no studies met WWC pilot SCD standards without reservations, the rating of effectiveness is potentially positive effects.

Nine studies that met WWC pilot single-case design standards with reservations reported findings in the writing achievement domain. Author-reported findings for each study are available in Appendix A. The results of the WWC’s visual analysis of each single-case design experiment are available in Appendix C. Across the 17 single-case design experiments included in these nine studies, 15 experiments (88%) documented a positive effect, and 0 experiments documented a negative effect.⁹ This results in a rating of potentially positive effects for the writing achievement domain.

References

Studies that meet WWC group design standards without reservations

None.

Studies that meet WWC group design standards with reservations

None.

Studies that meet WWC pilot single-case design standards without reservations

None.

Studies that meet WWC pilot single-case design standards with reservations

- Case, L. P., Harris, K. R., & Graham, S. (1992). Improving the mathematical problem-solving skills of students with learning disabilities: Self-regulated strategy development. *Journal of Special Education, 26*(1), 1–19. Retrieved from <https://eric.ed.gov/?id=EJ448562>
- Danoff, B., Harris, K. R., & Graham, S. (1993). Incorporating strategy instruction within the writing process in the regular classroom: Effects on the writing of students with and without learning disabilities. *Journal of Reading Behavior, 25*(3), 295–322. Retrieved from <https://eric.ed.gov/?id=EJ472501>
- De La Paz, S. (1999). Self-regulated strategy instruction in regular education settings: Improving outcomes for students with and without learning disabilities. *Learning Disabilities Research & Practice, 14*(2), 92–106. Retrieved from <https://eric.ed.gov/?id=EJ587699>
- De La Paz, S., & Graham, S. (1997). Strategy instruction in planning: Effects on the writing performance and behavior of students with learning difficulties. *Exceptional Children, 63*(2), 167–181. Retrieved from <https://eric.ed.gov/?id=EJ542671>
- Graham, S., & Harris, K. R. (1989). Improving learning disabled students' skills at composing essays: Self-instructional strategy training. *Exceptional Children, 56*(3), 201–214. Retrieved from <https://eric.ed.gov/?id=EJ400693>
- Saddler, B. (2006). Increasing story writing ability through self-regulated strategy development: Effects on young writers with learning disabilities. *Learning Disability Quarterly, 29*(4), 291–305. Retrieved from <https://eric.ed.gov/?id=EJ786220>
- Saddler, B., & Asaro, K. (2007). Increasing story quality through planning and revising: Effects on young writers with learning disabilities. *Learning Disability Quarterly, 30*(4), 223–234. Retrieved from <https://eric.ed.gov/?id=EJ786254>
- Sexton, M., Harris, K. R., & Graham, S. (1998). Self-regulated strategy development and the writing process: Effects on essay writing and attributions. *Exceptional Children, 64*(3), 295–311. Retrieved from <https://eric.ed.gov/?id=EJ563946>
- Straub, C. L. (2012). *The effects of synchronous online cognitive strategy instruction in writing for students with learning disabilities* (Doctoral dissertation). Retrieved from <http://stars.library.ucf.edu/>
- Troia, G. A., Graham, S., & Harris, K. R. (1999). Teaching students with learning disabilities to mindfully plan when writing. *Exceptional Children, 65*(2), 235–252. Retrieved from <https://eric.ed.gov/?id=EJ579491>

Studies that do not meet WWC group design standards

- Curry, K. A. (1997). *A comparison of the writing products of students with learning disabilities in inclusive and resource room settings using different writing instruction approaches* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 9810975) The study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

Johnson, L., Graham, S., & Harris, K. R. (1997). The effects of goal setting and self-instruction on learning a reading comprehension strategy: A study of students with learning disabilities. *Journal of Learning Disabilities, 30*(1), 80–91. Retrieved from <https://eric.ed.gov/?id=EJ542685> The study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

Studies that do not meet WWC pilot single-case design standards¹⁰

- Bednarczyk, A. M. (1991). *The effectiveness of story grammar instruction within a self-instructional strategy development framework for students with learning disabilities* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 9133032) The study does not meet WWC pilot single-case design standards because there are insufficient data to evaluate the attempts to demonstrate an intervention effect.
- Cuenca-Carlino, Y., Freeman-Green, S., Stephenson, G. W., & Hauth, C. (2016). Self-regulated strategy development instruction for teaching multi-step equations to middle school students struggling in math. *Journal of Special Education, 50*(2), 75–85. Retrieved from <https://eric.ed.gov/?id=EJ1106272> The study does not meet WWC pilot single-case design standards because the measures of effectiveness cannot be attributed solely to the intervention.
- Hoover, T. M., Kubina, Jr., R. M., & Mason, L. H. (2012). Effects of self-regulated strategy development for POW+TREE on high school students with learning disabilities. *Exceptionality, 20*(1), 20–38. Retrieved from <https://eric.ed.gov/?id=EJ953770> The study does not meet WWC pilot single-case design standards because there are insufficient data to evaluate the attempts to demonstrate an intervention effect.
- McConnell, A. E., Little, K. S., & Martin, J. E. (2015). Transition planning and writing instruction: The effects of a brief intervention. *British Journal of Special Education, 42*(1), 87–111. Retrieved from <https://eric.ed.gov/?id=EJ1054010> The study does not meet WWC pilot single-case design standards because there are insufficient data to evaluate the attempts to demonstrate an intervention effect.

Studies that are ineligible for review using the Students With a Specific Learning Disability Evidence Review Protocol

- Adkins, M. H. (2005). *Self-regulated strategy development and generalization instruction: Effects on story writing among second and third grade students with emotional and behavioral disorders* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 304994949) This study is ineligible for review because it does not use a sample aligned with the protocol.
- Albertson, L. R. (1998). *A cognitive-behavioral intervention study: Assessing the effects of strategy instruction on story writing* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 9826325) This study is ineligible for review because it does not use an eligible design.
- Allen-Bronaugh, D. (2013). *The effects of self-regulated strategy development on the written language performance of students on the autism spectrum* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 3562266) This study is ineligible for review because it is out of the scope of the protocol.
- Anderson, A. A. (1997). *The effects of sociocognitive writing strategy instruction on the writing achievement and writing self-efficacy of students with disabilities and typical achievement in an urban elementary school* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 9816221) This study is ineligible for review because it does not use a sample aligned with the protocol.
- Asaro, K. (2008). *The effects of planning instruction and self-regulation training on the writing performance of young writers with autism spectrum disorders* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 304356319) This study is ineligible for review because it does not use an eligible design.
- Asaro-Saddler, K. (2014). Self-regulated strategy development: Effects on writers with autism spectrum disorders. *Education and Training in Autism and Developmental Disabilities, 49*(1), 78–91. Retrieved from <https://eric.ed.gov/?id=EJ1016616> This study is ineligible for review because it does not use a sample aligned with the protocol.

- Asaro-Saddler, K. (2016). Writing instruction and self-regulation for students with autism spectrum disorders. *Topics in Language Disorders, 36*(3), 266–283. Retrieved from <https://eric.ed.gov/?id=EJ1110902> This study is ineligible for review because it does not use an eligible design.
- Asaro-Saddler, K., & Bak, N. (2012). Teaching children with high-functioning autism spectrum disorders to write persuasive essays. *Topics in Language Disorders, 32*(4), 361–378. Retrieved from <https://eric.ed.gov/?id=EJ1001639> This study is ineligible for review because it does not use an eligible design.
- Asaro-Saddler, K., & Bak, N. (2014). Persuasive writing and self-regulation training for writers with autism spectrum disorders. *The Journal of Special Education, 48*(2), 92–105. Retrieved from <https://eric.ed.gov/?id=EJ1031258> This study is ineligible for review because it does not use a sample aligned with the protocol.
- Baker, S., Chard, D. J., Ketterlin-Geller, L., Apichatabutra, C., & Doabler, C. (2009). Teaching writing to at-risk students: The quality of evidence for self-regulated strategy development. *Exceptional Children, 75*(3), 303–318. Retrieved from <https://eric.ed.gov/?id=EJ842537> This study is ineligible for review because it does not use an eligible design.
- Barry, L. M., & Moore, W. E. (2004). Students with specific learning disabilities can pass state competency exams: Systematic strategy instruction makes a difference. *Preventing School Failure, 48*(3), 10–15. Retrieved from <https://eric.ed.gov/?id=EJ744576> This study is ineligible for review because it does not use an eligible design.
- Benedek-Wood, E., Mason, L. H., Wood, P. H., Hoffman, K. E., & McGuire, A. (2014). An experimental examination of quick writing in the middle school science classroom. *Learning Disabilities: A Contemporary Journal, 12*(1), 69–92. Retrieved from <https://eric.ed.gov/?id=EJ1039825> This study is ineligible for review because it does not use a sample aligned with the protocol.
- Berninger, V., Vaughan, K., Abbot, R., Begay, K., Coleman, K. B., Curtin, G., & Graham, S. (2002). Teaching spelling and composition alone and together: Implications for the simple view of writing. *Journal of Educational Psychology, 94*(2), 291–304. Retrieved from <https://eric.ed.gov/?id=EJ648503> This study is ineligible for review because it does not use a sample aligned with the protocol.
- Biedenbach, S. B. (2004). *Surviving the academy through process and practice: The impact of using a self-regulated strategy development approach for teaching college-level basic writers* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 305209029) This study is ineligible for review because it does not use a sample aligned with the protocol.
- Borkowski, J. G. (1992). Metacognitive theory: A framework for teaching literacy, writing, and math skills. *Journal of Learning Disabilities, 25*(4), 253–257. Retrieved from <https://eric.ed.gov/?id=EJ445830> This study is ineligible for review because it does not use an eligible design.
- Butler, D. L., & Schnellert, L. (2015). Success for students with learning disabilities: What does self-regulation have to do with it? In T. J. Cleary (Ed.), *Self-regulated learning interventions with at-risk youth: Enhancing adaptability, performance, and well being* (pp. 89–111). Washington, DC: American Psychological Association. This study is ineligible for review because it does not use an eligible design.
- Cerar, N. I. (2012). *Teaching students with emotional and behavior disorder how to write persuasive essays fluently* (Unpublished doctoral dissertation). George Mason University, Fairfax, VA. Retrieved from <https://eric.ed.gov/?id=ED548724> This study is ineligible for review because it does not use a sample aligned with the protocol.
- Chalk, J. C., Hagan-Burke, S., & Burke, M. D. (2005). The effects of self-regulated strategy development on the writing process for high school students with learning disabilities. *Learning Disability Quarterly, 28*(1), 75–87. Retrieved from <https://eric.ed.gov/?id=EJ710418> This study is ineligible for review because it does not use an eligible design.
- Cohen, N. A. (2013). *Effectiveness of toys as an enhancement to instruction in explanation for students with learning disabilities* (Doctoral dissertation). Retrieved from <https://eric.ed.gov/?id=ED555894> This study is ineligible for review because it does not use an eligible design.

