Impact of Shape vs. Color Cues in Graphic Organizers on the Expository Paragraph Writing of Students With Learning Disabilities and Attention-Deficit Hyperactivity Disorder

Kathy B. Ewoldt and Suzanne R. Byrne
University of Texas at San Antonio

Abstract

Writing is a critical skill for academic and professional success, yet students with learning disabilities (LD) and attention-deficit hyperactivity disorder (ADHD) often struggle due to task complexity and disability limitations. This study examined the use of graphic organizers for expository paragraph writing proficiency by comparing the effectiveness of color-labeled vs. shape-labeled graphic organizers in improving knowledge and quality of writing among upper-elementary and middle school students. Five students, ages 9–12, participated in a synchronous remote intervention that included explicit instruction, reverse-engineered paragraph writing, and practice with feedback. The single-case research design also aimed to identify intervention components yielding the greatest improvement in writing quality. Students completed pre- and post-intervention knowledge assessments, writing probes during each session, and two maintenance probes. The independent variable was type of graphic organizer used (color-labeled or shape-labeled), and the dependent variables were understanding of expository paragraph sentence types and functions, and writing quality. Results indicated that both types of graphic organizers improved writing quality, with only practical difference between conditions. The study enhances understanding of optimal intervention components, such as session quantity and presentation order, and underscores the importance of graphic organizers, explicit instruction, and practice in supporting students with LD and ADHD.

Keywords: Learning disabilities, expository paragraph, graphic organizers, writing process

Effective writing skills are critical for success during the school years and in many modern jobs (Coyle, 2010), yet the majority of students in the United States are not performing well on writing assessments (National Center for Education Statistics, 2012; White et al., 2015). More specifically, students with learning disabilities (LD) and attention-deficit hyperactivity disorder (ADHD) demonstrate significant deficits in writing performance compared to their typical peers (Graham et al., 2016, 2017; Torres & Black, 2018) while presenting with similar challenges.

A complex task, writing places a burden on working memory – a key cognitive tool used during writing tasks that has been identified as a weakness for both students with LD and ADHD (Ramos et al., 2020; Roitsch et al., 2020). Fortunately, educators have access to effective writing interventions for students with LD and/or ADHD (Datchuk & Rodgers, 2018; Graham & Perin, 2007a; Kaldenberg et al., 2016; Roitsch et al., 2020), with selection determined by the specific goal of a given writing activity. For example, younger students learn story writing and transition to expository writing in later elementary

Ewoldt, K. B., & Byrne, S. R. (2026). Impact of Shape vs. Color Cues in Graphic Organizers on the Expository Paragraph Writing of Students With Learning Disabilities and Attention-Deficit Hyperactivity Disorder. *International Journal for Research in Learning Disabilities*, XX. https://doi.org/10.28987/ijrld.9.1.XX

grades. Expository writing is also used as an assessment tool and becomes increasingly important for students to be able to communicate their level of content understanding as they progress in their academic journey (Graham, 2006).

Some writing interventions include strategy instruction, explicit instruction, sentence knowledge, and practice (Graham & Perin, 2007b; Kaldenberg et al., 2016; Roitsch et al., 2020). Often, multiple strategies are combined into treatment packages designed to teach students to write a specific type of paragraph or essay (Brady et al., 2022; Ciullo et al., 2021; Evmenova et al., 2020). Many treatment packages for paragraph and essay writing, for example, utilize graphic organizers as a support for students with LD (Boon et al., 2018; Kang et al., 2015) to help free up working memory and organize information during writing tasks (Brady et al., 2022; Rose, 2019; Singer & Bashir, 2018; Stewart & Swanson, 2022).

Working Memory

Writing involves coordinating different skills, including planning, writing, and reviewing (Kaldenberg et al., 2016). It also involves transcription, task attention, planning, reviewing, revising, and recollecting information stored in long-term memory (e.g., vocabulary, content), in addition to self-monitoring and self-regulating the overall writing task (Berninger & Amtmann, 2003; Brady et al., 2022). Using these skills simultaneously taxes working memory, which is necessary to coordinate the myriad demands of writing (see Brady et al., 2022).

Individuals with LD and ADHD often demonstrate working memory deficits (Capodieci et al., 2018; Eckrich et al., 2019; Ramos et al., 2020), which can substantially impede their writing performance (Wiest et al., 2022). Interventions exist that enhance working memory through cognitive training; however, the empirical support for transfer to untrained academic tasks remains limited and inconsistent (Gillam et al., 2018). Therefore, instructional approaches that reduce working memory demands and provide targeted supports are needed to improve writing outcomes in this population, as discussed below.

Interventions and Supports

Successful writing interventions for students with disabilities typically include multiple components (Kaldenberg et al., 2016; Rose, 2019) and are taught using a variety of strategies (e.g., Self-Regulated Strategy Development; Harris & Graham, 1985). Teaching writing strategies has been found to have a significant positive impact on the quality of the writing of students with LD (Gillespie & Graham, 2014; Graham & Perin, 2007a), particularly when combined with explicit instruction (Gillespie & Graham, 2014; Graham & Perin, 2007b). Similarly, directing students' attention using instructional cues is effective for students with LD (see Swanson & Sasche-Lee, 2000).