- Cramer, M. M. (2011). *The effects of strategy instruction for writing and revising persuasive quick writes on middle school students with emotional behavioral disorders* (Doctoral dissertation). Retrieved from <https://eric.ed.gov/?id=ED534682> This study is ineligible for review because it does not use a sample aligned with the protocol.
- Cuenca-Sanchez, Y. (2010). *Middle school students with emotional disorders: Determined to meet their needs through persuasive writing* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 821549862) This study is ineligible for review because it does not use a sample aligned with the protocol.
- Damico, H. W. (2014). An investigation of the processes of meaning construction in the writing behaviors of a child with language disorder. In M. J. Ball, N. Müller, & R. L. Nelson (Eds.), *Handbook of qualitative research in communication disorders* (pp. 257–270). New York, NY: Psychology Press. This study is ineligible for review because it does not use an eligible design.
- De La Paz, S. (1997). Strategy instruction in planning: Teaching students with learning and writing disabilities to compose persuasive and expository essays. *Learning Disability Quarterly*, 20(3), 227–248. Retrieved from <https://eric.ed.gov/?id=EJ556905> This study is ineligible for review because it does not use an eligible design.
- De La Paz, S., & Graham, S. (2002). Explicitly teaching strategies, skills, and knowledge: Writing instruction in middle school classrooms. *Journal of Educational Psychology*, 94(4), 687–698. Retrieved from <https://eric.ed.gov/?id=EJ658850> This study is ineligible for review because it does not use a sample aligned with the protocol.
- De La Paz, S., & Sherman, C. K. (2013). Revising strategy instruction in inclusive settings: Effects for English learners and novice writers. *Learning Disabilities Research & Practice*, 28(3), 129–141. Retrieved from <https://eric.ed.gov/?id=EJ1026694> This study is ineligible for review because it does not use a sample aligned with the protocol.
- De La Paz, S., Owen, B., Harris, K. R., & Graham, S. (2000). Riding Elvis's motorcycle: using self-regulated strategy development to plan and write for a state writing exam. *Learning Disabilities Research & Practice*, 15(2), 101–109. This study is ineligible for review because it does not use an eligible design.
- Delano, M. E. (2007a). Improving written language performance of adolescents with Asperger syndrome. *Journal of Applied Behavior Analysis*, 40(2), 345–351. Retrieved from <https://eric.ed.gov/?id=EJ767631> This study is ineligible for review because it does not use a sample aligned with the protocol.
- Delano, M. E. (2007b). Use of strategy instruction to improve the story writing skills of a student with Asperger syndrome. *Focus on Autism and Other Developmental Disabilities*, 22(4), 252–258. Retrieved from <https://eric.ed.gov/?id=EJ787120> This study is ineligible for review because it does not use an eligible design.
- Dinkins, E. G. (2010). *The process and potential of combined writing instruction: Self-regulated strategy development in a workshop classroom* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 851551034) This study is ineligible for review because it does not use an eligible design.
- Ennis, R. P. (2013). Self-regulated strategy development for students with emotional/behavioral disorders in a residential school (Unpublished doctoral dissertation). Georgia State University, Atlanta. Retrieved from <https://eric.ed.gov/?id=ED555132> This study is ineligible for review because it does not use a sample aligned with the protocol.
- Ennis, R. P., & Jolivet, K. (2014). Existing research and future directions for self-regulated strategy development with students with and at risk for emotional and behavioral disorders. *The Journal of Special Education*, 48(1), 32–45. Retrieved from <https://eric.ed.gov/?id=EJ1022225> This study is ineligible for review because it does not use an eligible design.
- Ennis, R. P., Jolivet, K., Terry, N. P., Fredrick, L. D., & Alberto, P. A. (2014). Classwide teacher implementation of self-regulated strategy development for writing with students with E/BD in a residential facility. *Journal of Behavioral Education*, 24(1), 88–111. Retrieved from <https://eric.ed.gov/?id=EJ1052708> This study is ineligible for review because it does not use a sample aligned with the protocol.

- ERIC Clearinghouse on Disabilities and Gifted Education, Arlington, VA ERIC/OSEP, Special Project. (2002). Strengthening the second “R”: Helping students with disabilities prepare well-written compositions. *Research Connections in Special Education*, 10. Retrieved from <https://eric.ed.gov/?id=ED464444> This study is ineligible for review because it does not use an eligible design.
- Evmenova, A. S., Regan, K., Boykin, A., Good, K., Hughes, M., MacVittie, N., ... Chirinos, D. (2016). Emphasizing planning for essay writing with a computer-based graphic organizer. *Exceptional Children*, 82(2), 170–191. Retrieved from <https://eric.ed.gov/?id=EJ1085548> This study is ineligible for review because it does not use a sample aligned with the protocol.
- Gersten, R., Baker, S., Edwards, L., & ERIC Clearinghouse on Disabilities and Gifted Education. (1999). *Teaching expressive writing to students with learning disabilities*. ERIC/OSEP digest E590. Retrieved from <https://eric.ed.gov/?id=ED439532> This study is ineligible for review because it does not use an eligible design.
- Graham, S. (2006). Strategy instruction and the teaching of writing: A meta-analysis. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 187–207). New York, NY: Guilford Press. This study is ineligible for review because it does not use an eligible design.
- Graham, S., & Harris, K. R. (1989). Components analysis of cognitive strategy instruction: Effects on learning disabled students’ compositions and self-efficacy. *Journal of Educational Psychology*, 81(3), 353–361. Retrieved from <https://eric.ed.gov/?id=EJ399799> This study is ineligible for review because it does not use an eligible design.
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Appendix A.1: Research details for Danoff et al. (1993)

Danoff, B., Harris, K. R., & Graham, S. (1993). Incorporating strategy instruction within the writing process in the regular classroom: Effects on the writing of students with and without learning disabilities. *Journal of Reading Behavior, 25*(3), 295–322.

Setting The study was conducted in a suburban elementary school located in the northeastern United States. The intervention took place in three general education classrooms, including two fifth-grade classrooms and one fourth-grade classroom, during a period called “writers’ workshop.” The school’s special education teacher took primary responsibility for developing and delivering the lessons included in this study, with back-up provided by the general education classroom teachers. The school had about 370 students, and there were 25 to 28 students in each class.

Study sample The study sample included two fifth-grade students (one male, one female) and one fourth-grade student (female) who were identified as having learning disabilities (LD) by their school district. Each student had an IQ above 85, with achievement at least one standard deviation below grade level. The fifth graders were White, and the fourth grader was Asian. The study also included experiments for three additional participants who did not have LD. The experiments for these students are not described in this report or included in the ratings of effectiveness.

Intervention The *Self-Regulated Strategy Development (SRSD)* intervention model was used to teach students how to improve their writing skills. The writing and self-regulation strategies used in this study were taught to all students through a series of mini-lessons delivered by the school’s special education teacher. During the *SRSD* training phase, the teacher introduced a writing strategy to the class and gave them a small chart and a mnemonic device for remembering the seven basic parts of a story. The mnemonic device was ““WWW, What=2, How=2” and asked students to think about the following prompts: “Who are the main characters? When does the story take place? Where does the story take place? What do the main characters want to do? What happens when the main characters try to do it? How does the story end? How do the main characters feel?” Progression through the stages of instruction was criterion-based rather than time-based. The students required a series of nine to 11 mini-lessons to master the strategy and self-regulation procedures. The post-training story probes were administered immediately following *SRSD* instruction.

Comparison The study used a multiple baseline design across students for each outcome. During the baseline condition for each student, teachers taught their classes as usual, and the special education teacher provided instructional assistance to students with disabilities.

Outcomes and measurement The outcomes were the number of story elements and the story grammar scale score, which both fall within the writing achievement domain. For a more detailed description of these outcome measures, see Appendix B. The study also examined the number of words written and the holistic rating scale; these outcomes did not meet standards because they were not displayed graphically. In addition, the authors measured strategy usage and self-efficacy, but these outcomes are not eligible under the study review protocol. Results from the two experiments with outcomes in the writing achievement domain are presented in Appendix C.1.

Support for implementation	The special education teacher adapted lesson plans from previous studies of <i>SRSD</i> and followed all steps of the <i>SRSD</i> model.
Author-reported findings	The study authors found that <i>SRSD</i> had a positive impact on the story grammar scale score and the number of story elements for all students. The results of WWC's corresponding visual analysis are presented in Appendix C.
Maintenance	The students' general education classroom teacher for the writers' workshop administered a generalization story probe immediately following the post-training story probes. In addition, maintenance story probes were administered 2 weeks and 4 weeks following the completion of instruction. In general, the students' scores during the maintenance and generalization probes were similar to their post-training phases. However, there was a downward trend for the story grammar scale score.
WWC study rating	Meets WWC Pilot Single-Case Design Standards With Reservations. Reason for study rating: The experiments for both outcomes used multiple probe designs across participants. The baseline phase for the first student and the post-training phases for all students had just three data points (rather than five). In addition, the baseline sessions for each case only overlapped vertically for one probe data point. Finally, each case not receiving the intervention did not have a probe point in a session in which another case either first received the intervention or reached the prespecified intervention criterion, but cases did continue to have baseline data after cases in higher tiers of the experiment entered the post-training phase. ¹¹ For these three reasons, the experiments for both outcomes meet WWC pilot single-case design standards with reservations.

Appendix A.2: Research details for De La Paz (1999)

De La Paz, S. (1999). Self-regulated strategy instruction in regular education settings: Improving outcomes for students with and without learning disabilities. *Learning Disabilities Research & Practice, 14*(2), 92–106.