Other recommendations for supporting the written expression of students with LD and ADHD include process writing (e.g., prewriting, drafting) and text structure (Graham & Perin, 2007a; Hebert et al., 2018). In addition, instructional strategies used by many teachers incorporate color, but to date, this type of intervention has only undergone limited research and resulted in mixed results for students with LD and ADHD. Most notably, Irlin overlays were widely promoted in the 1980s, but later research has not found a statistically significant difference as a result of their use (Ritchie et al., 2011).

Graphic Organizers

Yet another type of intervention strategy combines supporting working memory with directing student attention to the task at hand through the use of graphic organizers. Several researchers have included training in and use of graphic organizers (GO) in intervention packages, which has improved writing for students with a variety of disabilities (Bishop et al., 2015; Brady et al., 2022; Ciullo et al., 2021; Evmenova et al., 2020). For example, in a review of research spanning more than 40 years, Boon et al. (2018) found that GOs are effective in improving the writing of students with LD, specifically narrative and expository writing.

There are different kinds of graphic organizers, and they are not equally effective (Brady et al., 2022; Singer & Bashir, 2018). The construction characteristics can vary (e.g., student- or teacher-created; Stull & Mayer, 2002; arrangement; Dexter & Hughes, 2011), which may explain the variation in effectiveness. However, these variations, specifically for students with LD and/or ADHD, have not been sufficiently explored.

The purpose of the present study, therefore, was to fill this gap in the literature by attempting to determine (a) if color or shape cueing on a graphic organizer during a writing intervention impacts student understanding and execution of expository paragraph writing; and (b) at what point during the intervention package a distinct change in writing quality emerges.

The research questions underlying the study were as follows:

1. Does using a color-labeled graphic organizer vs. a shape-labeled graphic organizer impact students' understanding of expository paragraph sentence types and functions?
2. Does using a color-labeled graphic organizer vs. a shape-labeled graphic organizer impact the quality of students' expository paragraph writing?
3. Which intervention session yields distinct changes in expository paragraph writing skills?

Methods

The intervention was conducted and video-recorded through synchronous sessions using the Zoom remote meeting platform during the school summer break. Students already had experience with synchronous remote instruction using Zoom due to the Covid-19 pandemic.

Setting

In their home, each student had a designated workspace, access to a computer, and reliable internet. Students were not receiving other writing or educational interventions. For the two 4th-grade students, parents were present throughout the sessions, but they did not otherwise participate with the rare exception of a redirection. The 6th-grade students worked independently.

Experimental Design

To determine if the type of graphic organizer cueing impacted knowledge about expository paragraph sentences and functions, we used a pre-/posttest comparison. To assess paragraph quality change, we used a concurrent multiple baseline across participants single-case design. Single-case research designs have proven to be an effective way to measure interventions across small and heterogenous populations, such as students with LD (Kratochwill et al., 2021). We selected the multiple-baseline design as instruction on expository paragraphs was sequential and cumulative, and could not be presented in a randomized order, reversed, or withdrawn. This design allowed us to compare the type of graphic organizer used within each dyad (see below), as well as to view changes in paragraph quality after each intervention component.

Participant and Selection Procedures

After Institutional Review Board approval, we recruited students in Grades 4–8 receiving small-group pull-out service for writing at a K-8 charter school located in a mid-sized southwestern city of the United States. The school literacy intervention specialist recruited students with disabilities who struggled with written expression (see Table 1). Students were excluded if they did not return consent forms. Six students (thus, meeting the minimum for

Table 1
Student Characteristics

Student	Gender	Age	Ethnicity	Grade	Plan	Disability
Alika	Cisgender female	9	White, Hawaiian	4	504	Dyslexia OHI (ADHD) Suspected dysgraphia
Bartoli	Cisgender male	9	White	4	IEP	Dyslexia
Adam	Cisgender male	12	White	6	504	OHI (ADHD)
Eddy	Nonbinary male	12	White	6	IEP	Dyslexia SLD Writing SLD Reading
Carmen	Cisgender female	11	White	6	IEP	OHI (ADHD)
Ryan*	Cisgender male	11	White, Hispanic	6	504	Dyslexia OHI (ADHD)

Note. OHI = Other health impairment; ADHD = Attention deficit/hyperactivity disorder; SLD = Specific learning disability.
*Dropped out after several failed attempts to schedule.

single-case research design), who assented to participate, were matched into three dyads (A-C) by age and grade. One student in each dyad was randomly assigned to either the color coding or the shape cueing condition (see Table 1); the alternate condition was assigned to the other student in the dyad. One student (Ryan) dropped out after canceling or rescheduling several sessions due to summer travel. Our final group of students consisted of two dyads and one individual.

Interventionist

The interventionist was a special education doctoral student with behavior analyst certification, who had implemented the intervention in a previous study.