Setting	The study was conducted in two middle schools in one school district in the southeastern United States. In one middle school, the student population was 94% White, 5% African American, and 1% Asian or Latino; 18% of the students qualified for free or reduced-price lunch. In the other middle school, the student demographics were nearly identical, except only 12% of its students qualified for free or reduced-price lunch. The intervention took place in two seventh-grade and one eighth-grade general education classrooms.
Study sample	The study sample included six students in seventh or eighth grade who were identified as having LD by their school district. The students had verbal IQ scores that ranged from 85 to 125; scored below average on the reading, writing, or math sections of the Wechsler Individual Achievement Test (WIAT); ¹² had no other disabilities; and spoke English as their primary language. One student was female, while the other five were male. All students in the study sample were White, and their ages ranged from 12 to 14 years old. The study also included separate experiments for 14 other students without LD, who were described as low-, average-, or high-achieving students. The experiments for students without LD are not described in this report or included in the ratings of effectiveness.

Intervention	<p>The <i>SRSD</i> intervention model was used to teach students how to write effective essays. The PLAN and WRITE mnemonics were used to help students remember the writing steps and strategies they had learned. The PLAN mnemonic asked students to pay attention to the writing prompt, list the main ideas, add supporting ideas, and number their ideas. The WRITE mnemonic asked them to work from the plan they had developed, remember their goals, include transition words, try to use different kinds of sentences, and use exciting words. Twelve to 16 sessions were offered, varying by classroom. Each <i>SRSD</i> session took place during one full class period for 4 days a week, over a 4-week period; some sessions were lost due to weather and other factors. Post-training essay probes were administered immediately following <i>SRSD</i> instruction.</p>
Comparison	<p>The study used a multiple probe design across classrooms for both outcomes. Each of the three classrooms had two students. During the baseline condition for each class, teachers taught their classes as usual.</p>
Outcomes and measurement	<p>The study outcomes were holistic quality and the number of words in each essay, which fall within the writing achievement domain. For a more detailed description of these outcome measures, see Appendix B. The study also measured the number of functional essay elements; this outcome does not meet standards because data on inter-assessor agreement were not collected in each phase.¹³ Results from the two experiments with outcomes in the writing achievement domain are presented in Appendix C.1.</p>
Support for implementation	<p>Teachers were given instruction manuals, and each attended 2 days of <i>SRSD</i> training.</p>
Author-reported findings	<p>The study authors found that the length of students' essays (as measured by number of words) increased by 250%. They also found that the holistic quality generally improved, with the exception of one post-training essay for two students. The results of WWC's corresponding visual analysis are presented in Appendix C.</p>
Maintenance	<p>Maintenance phases included one probe for each class and each outcome. In general, these probes were slightly lower than the mean of the post-training probes.</p>
WWC study rating	<p>Meets WWC Pilot Single-Case Design Standards With Reservations.</p> <p>Reason for study rating: The experiments for holistic writing and number of words used multiple probe designs; because the post-training phases had only three data points (rather than five) and some cases had data only in the first two baseline sessions (rather than the first three baseline sessions), these experiments meet WWC pilot single-case design standards with reservations.</p>

Appendix A.3: Research details for De La Paz and Graham (1997)

De La Paz, S., & Graham, S. (1997). Strategy instruction in planning: Effects on the writing performance and behavior of students with learning difficulties. *Exceptional Children*, 63, 167–181.

Setting	The study took place in two suburban mid-Atlantic elementary schools. The students received the intervention during individual instruction periods.
Study sample	The study sample included three fifth-grade students who received special education services for students with LD. Rand was an 11-year-old African-American student who had an IQ of 64 on the Wechsler Intelligence Scale-III. Elayne was an 11-year-old Caucasian student who had an IQ of 128. Aviendha was a 10-year-old African-American student who had an IQ of 105. ¹⁴
Intervention	The <i>SRSD</i> intervention model was used to teach students the STOP and DARE writing strategies. For STOP, students were taught to suspend judgment, take a side, organize ideas, and plan as they write. For DARE, students were taught to develop a topic sentence, add supporting ideas, reject possible arguments for the other side, and end with a conclusion. Each session lasted 45–55 minutes. Post-training essay probes were administered immediately following <i>SRSD</i> instruction.
Comparison	The study used a multiple probe design across participants. Prior to collecting baseline data, teachers had introduced students to the components of a good essay and the importance of advanced planning. During the baseline condition, students wrote essays on select topics without any planning instruction.
Outcomes and measurement	The study outcome was the number of functional essay elements, which falls within the writing achievement domain. For a more detailed description of this outcome measure, see Appendix B. The study also examined essay length, essay coherence, and holistic quality; these outcomes did not meet standards because they were not displayed graphically. In addition, the study authors measured the amount of time spent planning before writing, number of transformations from planning to essay, writing time, strategy use, and social validation. These outcomes are not eligible under the study review protocol. Results from the one experiment with outcomes in the writing achievement domain are presented in Appendix C.1.
Support for implementation	The teacher used scripted lesson plans and a checklist to ensure that all instructional steps were completed.
Author-reported findings	The study authors found that the number of functional essay elements increased by 376% for Rand, 204% for Elayne, and 199% for Aviendha. The results of WWC's corresponding visual analysis are presented in Appendix C.
Maintenance	All three students had one maintenance probe. Rand and Elayne's probe was 6 weeks after the post-training phase, and Aviendha's probe was 8 weeks after the post-training phase. In general, the values of these probes were in the same range as the post-training probes.

WWC study rating Meets WWC Pilot Single-Case Design Standards With Reservations.

Reason for study rating: The study used a multiple probe design across participants to measure the functional essay units outcome. The baseline sessions for each case only overlapped vertically for one probe data point (rather than three). In addition, each case not receiving the intervention did not have a probe point in a session in which another case either first receives the intervention or reaches the prespecified intervention criterion.¹¹ Thus, the experiment meets WWC pilot single-case design standards with reservations.

Appendix A.4: Research details for Graham and Harris (1989)

Graham S., & Harris K. R. (1989). Improving learning disabled students' skills at composing essays: Self-instructional strategy training. *Exceptional Children*, 56(3), 201–214.

Setting The study took place in one suburban elementary school in the northeastern United States. The intervention was administered individually to each student in a quiet room within the elementary school.

Study sample The study sample included three sixth-grade students who were identified as having LD by their district and were receiving special education services in a resource room. Elaine was a 12-year-old girl with an IQ of 101 on the Wechsler Intelligence Scale for Children-Revised (WISC-R). She scored at least 3 years below grade level in math, writing, and knowledge achievement. Morgane was a 12-year-old girl with an IQ score of 89 on the Slossom Intelligence Test. She scored 2 years below grade level in reading. Arthur was a 12-year-old boy with an IQ of 99 on the WISC-R. He also scored 2 years below grade level in reading and math achievement and had repeated third grade.

Intervention *SRSD*, referred to as self-instructional strategy training procedures in this study, was administered individually to students to help improve their writing skills. The instructor, a graduate student majoring in special education, first worked with each student to define the components of a good essay using a mnemonic device (TREE) which prompted students to think of a topic sentence, reasons, examples, and an ending. The instructor then reviewed the student's current level of essay writing and discussed goals. Next, the instructor presented a three-step essay-writing strategy to the student (Think, Plan, Write) and modeled for the student how to use the strategy. Next, the student memorized the strategy and practiced self-regulation. The instructor and the student then worked together to write an essay using the strategy. Finally, the student wrote essays independently. Elaine, Morgane, and Arthur participated in seven, five, and eight *SRSD* training sessions, respectively. Each session lasted approximately 40 minutes. Post-training essay probes were administered immediately following *SRSD* instruction.

Comparison The study used a multiple probe design across three students. During the baseline condition for each student, the graduate student instructor asked students to write essays on a specific topic or in response to a picture. General procedures were in effect in the resource room during this period.

Outcomes and measurement	The study outcome was the number of functional essay elements, which falls within the writing achievement domain. For a more detailed description of this outcome measure, see Appendix B. The study also examined four other eligible outcomes in the writing achievement domain that did not meet standards. These included the story grammar scale score, essay coherence, number of words written, and holistic quality. The story grammar scale outcome did not meet standards because there were fewer than three data points in baseline phases for Elaine and Morgane and in the post-training phase for Arthur. The other three outcomes did not meet standards because they were not presented graphically. Results from the one experiment with an outcome in the writing achievement domain are presented in Appendix C.1.
Support for implementation	The instructor received training on the step-by-step implementation procedures and received detailed lesson plans with guidance on how to conduct each step.
Author-reported findings	The study authors reported that the number of functional essay elements were greater for all three students after <i>SRS</i> D than they were at baseline. The results of WWC's corresponding visual analysis are presented in Appendix C.
Maintenance	For Elaine, three maintenance writing probes were collected at 6, 11, and 12 weeks following the end of her training. Her 6- and 12-week maintenance probes were similar in level to the post-training probes, but her 11-week maintenance probe was lower. For Morgane, one follow-up maintenance probe was collected 3 weeks following training. This probe was similar in level to the post-training probes. There were no maintenance probes for Arthur because the school year ended after his intervention was complete.
WWC study rating	Meets WWC Pilot Single-Case Design Standards With Reservations. Reason for study rating: The study used a multiple probe design across participants to measure the number of functional essay elements. The baseline sessions for each case only overlapped vertically for one or two data points (rather than three). In addition, some phases had only three or four data points (rather than five). Therefore, this experiment meets WWC pilot single-case design standards with reservations.

Appendix A.5: Research details for Saddler (2006)

Saddler, B. (2006). Increasing story-writing ability through self-regulated strategy development: Effects on young writers with learning disabilities. *Learning Disability Quarterly*, 29(4), 291–305.

Setting	The study was conducted in an urban elementary school in the northeastern United States. The school's population was 50% White, 37% African-American, 7% Asian, and 6% Hispanic; 48% of the students qualified for free or reduced-price lunch. The students' intervention took place in a room outside of their general education classroom.
Study sample	There were six 7-year-old students in the sample from five second-grade classrooms. School staff identified the students as having LD while they were in first grade, and their current teachers identified them as struggling writers. The students were all African American; four were male (Mike, John, Larry, and George) and two were female (Tracy and Alice). All six students were reading at the first-grade level, and their full-scale IQ scores from the Stanford-Binet ranged from 89 to 102. The students received co-teaching support during their general education language arts classes from a special education teacher.

Intervention The *SRSD* intervention used in this study included six lessons (some of which took multiple sessions) to help students improve their planning and story writing skills. A graduate student implemented the intervention to pairs of students. Students met with the instructor for 30 minutes per session, three times a week. The training sessions took place outside of the student's typical general education classroom, and students were still in their class during regular writing instruction. The number of sessions was either 10 or 11, as each group moved through the lessons at their own pace.

Lesson 1 focused on developing background knowledge, including introducing two mnemonic devices. POW reminded students to pick ideas, organize notes, and write and say more. The "WWW, What=2, How=2" device asked students to think about the following prompts: "Who are the main characters? When does the story take place? Where does the story take place? What do the main characters want to do? What happens when the main characters try to do it? How does the story end? How do the main characters feel?" Lesson 2 consisted of review and practice. Lesson 3 used self-statements designed to elicit story ideas. Lesson 4, which was repeated twice, involved a student-led collaborative writing exercise with the instructor. Lesson 5 involved another story writing exercise, but without the graphic organizer, and was repeated (two to three times) for each group until all seven story parts were included. Lesson 6 involved a story writing exercise without instructor assistance. Post-training story probes were administered immediately following *SRSD* instruction.

Comparison The study used multiple probe designs across pairs of students for each outcome. During the baseline condition, students wrote essays and participated in their regular writing instruction with their teachers in a general education classroom.

Outcomes and measurement The study outcomes were holistic quality, number of story elements, and number of words, which fall within the writing achievement domain. For a more detailed description of these outcome measures, see Appendix B. The study also measured planning time and quality of narratives. Planning time is not presented in the report because it does not fall under a domain specified in the protocol. The experiment measuring the effect on quality of narratives did not meet standards because data were not presented graphically. Results from the three experiments with outcomes in the writing achievement domain are presented in Appendix C.1.

Support for implementation The study author trained the graduate student instructor. The author modeled each lesson and then observed the graduate student's implementation of the lesson.

Author-reported findings The study author found that all students increased the number of story elements, but only one included all seven elements. They also found that all students increased their number of words and improved the holistic quality of their stories. The results of WWC's corresponding visual analysis are presented in Appendix C.

Maintenance The author collected maintenance probes for all three pairs of students, 3 weeks after instruction. The first two pairs also had a maintenance probe point 6 weeks after instruction. In general, the maintenance probes for the number of elements outcome were roughly similar with the post-training probe scores, although John scored consistently lower in maintenance than he did in post-training sessions.

For the number of words outcome, Mike, Tracy, and Larry had similar performance during their post-training and maintenance phases. John and George scored lower during maintenance than post-training, with no overlap between the phases. Alice scored higher during maintenance than post-training, with no overlap.

Finally, for the story quality outcome, all the students except George had similar performance during their post-training and maintenance phases. George scored lower on his one maintenance probe point, compared to the very consistent level in his three post-training probes.

WWC study rating Meets WWC Pilot Single-Case Design Standards With Reservations.

Reason for study rating: The experiments for all three outcomes used multiple probe designs across pairs of students; all three experiments receive the rating of meets WWC pilot single-case design standards with reservations because there are three data points (rather than five) in each baseline and post-training phase for all outcomes and students; there is just one baseline probe point within the first three sessions for Larry, Tracy, George, and Alice; and there are only 2 baseline probes immediately before the intervention is introduced for Larry, Tracy, George, and Alice. In addition, each case not receiving the intervention did not have a probe point when the other cases entered the post-training period. Specifically, George and Alice (the third pair) did not have a probe point when Mike and John entered the post-training period.¹¹

Appendix A.6: Research details for Saddler and Asaro (2007)

Saddler, B., & Asaro, K. (2007). Increasing story quality through planning and revising: Effects on young writers with learning disabilities. *Learning Disability Quarterly*, 30(4), 223–234.

Setting The study was conducted in an urban elementary school in the northeastern United States. The school's student population was 52% White, 35% African-American, 7% Asian, and 6% Hispanic; approximately half of the students qualified for free or reduced-price lunch. The students' intervention took place in a room outside of their general education classroom.

Study sample There were six students in the sample, all of whom were 7 years old and in second grade. All students (three males, three females) were identified by their teacher as having LD in first grade, and their IQ scores ranged from 98 to 103. A special education co-teacher provided each student with additional support within their general education classroom. The sample included four African-American students and two White students.

Intervention	<p>The <i>SRS</i>D intervention model was used to teach students how to improve their story writing skills. The students participated in the <i>SRS</i>D intervention in pairs (Arnold and Maria; Gracie and George; and Scarlet and Rhett). The first and third pair covered the content of the intervention in 11 lessons, and the second pair needed 12 lessons. Lessons were taught three times a week in 30-minute sessions, outside of the general education classroom.</p> <p>The intervention included two strategies. The first was POW (pick ideas; organize notes; write and say more). During the “organize notes” stage of POW, the instructor also introduced the “WWW, What=2, How=2” mnemonic device which asked students to think about the following prompts: “Who are the main characters? When does the story take place? Where does the story take place? What do the main characters want to do? What happens when the main characters try to do it? How does the story end? How do the main characters feel?” Both strategies were introduced in the first lesson and were repeated and reviewed at the start of each subsequent lesson. The students began writing their own stories using the strategies beginning in Lesson 2, with growing independence over time as they became more comfortable with the strategies. Post-training story probes were administered immediately following <i>SRS</i>D instruction.</p>
Comparison	<p>The study used a multiple baseline design across pairs of participants for each of the four eligible outcomes. During the baseline condition, students received their regular writing instruction and wrote essays without receiving any strategy instruction.</p>
Outcomes and measurement	<p>The study examined four outcomes: holistic quality (of the first draft), number of revisions, number of story elements, and quality changes from first to revised draft, all of which fall within the writing achievement domain. For a more detailed description of these outcome measures, see Appendix B. The study also measured students’ planning time; this outcome is not eligible for review because it does not fall under a domain specified in the protocol. Results from the four experiments with outcomes in the writing achievement domain are presented in Appendix C.1.</p>
Support for implementation	<p>Not reported.</p>
Author-reported findings	<p>The study authors found that holistic quality, number of revisions, and number of story elements all increased from baseline to post-training phases. They also reported that the quality of the revised draft was generally better than the first draft, with a few exceptions. The results of WWC’s corresponding visual analysis are presented in Appendix C.</p>
Maintenance	<p>There was no maintenance phase.</p>
WWC study rating	<p>Meets WWC Pilot Single-Case Design Standards With Reservations.</p> <p>Reason for study rating: The experiments for all four outcomes used multiple probe designs across pairs of participants. The experiments meet WWC pilot single-case standards with reservations because in each experiment, all six students’ post-training phases and Arnold, Maria, George, and Gracie’s baseline phases have three or four data points (rather than five). In addition, there is just one baseline probe point that overlaps vertically across all cases.</p>

Appendix A.7: Research details for Sexton et al. (1998)

Sexton, M., Harris, K. R., & Graham, S. (1998). Self-regulated strategy development and the writing process: Effects on essay writing and attributions. *Exceptional Children, 64*(3), 295–311.

Setting	The study was conducted in a suburban mid-Atlantic school. The school's student population was 62% African American, 23% White, 11% Asian, and 3% Hispanic; about 40% of students were eligible for free or reduced-price lunch, and 8% were English learners. The students in this study received services in general education classes, with the support of special education teachers.
Study sample	The study sample included six students who were identified as having LD by their district. Marian, a 10-year-old fifth grader, was a Black female with an IQ of 81 and a third-grade reading level. Robin, a 10-year-old fifth grader, was a Black male with an IQ of 96 and a third-grade reading level. Alan, a 12-year-old sixth grader, was a White male with an IQ of 98 and a fourth-grade reading level. Matilda, an 11-year-old sixth grader, was a Black female with an IQ of 86 and a third-grade reading level. Richard, a 10-year-old fifth grader, was a Black male with an IQ of 105 and a third-grade reading level. John, a 12-year-old sixth grader, was a Black male with an IQ of 117 and a fourth-grade reading level.
Intervention	The six-step <i>SRSD</i> intervention was used to help students write essays. Students were taught how to use the "TREE" mnemonic strategy which included starting with a topic sentence, stating the reasons behind their arguments, evaluating their reasons, and ending with a conclusion. Once a stable baseline was obtained for both students in the first pair (Marian and Robin), <i>SRSD</i> instruction was started for that pair. Instruction for the second pair of students (Alan and Matilda) began once the first pair reached criterion level (one and a half times the number of functional elements produced during baseline). The same procedure was used for the third pair (Richard and John). The instruction period consisted of 40–50 minute sessions, and the number of sessions varied across pairs, ranging from 8–10 to complete the training. The first author of the study led the instruction. Post-training essay probes were administered immediately following <i>SRSD</i> instruction.
Comparison	The study used a multiple probe design across pairs of students. During the baseline period, usual writing instruction processes were used, in which students were encouraged to plan, draft, edit, and publish their papers. During the baseline condition, students wrote essays without special instruction.
Outcomes and measurement	The study examined the number of functional essay elements, which falls within the writing achievement domain. For a more detailed description of this outcome measure, see Appendix B. The study also measured essay length and holistic quality; these outcomes are not displayed graphically, so they do not meet WWC pilot single-case design standards. The study also measured planning time, strategy use, and attributions; these outcomes are not eligible for review because they do not fall under a domain specified in the protocol. Results from the one experiment with an outcome in the writing achievement domain are presented in Appendix C.1.
Support for implementation	Not reported.