Materials

Graphic Organizers

The independent variable was two versions of a graphic organizer (GO; see Appendix A). Both were designed as concept maps using nodes and lines to visually represent content organization (Lambiotte et al., 1989). The lines included text labels identifying the type of connection between nodes. The nodes in one GO used shapes; the other used color. Students were randomly assigned to either the shapes or the colors GO within their dyad and were provided with a GO for every writing session.

Knowledge Assessment

Students were given an 18-question multiple-choice knowledge assessment (see Supplemental Materials) before and after the intervention (see Table 2). Ten questions assessed the purpose and function of sentences within expository paragraphs. Eight questions assessed the ability to determine the type of sentence used in an exemplar paragraph. The assessments were scored by the interventionist after completion. This assessment and the writing rubric described below were created with iterative collaboration from a special education professor, a special education English language arts resource classroom teacher, and a special education doctoral student. The measures had been piloted, refined, and used in previous studies (Ewoldt, 2018; Ewoldt & Byrne, 2023; Ewoldt & Morgan, 2022).

Writing Rubric and Prompts

The primary investigator examined previous writing quality measures (see Benedek-Wood et al., 2014; Hoover et al., 2012; Kiuhara et al., 2012) to develop the traits-based rubric (see Supplemental Materials). The 14 expository writing prompts (see Supplemental Materials) had been used in a prior study, resembled state standardized writing assessments, and had Fleisch-Kincaid difficulty levels ranging from 3.3 to 8.8 (*Mn* = 5.8). Writing prompts were randomized across rather than within dyads to allow for comparison of the shapes and colors conditions.

Procedures

Once students had received parental consent and given their assent to participate, sessions were held two to three days per week (see Table 2). Days varied depending on students' summer activity schedules. The interventionist communicated with parents to select times and days when each student was available. All students completed the pre-intervention knowledge assessment on the same day for the initial baseline (see schedule in Supplemental Materials). Within the next two days, all students completed their first pre-intervention writing session.

The following week, Dyads A and B completed two additional pre-intervention writing sessions whereas Dyad C completed one additional pre-intervention writing session. The intervention was then introduced to Dyad A, and as each dyad completed the intervention, the next dyad began. After each dyad had completed their final practice writing session, they proceeded to the post-intervention knowledge assessment and the post-intervention writing

Table 2
Phase Elements

Pre-Intervention	Intervention	Post-Intervention
1. Parental consent, student assent	1. Lessons 1–4 and writing session (unsupported)	1. Knowledge assessment
2. Knowledge assessment	2. Lessons 5–7: writing session with support	2. Post-intervention writing session (unsupported)
3. Pre-intervention writing sessions (unsupported)		3. Maintenance writing sessions (unsupported)

session. Finally, maintenance writing sessions were conducted one week and again two weeks after the completion of the post-intervention writing session.

Salient Intervention Features

The difference between interventions was the cueing code of the GO: colors or shapes. Therefore, vocabulary was modified to either reflect colors or shapes aligned to the student's GO condition. Instruction related to sentence types and functions in expository paragraphs was the same for all participants regardless of cueing condition. Additionally, all students participated in reverse-engineered instruction of paragraph writing (Ewoldt & Byrne, 2023; Ewoldt & Morgan, 2022). This included reversed presentation of an exemplar paragraph, its analysis, coding, and completion of a graphic organizer, which only differed by the cueing (see Supplemental Materials).

Student engagement was also monitored throughout the sessions. If students expressed frustration during any session, they were offered a break; if frustration continued, the session was rescheduled. At the end of each session, students were praised for participation or effort, and given information about what would happen during the following session.

Knowledge Assessment

During the knowledge assessment, the interventionist read the instructions aloud and asked students if they had any questions. She then read question and answer choices. If a student asked for assistance or expressed uncertainty, the interventionist told them to make their best guess. Feedback about the performance was not given during any of these sessions other than praise for effort or completion. The interventionist used an objective key to score pre-assessments.

Writing Sessions

At the start of all writing sessions, students were provided with a GO, lined paper, and blank paper and told they would be writing a paragraph. The interventionist then shared a Microsoft PowerPoint slide with the written prompt and read the prompt aloud. The interventionist asked the students if they had any questions and told them to let her know when they were finished writing. After they had completed writing, the interventionist asked the students to read their paragraph and provided praise for completion. The exception to this pattern was the three practice writing sessions (5–7) where the inter-

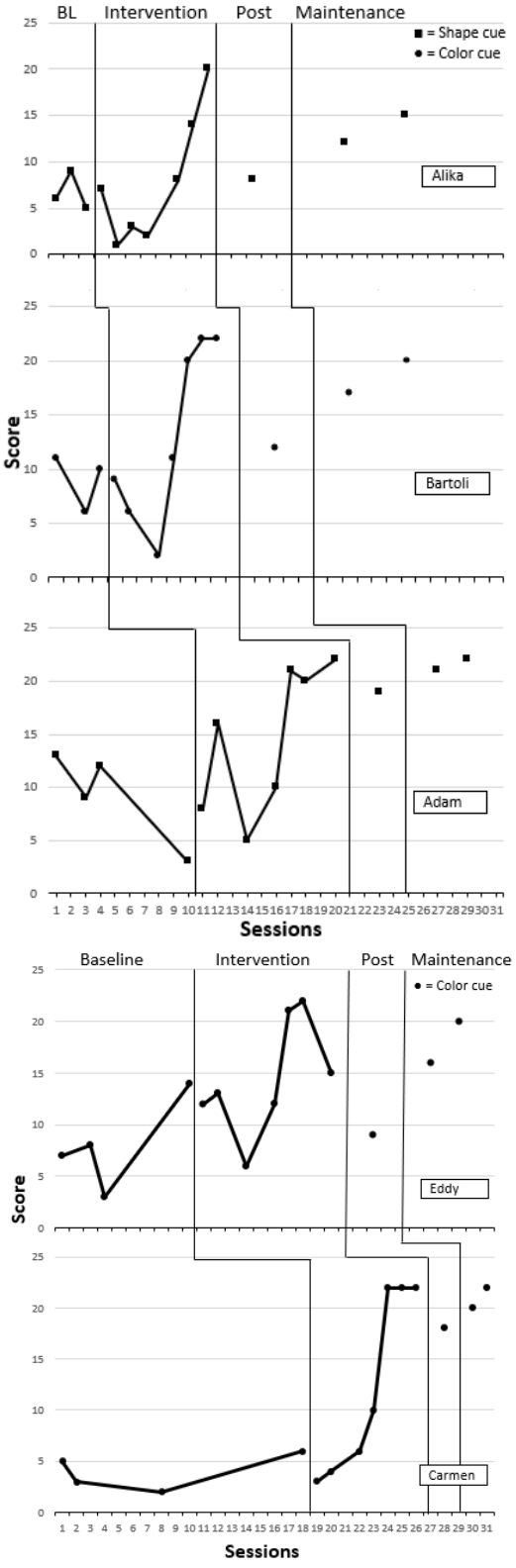


Figure 1
Paragraph Quality Scores

ventionist explicitly supported the use of the graphic organizer.

Post-Intervention Writing Session

After the intervention, the knowledge assessment was re-administered, whereupon the students participated in three additional writing sessions without support. The first of these took place immediately following the knowledge assessment; two maintsenance sessions occurred one and two weeks later, respectively..

Procedural Fidelity

The primary investigator and two research assistants naïve to the intervention and conditions performed reliability checks for implementation fidelity and data preparation. All sessions were cloud-recorded; however, one file was corrupted and unable to be opened. Videos were reviewed for procedural fidelity using a checklist aligned with each session; results indicated 98.6% implementation fidelity. The knowledge assessment was scored using a grading key, and 20% was scored for interrater reliability of 100%. Reliability for the quality of the written paragraphs was determined using a multistep process described below.

Analyses of Data

Knowledge Assessment

Knowledge assessments were collected and scored by the interventionist using an answer key. Percent correct was calculated by dividing the total number of correct answers by the total number of questions on the assessment.

Paragraph Quality

To determine writing quality, student writing samples were typed and transcribed by the interventionist and corrected for minor mechanical errors (see Kaldenberg et al., 2016). A randomly selected 20% were also transcribed from handwritten to digital text by the second author. To determine interrater reliability, transcriptions were compared using a method similar to the Correct Incorrect Word Sequence (Videen et al., 1982). That is, each word and punctuation mark were compared and scored with either an upward- (i.e., match) or downward-facing caret mark. The number of up marks divided by the total possible number of carrot marks multiplied by 100 calculated to an 86% interrater reliability of transcription from handwritten to typed text.

Each sample was assigned a code number with student, session, and condition information removed. Using the Sentence Types and Characteristics chart descriptions (see Appendix B), research assistants labeled each typed sentence of the students' writing samples as *Topic, Detail, Explanation,* or *Conclusion* in 14 randomly selected batches. After each batch was labeled, the assistants and primary investigator met to discuss differences. Of 424 total sentences, both assistants had labeled the sentence the same for 384 sentences (i.e., interobserver agreement of 90.6%). The remaining 40 sentences were discussed until consensus was reached for the labeling of each sentence.

The labeled samples were scored by a graduate student naïve to the study's conditions and intervention components using a paragraph quality rubric. In addition, 25% of the paragraphs were randomly selected and scored by the primary investigator. Interrater reliability of the paragraph quality rubric scores was 95.8%.

The final paragraph quality scores were re-identified and graphed by student and session (see Figure 1). Graphs were examined visually first for level, trend, and variability of the data within and between each phase (Kennedy, 2005; Maggin et al., 2018). We expected to see a stable level and trend with limited variability during baseline, posttest, and maintenance conditions. In contrast, we expected a positive trend in paragraph quality scores during the intervention phase. We specifically expected improvement during the fifth to seventh sessions of intervention for each participant, as these sessions included direct writing support.