Author-reported findings	The study authors reported that all six students increased their number of functional essay elements from baseline to post-training, but that there was some overlap in scores for three of the students. The results of WWC's corresponding visual analysis are presented in Appendix C.
Maintenance	The authors administered a maintenance probe for the first two pairs of students. The maintenance probe points for Matilda and Robin were lower than their post-training probe points, while Marian and Alan's maintenance probe points generally fell within the range of their post-training probe points. The third pair did not have any maintenance probes.
WWC study rating	Meets WWC Pilot Single-Case Design Standards With Reservations. Reason for study rating: The experiment for the number of functional essay elements used a multiple probe design across pairs of students. The experiment meets WWC pilot single-case design standards with reservations because there were at least three, but fewer than five, data points in several phases, and only one overlapping point across cases in the first three baseline sessions. In addition, Richard and John did not have a point in the first session after Alan and Matilda completed their <i>SRSD</i> instruction. ¹¹

Appendix A.8: Research details for Straub (2012)

Straub, C. L. (2012). *The effects of synchronous online cognitive strategy instruction in writing for students with learning disabilities (Doctoral dissertation)*. Retrieved from <http://stars.library.ucf.edu/>

Setting	The study intervention took place in a secondary school in Florida, via an online tutoring system that connected the students to an instructor at a local university. The intervention occurred during a study hall period immediately after lunch.
Study sample	The study sample included four secondary school students who had been diagnosed with LD. All four students were White. Damon was a 14-year-old male in eighth grade; Carson was a 15-year-old male in ninth grade; Jake was a 16-year-old male in tenth grade; and Monica was a 13-year-old female in sixth grade.
Intervention	<i>SRSD</i> was used to teach students strategies for both planning and writing. An undergraduate research assistant delivered the instruction via online chatting and video conferencing through the use of Adobe Connect and Google Docs. The structure of the intervention included up to five lessons, where the fifth lesson would be repeated if the student did not meet prespecified criteria. Students were taught how to use the "POW+TREE" mnemonic strategies. POW reminded students to pick ideas, organize information, and then write and check their work. TREE prompted students to think of a topic sentence, reasons, examples, and an ending. During training, students could also earn points towards reinforcers. These reinforcers were described as "items valued at two dollars or less." A preference assessment was used to develop a list of reinforcers, based on students' preferences. Post-training essay probes were administered immediately following <i>SRSD</i> instruction.
Comparison	The study uses a multiple probe design across participants. During the baseline condition for each student, teachers taught their classes as usual.

Outcomes and measurement	The study examined the number of correct minus incorrect word sequences and the number of functional essay elements, which both fall within the writing achievement domain. For a more detailed description of these outcome measures, see Appendix B. The study also measured holistic quality and spontaneous writing; these outcomes are not displayed graphically, so they do not meet WWC pilot single-case design standards. There are also four ineligible outcomes. Social validity was measured but is not eligible for review because it does not fall under a domain specified in the protocol. Data were also collected on number of words written, number of seconds spent planning, and number of seconds spent writing, but these were not part of the primary analyses or used to measure impacts of <i>SRSD</i> , and thus are not eligible for review. Results from the two experiments with an outcome in the writing achievement domain are presented in Appendix C.1.
Support for implementation	The tutor received 4 hours of training in applying the instructional procedures of <i>SRSD</i> .
Author-reported findings	The study author found that students increased both the number of correct minus incorrect word sequences and the number of functional essay elements. The author reported that all four students had marked changes in trend and level in both outcomes after receiving <i>SRSD</i> . The results of WWC's corresponding visual analysis are presented in Appendix C.
Maintenance	Damon had two maintenance probes, Monica and Carson each had one, and Jake did not have any. Damon's maintenance probe was consistent with the level of his tutoring phase probes, while the maintenance data for Monica and Carson show a drop-off in performance.
WWC study rating	Meets WWC Pilot Single-Case Design Standards With Reservations. Reason for study rating: The study uses a multiple probe design across participants for both outcomes. Carson's tutoring phase had only four points, rather than five. In addition, each case had data points just prior to introduction of the independent variable, but only one of the cases (Damon) had three consecutive baseline probes. None of the cases had data points when prior cases either began the intervention or reached a prespecified level. ¹¹ Thus, the experiments for both outcomes meet WWC pilot single-case design standards with reservations.

Appendix A.9: Research details for Troia et al. (1999)

Troia, G. A., Graham, S., & Harris, K. R. (1999). Teaching students with learning disabilities to mindfully plan when writing. *Exceptional Children*, 65(2), 235–252. Retrieved from <https://eric.ed.gov/?id=EJ579491>

Setting	The study took place in two suburban elementary schools located in the mid-Atlantic United States.
Study sample	<p>The study sample included three students (Luke, Ben, and Leia) from two schools. All three students were in the fifth grade, had an IQ of 101, were from an economically disadvantaged background, spoke English as their primary language, and were identified by their school district as having LD.</p> <p>Luke was a 10-year-old African-American male. Ben was an 11-year-old White male who had been retained in second grade. Leia was an 11-year-old White female who had repeated first grade.</p>

Intervention	<p><i>SRSD</i> was used to teach students how to integrate planning strategies into the writing process. Using the <i>SRSD</i> intervention, the instructor modeled how to use three strategies in the first three lessons: goal setting, brainstorming, and organizing. In the first lesson, the instructor prepared a speech and wrote a story while modeling aloud how to use the strategies. The instructor gave students a list of questions to help them identify essential features and the value of the strategies used by the instructor. The second lesson followed the same procedures, but the instructor instead read a chapter and wrote a story, and the third lesson followed the same procedures as the first two lessons, with the instructor planning a trip. In the second and third lessons, the students were asked to compare the strategy usage with earlier lessons. The instructor also introduced the STOP & LIST (Stop, Think of Purpose & List Ideas, Sequence Them) strategies to the students. The fourth and fifth lessons focused on applying the STOP & LIST strategies. In lessons 6 and 7, the students were expected to plan and write stories independently. The seven lessons took 3 weeks to cover, in 60–90 minute sessions. Post-training story probes were administered immediately following <i>SRSD</i> instruction.</p>
Comparison	<p>The study used a multiple probe design across participants. During the baseline condition for each student, teachers taught their classes as usual.</p>
Outcomes and measurement	<p>The study examined the story grammar scale score, which falls within the writing achievement domain. For a more detailed description of this outcome measure, see Appendix B. The study also measured the number of functional essay elements; this outcome did not meet WWC standards because there are insufficient data to evaluate the attempts to demonstrate an intervention effect. In addition, the study measured eight other outcomes that do not meet WWC standards because they are not displayed graphically: number of propositions in planning stories; number of propositions in planning essays; strategy use when writing; strategy use in final drafts; length of story; length of essay; essay holistic quality; and story holistic quality. The study also reported five ineligible outcomes: planning time for stories, writing time for stories, planning time for essays, writing time for essays, and social validation. These outcomes are not eligible for review because they do not fall under a domain specified in the protocol. Results from the one experiment with an outcome in the writing achievement domain are presented in Appendix C.1.</p>
Support for implementation	<p>Not reported.</p>
Author-reported findings	<p>The study authors found that the students increased their story grammar scale scores from baseline to post-training. The results of WWC’s corresponding visual analysis are presented in Appendix C.</p>
Maintenance	<p>Each student had one maintenance probe 3 weeks after their last post-training probe point. Ben’s maintenance probe was at a comparable level to his post-training probes, but Luke and Leia scored lower in maintenance than they did in the post-training phase.</p>
WWC study rating	<p>Meets WWC Pilot Single-Case Design Standards With Reservations.</p> <p>Reason for study rating: The experiment used a multiple probe design across participants, and there were fewer than five data points in at least one phase; because all phases had at least three data points, but less than five, this experiment meets WWC pilot single-case design standards with reservations. In addition, none of the cases had data points when prior cases either began the intervention or reached a prespecified level.¹¹</p>

Appendix B: Outcome measures for the writing achievement domain

Writing achievement	
<i>Holistic quality</i>	<p>Holistic quality was measured in multiple studies, but the measurement and definition of the outcome varied:</p> <p>In De La Paz (1999), two general education teachers reviewed and scored all of the essays, on a scale of 0 (low quality) to 7 (high quality), which represents a general impression of overall quality. The teachers were given representative examples of low, average, and high quality essays, and were asked to consider the ideas portrayed, the development, organization, unity, and coherence of the essay, and the quality of the vocabulary used. Essays were typed and corrected for spelling, punctuation, and capitalization prior to review. Any differences between reviewers were discussed, and the resulting score was based on mutual agreement (as cited in De La Paz, 1999).</p> <p>In Saddler (2006), two graduate students reviewed and scored all stories on a scale of 1 (low quality) to 8 (high quality), which represents a general impression of overall story quality. Scorers were given representative examples of scores 2, 4, and 6. Essays were typed prior to review, and no changes were made to spelling, punctuation, or capitalization. The average score across the two reviewers was used as the measure of holistic quality (as cited in Saddler, 2006).</p> <p>In Saddler and Asaro (2007), two examiners unfamiliar with the study scored the first draft of all compositions on a scale of 1 (low quality) to 8 (high quality), based on the measure developed by Graham and Harris (1989)¹⁵ to assess overall story quality. Scorers were given representative examples of scores 2, 4, and 7. Stories were typed prior to review, and no corrections were made to spelling, punctuation, or capitalization. The average score across the two reviewers was used as the measure of holistic quality (as cited in Saddler & Asaro, 2007).</p>
<i>Number of correct minus incorrect word sequences</i>	<p>This measure was used to assess improvements in writing, and captured changes in frequency of spelling, punctuation, and grammatical errors. Higher values represent a higher degree of improvement (as cited in Straub, 2012).</p>
<i>Number of functional essay elements</i>	<p>Number of functional essay elements was measured in multiple studies, but the measurement and definition of the outcome varied:</p> <p>In three of the studies, the total number of functional essay elements outcome assessed the use of four elements recommended by Graham (1990)¹⁶ and Scardamalia, Bereiter, and Goelman (1982)¹⁷: premise, reason, conclusion, and elaboration. Essay elements were deemed functional if they directly supported the development of the student’s argument. For example, in order for a statement to be scored as a functional “premise,” the statement had to fully explain the position the student was trying to make in the essay. “Reasons” needed to explain why the writer believed a particular premise. “Conclusions” were closing statements that brought everything together, and “elaborations” included text that supported or exemplified premises, reasons, or conclusions. These functional text units were summed to form the outcome. Nonfunctional text referred to text that was repeated without but had no purpose (as cited in De La Paz & Graham, 1997^a; Graham & Harris, 1989^a; and Sexton, Harris, & Graham, 1998).</p> <p>In Straub (2012), researchers followed the scoring format used by Mason, Kubina, and Taft (2009).¹⁸ The number of functional essay elements assessed the inclusion of four elements: belief/topic sentence, reason, explanation, and ending statement. One point was awarded for each element that was included, and extra points were awarded for each additional reason or explanation, resulting in a potential score of eight points or more (as cited in Straub, 2012).</p>
<i>Number of revisions</i>	<p>The number of revisions made to stories included changes in spelling, punctuation, capitalization, as well as the addition, deletion, or substitution of text. Each word that was changed, added, or deleted counted as a single revision (as cited in Saddler & Asaro, 2007).</p>
<i>Number of story elements</i>	<p>Number of story elements was measured similarly in multiple studies. Two examiners unfamiliar with the study scored the number of story elements on a 0–7 scale. This score, which was used as a measure of story completeness, was designed by Graham and Harris (1989). The reviewers tabulated the inclusion of seven common elements that students included in their paper, including the main character, locale, time, goal, action, ending, and reaction (as cited in Danoff, Harris, & Graham, 1993; Saddler, 2006; and Saddler & Asaro, 2007).</p>
<i>Number of words</i>	<p>Number of words was measured in multiple studies, but the measurement and definition of the outcome varied:</p> <p>The total number of words was captured by word processing software after essays were typed. All words that represented a spoken word were counted regardless of any spelling errors (as cited in De La Paz, 1999).</p> <p>The total number of words was tabulated after essays were typed. All words, except for those in the title, were counted regardless of any spelling errors (as cited in Saddler, 2006).</p>