Next, we examined graphs for between-phase patterns, looking for overlap and immediacy (Kennedy, 2005). We expected to see a gradual incline during intervention and no overlap between baseline and post-intervention and maintenance paragraph quality scores. The post-intervention writing score represented the students' first return to baseline conditions; the maintenance sessions matched baseline conditions. Therefore, we expected no overlapping data points when comparing baseline to post-intervention and maintenance conditions.

To examine the effects of the entire treatment package (i.e., the intervention training and the intervention practice), we combined the post-intervention score with the maintenance scores and compared them to baseline. Our rationale for combining and comparing in this manner was that these were the sessions from which support from the interventionist was removed and conditions reverted to baseline – effectually an ABA design. We calculated Tau-U to measure effect size (Vannest et al., 2016) by

comparing each student's baseline paragraph quality scores to their post-intervention-plus-maintenance combined scores.

Results

The length of the intervention sessions was idiosyncratic, ranging from 20 to 88 minutes depending on the student's level of engagement. The cue format of the graphic organizers during instruction did not appear to impact either general knowledge about expository sentence types and functions or paragraph quality.

Knowledge Assessment

The knowledge assessment was administered twice (i.e., pre-/post-intervention). Wilcoxon signed rank test comparing these two scores was not statistically significant ($Mn = 6$, $z = 1.825$, $p = .068$). The scores showed overall improvement from pretest (range 6–16 points) to posttest (range 15–18 points), with four out of five participants increasing their scores to 15 or higher on a scale of 0–22 points, suggesting strong gains following the intervention.

Paragraph Quality

Visual analyses (Bailey & Burch, 2018; Cooper et al., 2020; Kennedy, 2005) contrasting baseline with the post-intervention scores (i.e., combined posttest and maintenance) indicated improved paragraph quality across all students, although two participants (i.e., Alika and Eddy) did have overlapping data points during their first post-intervention session. Both had no overlap between baseline sessions and maintenance sessions. The other three participants had no overlap between baseline and post-intervention and maintenance sessions. Writing quality exceeded baseline levels during the first intervention practice session for four of five participants, and during the second intervention practice session for Alika.

Alika showed a decline in paragraph quality during the first four sessions of the intervention, followed by the expected improvement during the supported writing practice sessions. Her post-intervention writing sample declined to baseline levels. However, during maintenance sessions, the quality of her paragraphs was higher than all baseline paragraphs.

During baseline samples, Bartoli's paragraph quality scores had a stable trend for three sessions with a drop for the fourth session. The quality of his post-intervention writing showed only a slight increase from baseline, but his maintenance paragraphs showed a larger improvement similar to scores during supported practice sessions.

During baseline samples, Adam's paragraph quality scores had a mean of 9.25. His post-intervention and maintenance writing quality both showed substantial improvement, with scores more than 45% higher than baseline.

During baseline samples, Eddy's paragraph quality scores had a mean of 8. The expected improvement in scores was observed during the first two supported practice sessions, but there was an unexpected decline during the final practice session. This was followed by another decline during his post-intervention writing, then improvement with two high maintenance session scores.

Finally, during baseline samples, Carmen's paragraph quality scores had a mean of 4. After the intervention, all of her scores remained high, showing the largest increase from baseline across participants.

Effect sizes were calculated using Tau-UA vs. B + trend B – trend A (Vannest et al., 2016) to measure the

Table 3
Paragraph Quality Scores by Phase

	Baseline mean (n = 3–4)	Intervention mean (n = 7)	Post-intervention score	Maintenance mean (n = 2)	Aggregate post + maintenance mean (n = 3)	Tau-U (baseline to aggregate post-intervention scores)	90 % CI
Alika	6.67	7.86	8	13.5	11.67	0.778	-.060, 1
Bartoli	9	13.14	12	18.5	16.33	1	.162, 1
Adam	9.25	14.58	19	21.5	20.67	1	.225, 1
Eddy	8	14.43	9	18	15	0.833	.058, 1
Carmen	4	12.71	18	21	20	1	.225,1

proportion of improvement in paragraph writing quality. Tau-UA vs. B + trend B – trend A was selected for its ability to account for small data sets in each phase, account for overlap of data points, and adjust for baseline trend if needed (Vannest & Ninci, 2015), and was calculated using an online calculator (Vannest et al., 2016). Due to variability and lack of an increasing trend, baselines did not require trend correction. Baseline to aggregate post-intervention contrasts was not statistically significant for Alika and approached significance for the other participants (see Table 3). We combined phase contrasts to determine the aggregate effect size, Tau-U = 0.923, p <.001, 95% CI (.497, 1), indicating that a large proportion of the variability can be explained by the intervention. Comparing the two types of graphic organizers used, the between-phase contrasts for using the color graphic organizer (Tau-U = 0.943, p = 0.001) were slightly higher than for using the shape-coded graphic organizer (Tau-U = 0.089, p = 0.013). However, the Mann-Whitney U test on the median of the combined posttest and maintenance scores indicated there was not a statistically significant difference in paragraph quality scores for students who used the shapes GO (*Mdn* = 9.54) compared to those who used the colors GO (*Mdn* = 10.00), U = 1.00, z = -1.16, p = .248.