<i>Quality of changes from first to revised draft</i>	Two graduate students reviewed stories and scored changes in quality between drafts, following procedures from MacArthur and Graham (1987). ¹⁹ This score is an indicator of the effectiveness of the revisions made by the students. Raters used the first draft as the standard and rated the second draft in comparison, using a scale of -2 (the second draft was much worse than the first) to +2 (the second draft was much better than the first) (as cited in Saddler and Asaro, 2007).
<i>Story grammar scale score</i>	<p>The story grammar scale score, based on a measure designed by Graham and Harris (1989),²⁰ was measured in multiple studies, but the measurement and definition of the outcome varied:</p> <p>In Danoff, Harris, and Graham (1993), the scale was used to assess the quality of eight story elements: main character, locale, time, starter event, goal, action, ending, and reaction. For each story element, a score of 0 was awarded if the element was not present in the student's story, a score of 1 was awarded if the element was present, and a score of 2 was awarded if the element was highly developed. Additional points were awarded if two or more goals were articulated or if stories contained well-defined episodes or included events that happened in a logical order. Scores for the individual story elements were totaled to obtain a total story grammar scale score, with a maximum of 19 points (as cited in Danoff, Harris, & Graham, 1993).</p> <p>In Troia, Graham, and Harris (1999), this scale was used to evaluate the schematic structure of the stories, including the inclusion and quality of 10 elements: main character, locale, time, initiating event, goal, attempt to achieve goal, consequence of attempt, reaction, dialogue, and title. For each story element other than dialogue, a score of 0 was awarded if the element was not present in the student's story, a score of 1 was awarded if the element was present, and a score of 2 was awarded if the element was highly developed. For dialogue, the score ranged from 0 (dialogue not present) to 1 (dialogue present). For all elements other than dialogue, additional points were awarded if the story contained more than one episode (as cited in Troia, Graham, & Harris, 1999).^a</p>

^a The authors collected inter-assessor agreement (IAA) data in each phase and on at least 20% of all sessions, but it is not clear if IAA data were collected during 20% of the data points in each condition.

Appendix C: Single-case design findings included in the effectiveness ratings

Table C: Single-case design findings for the writing achievement domain

Outcome measure	Study characteristics			WWC summary		
	Sample size (case)	Age(s)	Design type	Evidence level	Intervention effects	
					Total demonstrated	Total attempted
Danoff, Harris, & Graham (1993)^a						
<i>Number of story elements</i>	3 (Students with learning disabilities subgroup)	Grades 4 and 5	Multiple probes across participants	Strong (+)	3	3
<i>Story grammar scale score</i>	3 (Students with learning disabilities subgroup)	Grades 4 and 5	Multiple probes across participants	Strong (+)	3	3
De La Paz (1999)^b						
<i>Holistic quality</i>	3 (Classes taught by Graham, Parker, and Owen, with two students in each class)	12–14	Multiple probes across participants	No evidence	2	3
<i>Number of words</i>	3 (Classes taught by Graham, Parker, and Owen, with two students in each class)	12–14	Multiple probes across participants	Strong (+)	3	3
De La Paz & Graham (1997)						
<i>Number of functional essay elements</i>	3 (Rand, Elayne, and Aviendha)	10–11	Multiple probes across participants	Strong (+)	3	3
Graham & Harris (1989)						
<i>Number of functional essay elements</i>	3 (Elaine, Morgane, Arthur)	12	Multiple probes across participants	Strong (+)	3	3
Saddler (2006)^c						
<i>Holistic quality</i>	6 (Mike, John, Tracy, Larry, George, and Alice)	7	Multiple probes across participants	Strong (+)	6	6
<i>Number of story elements</i>	6 (Mike, John, Tracy, Larry, George, and Alice)	7	Multiple probes across participants	Strong (+)	6	6
<i>Number of words</i>	6 (Mike, John, Tracy, Larry, George, and Alice)	7	Multiple probes across participants	Strong (+)	6	6
Saddler & Asaro (2007)^d						
<i>Holistic quality (of first draft)</i>	6 (Arnold, Maria, Gracie, George, Scarlett, and Rhett)	7	Multiple probes across participants	Strong (+)	6	6
<i>Number of revisions</i>	6 (Arnold, Maria, Gracie, George, Scarlett, and Rhett)	7	Multiple probes across participants	Strong (+)	6	6
<i>Number of story elements</i>	6 (Arnold, Maria, Gracie, George, Scarlett, and Rhett)	7	Multiple probes across participants	Strong (+)	6	6
<i>Quality of changes from first to revised draft</i>	6 (Arnold, Maria, Gracie, George, Scarlett, and Rhett)	7	Multiple probes across participants	No evidence	3	6
Sexton, Harris, & Graham (1998)^e						
<i>Number of functional essay elements</i>	6 (Marian, Robin, Alan, Matilda, Richard, and John)	10–12	Multiple probes across participants	Moderate (+)	3	6

Outcome measure	Study characteristics			WWC summary		
	Sample size (case)	Age(s)	Design type	Evidence level	Intervention effects	
					Total demonstrated	Total attempted
Straub (2012)						
<i>Number of correct minus incorrect word sequences</i>	4 (Damon, Carson, Jake, and Monica)	13–16	Multiple probes across participants	Strong (+)	4	4
<i>Number of functional essay elements</i>	4 (Damon, Carson, Jake, and Monica)	13–16	Multiple probes across participants	Strong (+)	4	4
Troia, Graham, & Harris (1999)						
<i>Story grammar scale score</i>	3 (Luke, Ben, and Leia)	10–11	Multiple probes across participants	Strong (+)	3	3

Table Notes: The WWC does not calculate effect sizes for single-case design research. Characterizations of Strong and Moderate evidence, based on WWC visual analysis, indicate that the experiment demonstrated an effect of the intervention. Characterizations of No evidence indicate that the experiment did not provide at least three demonstrations of an intervention effect in the same direction. + = a positive (favorable) effect in the desired direction.

^a In Danoff et al. (1993), the ages of students were not provided.

^b In De La Paz (1999), each experiment included three classrooms (or cases), with two students within each classroom, for a total of six students across three total cases. In the experiments for both outcomes, each probe point reflects the average score of the two students in a classroom.

^c In Saddler (2006), each experiment involved introducing the intervention to three pairs of students. Mike and John received *SRSD* first, then Tracy and Larry, and then George and Alice. Thus, there are six attempts to demonstrate an effect at three different points in time.

^d In Saddler and Asaro (2007), each experiment involved introducing the intervention to three pairs of students. Arnold and Maria received *SRSD* first, then George and Gracie, and then Scarlett and Rhett. Thus, there are six attempts to demonstrate an effect at three different points in time. The experiment for the outcome measuring quality changes from first to revised drafts was characterized as providing No evidence following WWC visual analysis. The WWC Procedures and Standards Handbook (version 3.0) characterizes experiments as providing Moderate evidence when the experiment has at least three demonstrations of an effect at three different points in time, and at least one demonstration of a non-effect. This experiment had at least three demonstrations of an effect, but the effects occurred at only two points in time, so the experiment was characterized as providing No evidence. For the number of story elements outcome, an author query confirmed that Maria had three baseline probe points, even though one was missing from the graph in the original study; she scored a 2 on this missing probe point. The authors also confirmed that all students had at least three data points in each phase for each of the outcomes that meet review requirements.

^e In Sexton et al. (1998), the experiment involved introducing the intervention to three pairs of students. Marian and Robin received *SRSD* first, then Alan and Matilda, and then Richard and John. Thus, there are six attempts to demonstrate an effect at three different points in time.

Appendix D: Single-case design findings in a domain not included in the effectiveness ratings²¹

Table D.1. Research details for single-case design studies with outcomes in the math achievement domain

Study	Study sample, setting, comparison sessions, and intervention sessions
<p>Case, Harris, & Graham (1992), Meets WWC Pilot Single-Case Design Standards With Reservations</p>	<p>This study included four children (Ben, Abernathy, Willow, and Paladin) with learning disabilities. All four students were 11 years old and in self-contained fifth- or sixth-grade classrooms in an urban elementary school in the northeastern United States. Students had IQ scores between 77 and 82 on the Wechsler Intelligence Scale for Children-Revised (WISC-R) and achievement at least 2 years below grade level on one or more academic areas. Paladin’s contrast was not included in the current review, as his baseline phase was not concurrent with the baseline phases of the other three students.</p> <p>The study used a multiple baseline design experiment across participants. The baseline condition consisted of normal classroom practice. There were two successive <i>SRSD</i> intervention conditions: addition instruction and subtraction instruction, both of which used <i>SRSD</i> procedures that focused on self-assessment and self-recording. The addition instruction was given first, and the subtraction instruction was given after addition outcomes were measured. Due to possible carryover or residual treatment effects from the addition intervention, the subtraction outcomes measured after the subtraction instruction cannot meet WWC pilot single-case design standards because the measures of effectiveness cannot be attributed solely to the subtraction intervention. Thus, the current review focuses on the addition <i>SRSD</i> instruction and addition outcomes.</p> <p><i>SRSD</i> was used to improve students’ mathematical problem-solving skills. Instruction included asking students to list words that indicated when addition (or subtraction) should be used; the instructor gave students cards with vocabulary words and examples to help students learn key phrases and cue words within word problems. The instructor had a conference with each student to discuss their performance and the goals of the instruction and then introduced the strategy (for example, reading the problem out loud, looking for and circling important words, drawing a picture, writing a sentence, and writing the answer). The instructor modeled the strategy using a think-aloud process, worked through problems with the student, and then asked the student to independently use the strategy to solve problems. The addition intervention was implemented during 35-minute sessions, two-to-three times a week. Ben, Abernathy, and Willow received 165, 130, and 180 minutes of addition instruction, respectively.</p> <p>For all three students, addition outcomes included number of correct equations and number of correct equations and answers, both of which fall under the math achievement domain. For a more detailed description of these outcome measures, see Appendix D, Table D.2.</p> <p>In the multiple baseline design across participants, there were fewer than five data points in at least one phase, so this study meets WWC pilot single-case design standards with reservations.</p>

Table D.2. Outcome measures in single-case design studies for the math achievement domain

Math achievement	
<p><i>Number of correct equations</i></p>	<p>The number of correct equations measured the degree to which students understood word problems. The score represents the number of times a student provided a correct addition equation, based on a word problem. This outcome ranged from 0 to 7, with higher values representing higher degrees of understanding (as cited in Case, Harris, & Graham, 1992).^a</p>
<p><i>Number of correct equations and answers</i></p>	<p>This outcome measured the degree to which students understood word problems and correctly solved equations. The score represents the number of times a student provided a correct addition equation, based on a word problem, and then correctly solved the equation. This outcome ranged from 0 to 7, with higher values representing higher degrees of understanding and correct answers (as cited in Case, Harris, & Graham, 1992).^a</p>

^a The authors collected inter-assessor agreement (IAA) data in each phase and on at least 20% of all sessions, but it is not clear whether IAA data were collected during 20% of the data points in each condition.

Table D.3: Single-case design findings for the math achievement domain

Outcome measure	Study characteristics			WWC summary
	Sample size (case)	Age(s)	Design type	Evidence level
Case, Harris, & Graham (1992)^a				
<i>Number of correct equations</i>	3 (Ben, Abernathy, Willow)	11	Multiple probes across participants	No evidence
<i>Number of correct equations and answers</i>	3 (Ben, Abernathy, Willow)	11	Multiple probes across participants	No evidence

Table Notes: The WWC does not calculate effect sizes for single-case design research. Characterizations of Strong and Moderate evidence, based on WWC visual analysis indicate that the experiment demonstrated an effect of the intervention. Characterizations of No evidence indicate that the experiment did not provide at least three demonstrations of an intervention effect in the same direction. The evidence from the SCD studies on *SRS* does not reach the threshold to include SCD evidence in the effectiveness ratings for the math achievement domain.

^a For Case et al. (1992), the study used a multiple baseline design experiment across participants to measure the effect of two successive *SRS* intervention conditions: addition instruction and subtraction instruction. The addition instruction was given first, and the subtraction instruction was given after addition outcomes were measured. Due to a possible carryover or residual treatment effect from the addition intervention, the subtraction outcomes measured after the subtraction instruction cannot meet WWC pilot single-case design standards because the measures of effectiveness cannot be attributed solely to the subtraction intervention. Therefore, the subtraction outcomes are not included in this report. In addition, Paladin’s contrast was not included in the current review, as his baseline phase was not concurrent with the baseline phases of the other three students.

Endnotes

¹ The descriptive information for this intervention was obtained from Harris et al. (2003) and Santangelo et al. (2008). The What Works Clearinghouse (WWC) requests developers review the intervention description sections for accuracy from their perspective. The WWC provided the developers with the intervention description in January 2015, and the WWC incorporated feedback from the developers. Further verification of the accuracy of the descriptive information for this intervention is beyond the scope of this review. Full citations: Harris, K. R., Graham, S., & Mason, L. H. (2003). Self-regulated strategy development in the classroom: Part of a balanced approach to writing instruction for students with disabilities. *Focus on Exceptional Children*, 35(7), 1–16; Santangelo, T., Harris, K. R., & Graham, S. (2008). Using self-regulated strategy development to support students who have ‘trubol giting thangs into werds.’ *Remedial and Special Education*, 29(2), 78–89.

² The literature search reflects documents publicly available by February 2017. Studies in this report were reviewed using the WWC Procedures and Standards Handbook (version 3.0) and the Students With a Specific Learning Disability review protocol (version 3.0). One study, Curry (1997), was reviewed previously for the WWC practice guide on Teaching Elementary Students to Be Effective Writers (2012), and met WWC group design standards with reservations. The review for the current report resulted in a revised rating of Does Not Meet WWC Group Design Standards because baseline differences between the analytic intervention and comparison groups are in the range where the WWC requires a statistical adjustment for the baseline measure, but an acceptable statistical adjustment was not performed. The author adjusted for baseline differences using an ANCOVA but did not report adjusted means or describe the direction of the impact. The WWC Reviewer Guidance for the WWC Procedures and Standards Handbook (version 3.0) clarifies that when the WWC requires a statistical adjustment to be performed, but a study does not describe the direction of the finding after the adjustment from a credible analysis, the finding is rated Does Not Meet WWC Group Design Standards. The author did not respond to a request for information about the direction, magnitude, and statistical significance of the adjusted finding. The prior review for the WWC practice guide was conducted using the WWC Procedures and Standards Handbook (version 2.0), which specified that a difference-in-differences adjustment applied by the WWC was an acceptable approach for satisfying the statistical adjustment requirement, but this approach is not acceptable under the WWC Procedures and Standards Handbook (version 3.0). The evidence presented in this report is based on available research. Findings and conclusions could change as new research becomes available.

³ For the math achievement domain, there is one study (fewer than the five required), one research team (fewer than the three required), and three cases (fewer than the 20 required).

⁴ Please see the Students With a Specific Learning Disability review protocol (version 3.0) for a list of all outcome domains.

⁵ For criteria used to determine the rating of effectiveness for single-case design studies, see the WWC Rating Criteria on p. 39.

⁶ The results from single-case design studies are not used to report an intervention effectiveness rating for an outcome domain unless the studies collectively meet the threshold criteria described on p. 39. The evidence from the single-case design studies on *SRSD* does not reach the threshold to include single-case design evidence in the effectiveness ratings for the math achievement domain.

⁷ In single-case design research, a case, such as a student or classroom, is the unit of intervention administration and data analysis. A single-case design experiment examines a single outcome measure repeatedly within and across different phases defined by the presence or absence of the intervention. There might be multiple experiments for a case if more than one outcome is examined, for example. All experiments within a research article are considered as one single-case design study.

⁸ The results from single-case design studies are not used to report an intervention effectiveness rating for an outcome domain unless the studies collectively meet the threshold criteria described on p. 39. The evidence from the single-case design studies on *SRSD* does not reach the threshold to include single-case design evidence in the effectiveness ratings for the math achievement domain.

⁹ In single-case design research, a case, such as a student or classroom, is the unit of intervention administration and data analysis. A single-case design experiment examines a single outcome measure repeatedly within and across different phases defined by the presence or absence of the intervention. There might be multiple experiments for a case if more than one outcome is examined, for example. All experiments within a research article are considered as one single-case design study.

¹⁰ When there is more than one single-case design experiment in a publication that does not meet WWC pilot single-case design standards, the citation list reports the disposition code that applies to the majority of single-case designs in that publication. Some single-case design experiments within a given publication might not meet WWC pilot single-case design standards for reasons other than the one listed in the citation list.

¹¹ The WWC Procedures and Standards Handbook includes three criteria that multiple probe designs must meet in order to Meet WWC Pilot Single-Case Design Standards With or Without Reservations. These additional criteria are required because some baseline data points are intentionally missing in multiple probe designs. One of these criteria requires that each case not receiving the intervention must have a probe point in a session where another case either (a) first receives the intervention or (b) reaches the prespecified intervention criterion. However, as specified in the Students With a Specific Learning Disability topic area protocol, studies can Meet WWC Pilot Single-Case Design Standards With Reservations, even if they do not meet this requirement. Cases must still continue to have baseline data for at least one session after the intervention is administered to preceding cases, as this is a requirement for all multiple baseline designs, and must meet the other two multiple probe criteria specified in the Handbook.

¹² Five of the students scored at least one standard deviation below average on the WIAT, and the remaining student scored in the low average range of the WIAT, rather than a full standard deviation below average.

¹³ For De La Paz (1999), a response to an author query confirmed that data on inter-assessor agreement were not collected in each phase.

¹⁴ Single-case design studies typically assign participants a pseudonym; we use the pseudonyms provided by study authors in this report so that WWC ratings can be easily mapped to the correct single-case design in the original study.

¹⁵ Graham, S., & Harris, K. R. (1989). A components analysis of cognitive strategy training: Effects on learning disabled students' compositions and self-efficacy. *Journal of Educational Psychology, 87*, 353–361.

¹⁶ Graham, S. (1990). The role of production factors in learning disabled students' compositions. *Journal of Educational Psychology, 82*, 781–791.

¹⁷ Scardamalia, M., Bereiter, C., & Goelman, H. (1982). The role of production factors in writing ability. In M. Nystrand (Ed.), *What writers know: The language, process, and structure of written discourse*. New York, NY: Academic Press.

¹⁸ Mason, L. H., Kubina, R. M., & Taft, R. J. (2009). Developing quick writing skills of middle school students with disabilities. *Journal of Special Education, 44*(4), 205–220.

¹⁹ MacArthur, C. A., & Graham, S. (1987). Learning disabled students' composing under three methods of text production: Handwriting, word processing, and dictation. *Journal of Special Education, 21*(3), 22–42.

²⁰ Graham, S., & Harris, K. R. (1989). A components analysis of cognitive strategy training: Effects on learning disabled students' compositions and self-efficacy. *Journal of Educational Psychology, 87*, 353–361.