Discussion

As illustrated, score changes on the knowledge assessment were slightly higher for participants who received training with the shape (*Mn* = 7.5) than color (*Mn* = 5). However, the difference between color and shape cues while learning to use the graphic organizer did not impact students' learning of expository paragraph sentence types and functions, with four of five students improving their score and one remaining constant. Given the repeated use of the definitions during the intervention, this is a surprising finding; we expected the repeated application of the vocabulary would yield a significant change in students' understanding of the types of sentences used in an expository paragraph as has been found in other studies (Ewoldt & Morgan, 2022; Saddler & Graham, 2007). However, in the current study, this may be explained by Carmen's score, which remained unchanged. If her score had increased by one point, the overall differences would have reached statistical significance.

The intervention package improved writing quality for all participants, although the timing and degree of improvement were idiosyncratic. Once the reversed procedure was completed (i.e., Lesson 4, whereby the connections could be fully made between how a proficient writer might have developed an idea into a complete sentence from a graphic organizer, all participants' quality scores had already hit a low and continued to increase from that point. The sharpest gains typically occurred between Lessons 4 and 5 or between Lessons 5 and 6. Our findings align with other research showing that students with LD and ADHD need not just a graphic organizer, but explicit instruction and supported practice to improve writing skills (Rodríguez et al., 2015). Our findings extend the research in that reverse presentation of the exemplar contributed a unique type of support and that paragraph writing quality can improve in as little as four practice sessions.

Consistent with Singer and Bashir (2018), the graphic organizers appeared to serve as a holding cell or static place for students to save their ideas while they exercised their working memory resources to continue to generate additional content. This was most evident in anecdotal observations showing that students often had forgotten one of their response ideas until they referenced the GO. While continued research on which graphics are helpful for students (Singer & Bashir, 2018) is important, the findings of the current study suggest that while color and/or shapes are not a critical component of GO construction, having a constant product to refer to is significant.

Our findings support the effectiveness of prewriting strategies, including GOs (Bishop et al., 2015; Gillespie & Graham, 2014; Kaldenberg et al., 2016), modeling, and practice (Lee & De La Paz, 2021). During the beginning of the intervention when students were learning about expository sentences and the graphic organizer, their writing quality matched baseline levels. During the supported practice, expected improvement occurred. After the supported practice, the writing quality of three of five students immediately exceeded baseline levels. For the other two participants, this improvement occurred with one additional session. This timing coincides with the conclusion of the reverse engineering process. Combined with the finding that type of GO was not critical, this suggests that a key part of the intervention package was the reverse-engineered instruction (Ewoldt & Byrne, 2023; Ewoldt & Morgan, 2022). It also supports previous research that employed writing practice in a gradual release method (Brady et al., 2022; Cuillo et al., 2021).

Two students had multiple diagnoses, while the other three each had one diagnosis. The com-

pounding impact of disabilities on response to interventions is documented (Middleton et al., 2022) and offers one possible explanation for why these two students required an additional session before showing improvement. During the maintenance phase, all five students wrote paragraphs with quality scores that did not overlap their baseline.

While explicit instruction is included in other studies teaching graphic organizer use (Brady et al., 2022; Evmenova et al., 2020), the package in the current study used a slightly different process. The reverse-engineering intervention package of learning the types and functions of expository paragraph sentences was not impacted by the type of cueing that was used within the intervention. However, the interventionist anecdotally noted that cueing with highlighters appeared easier for the students to use whereas shapes were sometimes difficult to wrap around sentences, particularly when sentences were split across lines. Alternatively, using shapes drawn with a pen or pencil is more economical than highlighting with multiple colors and may be more readily available depending on the writing environment.

Conclusion

Overall, this study supports the growing body of literature demonstrating graphic organizers, explicit instruction, and practice with feedback as effective interventions for students with LD and/or ADHD. Additionally, it provides further evidence for the importance of explicit instruction on prewriting skills, including graphic organizers, while finding that shape and color cues are not critical features for students learning or using a graphic organizer. Because improvements were seen at the conclusion of the reversed presentation of the graphic organizer and exemplar paragraphs, future research exploring other components of graphic organizers or breaking down the writing intervention package components (e.g., with and without reversed presentation) to measure their individual impact could be useful.

Implications for Practice

This study provides additional evidence for a package intervention that includes GOs, explicit instruction, and practice. When using GOs, students require guidance on how the writing genre is organizationally depicted and how placement of content relates to the sentences within their written draft. They should be encouraged to use the GO as a reference when writing a draft. Opportunities for multiple supported practices appear to be a critical component, indicating the benefits of daily writing practice, particularly for students who have multiple diagnoses, which is often the case for students with LD.