²¹ The results from single-case design studies are not used to report an intervention effectiveness rating for an outcome domain unless the studies collectively meet the threshold criteria described on p. 39. The evidence from the single-case design studies on *SRSD* does not reach the threshold to include single-case design evidence in the effectiveness ratings for the math achievement domain.

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WWC Rating Criteria

Criteria used to determine the rating of a study that includes single-case experiments

Study rating	Criteria
Meets WWC pilot single-case design standards without reservations	A single-case design study that provides the highest degree of confidence for assessing an intervention's effectiveness.
Meets WWC pilot single-case design standards with reservations	A study that provides a lower degree of confidence for assessing an intervention's effectiveness, such as a reversal-withdrawal design with three or four data points per phase, rather than five.

Criteria used to determine evidence of a causal relation in a single-case design experiment

Evidence level	Criteria
Strong evidence of a causal relationship	A single-case design study with at least three demonstrations of the intervention effect and no non-effects.
Moderate evidence of a causal relationship	A single-case design study with at least three demonstrations of the intervention effect and at least one non-effect.
No evidence of a causal relationship	A single-case design study with fewer than three demonstrations of the intervention effect.

Criteria used to determine whether there is enough research for single-case design evidence to contribute to a WWC effectiveness rating for a given domain

Threshold to include single-case design evidence	Criteria
Threshold met	At least five studies examining the intervention meet WWC pilot single-case design standards without reservations or meet WWC pilot single-case design standards with reservations, AND The single-case design studies are conducted by at least three different research teams with no overlapping authorship at three different institutions, AND The combined number of cases (i.e., participants, classrooms, etc.) totals at least 20.

Criteria used to determine the rating of effectiveness for an intervention based on single-case design research

Rating of effectiveness	Criteria
Positive effects	Across all single-case design experiments, at least 80% show positive effects, AND No single-case design experiment shows negative effects, AND At least one single-case design experiment meets WWC pilot single-case design standards without reservations.
Potentially positive effects	Across all the single-case design experiments, 51% to 79% show positive effects, AND No single-case design experiment shows negative effects.
Mixed effects	At least one single-case design experiment shows positive effects AND at least one single-case design experiment shows negative effects, OR At least one single-case design experiment shows positive or negative effects AND 50% or more show indeterminate effects.
Potentially negative effects	Across all the single-case design experiments, 51% to 79% show negative effects, AND No single-case design experiment shows positive effects.

WWC Rating Criteria

Rating of effectiveness	Criteria
Negative effects	Across all the single-case design experiments, at least 80% show negative effects, AND No single-case design experiment shows positive effects, AND At least one single case design experiment meets WWC pilot single-case design standards without reservations.
No discernible effects	None of the single-case design experiments shows effects, either positive or negative.

Notes: A single-case design experiment has all of the design elements required to meet WWC standards with or without reservations (such as three attempts to demonstrate an effect) and is presented as one experiment in a study. The WWC characterizes all single-case design experiments in the same research article as one study, and thus one study can have multiple single-case design experiments. For example, a study could include three separate ABAB design experiments for one student (across three different eligible outcomes) or could include three separate ABAB design experiments for three separate eligible students. If a study presents data for more than one outcome, the WWC classifies the single-case design for each outcome as a separate experiment. The WWC visual analysis characterizations of Strong and Moderate evidence indicate that the design demonstrated an effect of the intervention. A visual analysis rating of *No evidence* indicates that the experiment did not provide at least three demonstrations of an intervention effect in the same direction.

Glossary of Terms

ABAB design This is an example of a reversal-withdrawal single-case design in which there are four phases: a baseline (A) followed by an introduction of the intervention (B), a withdrawal of the intervention to return to the baseline condition (A), and a second introduction of the intervention (B).

Alternating treatment design A single-case design experiment that rapidly alternates between two or more interventions to examine how outcomes change; outcomes are measured with only one or two data points within each phase.

Attrition Attrition occurs when an outcome variable is not available for all subjects initially assigned to the intervention and comparison groups. If a randomized controlled trial (RCT) or regression discontinuity design (RDD) study has high levels of attrition, the validity of the study results can be called into question. An RCT with high attrition cannot receive the highest rating of *Meets WWC Group Design Standards Without Reservations*, but can receive a rating of *Meets WWC Group Design Standards With Reservations* if it establishes baseline equivalence of the analytic sample. Similarly, the highest rating an RDD with high attrition can receive is *Meets WWC RDD Standards With Reservations*.

For single-case design research, attrition occurs when an individual fails to complete all required phases or data points in an experiment, or when the case is a group and individuals leave the group. If a single-case design does not meet minimum requirements for phases and data points within phases, the study cannot receive the highest rating of *Meets WWC Pilot Single-Case Design Standards Without Reservations*.

Baseline A point in time before the intervention was implemented in group design research and in regression discontinuity design studies. When a study is required to satisfy the baseline equivalence requirement, it must be done with characteristics of the analytic sample at baseline. In a single-case design experiment, the baseline condition is a period during which participants are not receiving the intervention.

Case A case is the unit of intervention administration and data analysis in a single-case design experiment. A case may be a single participant or a group of participants, such as a classroom.

Confounding factor A confounding factor is a component of a study that is completely aligned with one of the study conditions, making it impossible to separate how much of the observed effect was due to the intervention and how much was due to the factor.

Demonstration of an intervention effect In single-case design research, an effect is demonstrated when the data pattern in one phase (e.g., an intervention phase) differs more than would be expected from the data pattern observed in a previous phase (e.g., a baseline phase).

Design The method by which intervention and comparison groups are assigned (group design and regression discontinuity design) or the method by which an outcome measure is assessed repeatedly within and across different phases that are defined by the presence or absence of an intervention (single-case design). Designs eligible for WWC review are randomized controlled trials, quasi-experimental designs, regression discontinuity designs, and single-case designs.

Effect size The effect size is a measure of the magnitude of an effect. The WWC uses a standardized measure to facilitate comparisons across studies and outcomes.

Glossary of Terms

- Eligibility** A study is eligible for review and inclusion in this report if it falls within the scope of the review protocol and uses either an experimental or matched comparison group design.
- Group design** A study design in which outcomes for a group receiving an intervention are compared to those for a group not receiving the intervention. Comparison group designs eligible for WWC review are randomized controlled trials and quasi-experimental designs.
- Intervention** An educational program, product, practice, or policy aimed at improving student outcomes.
- Intervention report** A summary of the findings of the highest-quality research on a given program, product, practice, or policy in education. The WWC searches for all research studies on an intervention, reviews each against design standards, and summarizes the findings of those that meet WWC design standards.
- Maintenance probes** In single-case design research, maintenance probes measure outcomes to understand if desired effects are retained after the intervention has ended.
- Multiple baseline design** A single-case design that introduces the intervention at different times to different cases or to the same case in different settings.
- Outcome domain** A group of closely-related outcomes. A domain is the organizing construct for a set of related outcomes through which studies claim effectiveness.
- Phase** In single-case design research, phases are the different conditions or varying levels of the intervention under which an outcome variable is measured.
- Quasi-experimental design (QED)** A quasi-experimental design (QED) is a research design in which study participants are assigned to intervention and comparison groups through a process that is not random.
- Randomized controlled trial (RCT)** A randomized controlled trial (RCT) is an experiment in which eligible study participants are randomly assigned to intervention and comparison groups.
- Rating of effectiveness** For group design research, the WWC rates the effectiveness of an intervention in each domain based on the quality of the research design and the magnitude, statistical significance, and consistency in findings. For single-case design research, the WWC rates the effectiveness of an intervention in each domain based on the quality of the research design and the consistency of demonstrated effects. The criteria for the ratings of effectiveness are given in the WWC Rating Criteria on p. 39.
- Regression discontinuity design (RDD)** A design in which groups are created using a continuous scoring rule. For example, students may be assigned to a summer school program if they score below a preset point on a standardized test, or schools may be awarded a grant based on their score on an application. A regression line or curve is estimated for the intervention group and similarly for the comparison group, and an effect occurs if there is a discontinuity in the two regression lines at the cutoff.
- Reversal/withdrawal design** A single-case design that introduces the intervention and withdraws the intervention. The design may be extended by adding additional baseline and/or intervention phases.
- Single-case design** A research approach in which an outcome variable is measured repeatedly within and across different conditions that are defined by the presence or absence of an intervention.

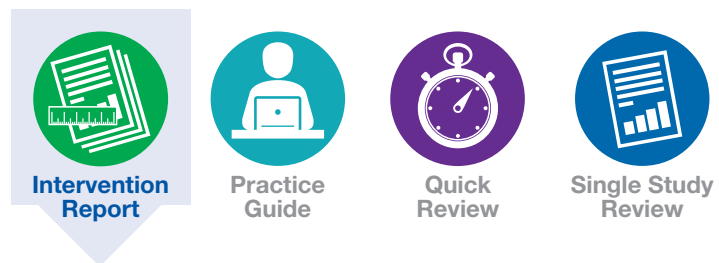
Glossary of Terms

Study rating The result of the WWC assessment of a study. The rating is based on the strength of the evidence of the effectiveness of the educational intervention. Studies are given a rating of *Meets WWC Design Standards Without Reservations*, *Meets WWC Design Standards With Reservations*, or *Does Not Meet WWC Design Standards*, based on the assessment of the study against the appropriate design standards. The WWC has design standards for group design, single-case design, and regression discontinuity design studies.

Systematic review A review of existing literature on a topic that is identified and reviewed using explicit methods. A WWC systematic review has five steps: 1) developing a review protocol; 2) searching the literature; 3) reviewing studies, including screening studies for eligibility, reviewing the methodological quality of each study, and reporting on high quality studies and their findings; 4) combining findings within and across studies; and, 5) summarizing the review.

Visual analysis A visual analysis reviews the pattern of outcome data in a single-case design experiment to determine whether the intervention led to a positive (favorable) effect, a negative (unfavorable) effect, or no effect is demonstrated.

Please see the [WWC Procedures and Standards Handbook \(version 3.0\)](#) for additional details.



An **intervention report** summarizes the findings of high-quality research on a given program, practice, or policy in education. The WWC searches for all research studies on an intervention, reviews each against evidence standards, and summarizes the findings of those that meet standards.

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