Limitations and Future Research

The present study has some limitations. As with most single-case research, a small number of students limits the generalizability of results. Although we were able to identify disability eligibility categorizations for each student, we did not have access to any standardized testing data that could be used to compare general academic performance.

Because the package did result in significant improvement from pre- to post-quality measures, more research is needed to determine if the presentation order of the writing process (e.g., exemplar draft prior to brainstorming) and/or the aspects of working memory support are more critical to the improvements. Additionally, future studies using group design methods and a larger number of participants could parse out these effects.

References

Bailey, J. S., & Burch, M. R. (2018). *Research methods in applied behavior analysis* (2nd ed.). Routledge.

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.

Berninger, V. W., & Amtmann, D. (2003). Preventing written expression disabilities through early and continuing assessment and intervention for handwriting and/or spelling problems: Research into practice. In H. L. Swanson, K. R. Harris, & S. Graham (Eds.), *Handbook of learning disabilities* (pp. 345–363). Guilford Press.

Bishop, A. E., Sawyer, M., Alber-Morgan, S. R., & Boggs, M. (2015). Effects of a graphic organizer training package on the persuasive writing of middle school students with autism. *Education and Training in Autism and Developmental Disabilities, 50*(3), 290–302.

Boon, R. T., Barbetta, P. M., & Paal, M. (2018). The efficacy of graphic organizers on the writing outcomes of students with learning disabilities: A research synthesis of single-case studies. *Learning Disabilities: A Multidisciplinary Journal, 23*(2),18–33. https://doi.org/10.18666/LDMJ-2018-V23-I2-9042

Brady, K., Evmenova, A. S., Regan, K. S., Ainsworth, M. K., & Gafurov, B. S. (2022). Using a technology-based graphic organizer to improve the planning and persuasive paragraph writing by adolescents with disabilities and writing difficulties. *The Journal of Special Education, 55*(4), 222–233. https://doi.org/10.1177/00224669211008256

Capodieci, A., Serafini, A., Dessuki, A., & Cornoldi, C. (2018). Writing abilities and the role of working memory in children with symptoms of attention deficit and hyperactivity disorder. *Child Neuropsychology*, *25*(1), 103–121. https://doi.org/10.1080/09297049.2018.1441390

Ciullo, S., Mason, L. H., & Judd, L. (2021). Persuasive quick-writing about text: Intervention for students with learning disabilities. *Behavior Modification*, *45*(1), 122–146. https://doi.org/10.1177/0145445519882894

Cooper, J. O., Heron, T. E., & Heward, W. L. (2020). *Applied behavior analysis* (3rd ed.). Pearson.

Coyle, J. P. (2010). Teaching writing skills that enhance student success in future employment. *Collected Essays on Learning and Teaching*, *3*, 195–200. https://eric.ed.gov/?id=EJ1058314

Datchuk, S. M., & Rodgers, D. B. (2018). Text writing within simple sentences: A writing fluency intervention for students with high-incidence disabilities. *Learning Disabilities Research & Practice*, *34*(1), 23–34. https://doi.org/10.1111/ldrp.12185

Dexter, D. D., & Hughes, C. A. (2011). Graphic organizers and students with learning disabilities: A meta-analysis. *Learning Disabilities Quarterly*, *34*(1), 51–72. https://doi.org/10.1177/073194871103400104

Eckrich, S. J., Rapport, M. D., Calub, C. A., & Friedman, L. M. (2019). Written expression in boys with ADHD: The mediating roles of working memory and oral expression. *Child Neuropsychology*, *25*(6), 772–794. https://doi.org/10.1080/09297049.2018.1531982

Evmenova, A. S., Regan, K., Ahn, S. Y., & Good, K. (2020). Teacher implementation of a technology-based intervention for writing. *Learning Disabilities: A Contemporary Journal, 18*(1), 27–47.

Ewoldt, K. B. (2018). *Reverse engineering an expository paragraph for students with mild to moderate disabilities and English learners* [Doctoral dissertation, University of Nevada, Las Vegas]. http://dx.doi.org/10.34917/13568456

Ewoldt, K. B., & Byrne, S. R. (2023). Colour-cued paragraph writing instruction for students with learning disabilities. *Dyslexia, 29*(2), 97–115. http://doi.org/10.1002/dys.1732

Ewoldt, K. B., & Morgan, J. J. (2022). Reverse engineering the initial writing process steps for students with learning disabilities. *Learning Disabilities: A Multi-Disciplinary Journal, 27*(1). https://doi.org/10.18666/LDMJ-2021-V27-I1-11224

Gillam, S., Holbrook, S., Mecham, J., & Weller, D. (2018). Pull the Andon rope on working memory capacity interventions until we know more. *Language, Speech, and Hearing Services in Schools*, *49*(3), 434–448. https://doi.org/10.1044/2018_LSHSS-17-0121

Gillespie, A., & Graham, S. (2014). A meta-analysis of writing interventions for students with learning disabilities. *Exceptional Children*, *80*(4), 454–473. https://doi-org/10.1177/0014402914527238

Graham, S. (2006). Writing. In P. Alexander & P. Winne (Eds.), *Handbook of educational psychology* (2nd ed., pp. 457–478). Routledge.

Graham, S., Collins, A. A., & Rigby-Wills, H. (2017). Writing characteristics of students with learning disabilities and typically developing peers: A meta-analysis. *Exceptional Children, 83*(2), 199–218. https://doi.org/10.1177/0014402916664070

Graham, S., Fishman, E. J., Reid, R., & Hebert, M. (2016). Writing characteristics of students with attention deficit hyperactive disorder: A meta-analysis. *Learning Disabilities Research & Practice, 31*(2), 75–89. https://doi.org/10.1111/ldrp.12099

Graham, S., & Perin, D. (2007a). *Writing next: Effective strategies to improve writing of adolescents in middle and high school.* Alliance for Excellent Education & Carnegie Corporation of New York. https://www.carnegie.org/publications/writing-next-effective-strategies-to-improve-writing-of-adolescents-in-middle-and-high-schools/

Graham, S., & Perin, D. (2007b). A meta-analysis of writing instruction for adolescent students. *Journal of Educational Psychology*, *99*(3), 445–476. https://10.1037/0022-0663.99.3.445

Harris, K. R., & Graham, S. (1985). Improving learning disabled student's composition skills: Self-concept training. *Learning Disabilities Quarterly, 8*(1), 27–36.

Hebert, M., Bohaty, J. J., Nelson, J. R., & Roehling, J. V. (2018). Writing informational text using provided information and text structures: An intervention for upper elementary struggling writers. *Reading and Writing, 31*, 2165–2190. https:// 10.1007/s11145-018-9841-x

Hoover, T. M., Kubina, 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. https://doi.org/10.1080/09362835.2012.640903

Kaldenberg, E. R., Ganzeveld, P., Hosp, J. L., & Rodgers, D. B. (2016). Common characteristics of writing interventions for students with learning disabilities: A synthesis of the literature. *Psychology in the Schools*, *53*(9), 938–953. https://doi.org/10.1002/pits.21958

Kang, E. Y., McKenna, J. W., Arden, S., & Ciullo, S. (2015). Integrated reading and writing interventions for students with learning disabilities: A review of the literature. *Learning Disabilities Research & Practice*, *31*(1), 22–33. https://doi.org/10.1111/ldrp.12091

Kennedy, C. H. (2005). *Single-case designs for educational research*. Pearson.

Kiuhara, S. A., O'Neill, R. E., Hawken, L. S., & Graham, S. (2012). The effectiveness of teaching 10th-grade students STOP, AIMS, and DARE for planning and drafting persuasive text. *Exceptional Children, 78*(3), 335–355. https://doi.org/10.1177/001440291207800305

Kratochwill, T. R., Horner, R. H., Levin, J. R., Machalicek, W., Ferron, J., & Johnson, A. (2021). Single-case design standards: An update and proposed upgrades. *Journal of School Psychology*, *89*, 91–105. https://doi.org/10.1016/j.jsp.2021.10.006

Lambiotte, J. G., Dansereau, D. F., Cross, D. R., & Reynolds, S. B. (1989). Multirelational semantic maps. *Educational Psychology Review*, *1*(4), 331–367. https://doi.org/0.1007/BF01320098

Lee, Y., & De La Paz, S. (2021). Science writing intervention research for students with and at risk for learning disabilities, and English learners: A systematic review. *Learning Disability Quarterly*, *44*(4), 261–274. https://doi.org/10.1177/07319487211018213

Maggin, D. M., Cook, B. G., & Cook, L. (2018). Using single-case research designs to examine the effects of interventions in special education. *Learning Disabilities Research and Practice, 33*(4), 182–191. https://doi.org/10.1111/ldrp.12184

Middleton, A. E., Farris, E. A., Ring, J. J., & Odegard, T. N. (2022). Predicting and evaluating treatment response: Evidence toward protracted response patterns for severely impacted students with dyslexia. *Journal of Learning Disabilities, 55(*4), 272–291. https://doi.org/10.1177/00222194211047633

National Center for Education Statistics. (2012). *2011 writing assessment.* U.S. Department of Education, Institute of Education Sciences. https://nces.ed.gov/nationsreportcard/pubs/main2011/2012470.aspx

Ramos, A. A., Hamdan, A. C., & Machado, L. (2020). A meta-analysis on verbal working memory in children and adolescents with ADHD. *The Clinical Neuropsychologist, 34*(5), 873–898. https://doi.org/10.1080/13854046.2019.1604998

Ritchie, S. J., Della Sala, S., & McIntosh, R. D. (2011). Irlen colored overlays do not alleviate reading difficulties. *Pediatrics, 128*(4), 932–938. https://doi.org/10.1542/peds.2011-0314

Rodríguez, C., Grünke, M., González-Castro, P., García, T., & Álvarez-García, D. (2015). How do students with attention-deficit/hyperactivity disorders and writing learning disabilities differ from their nonlabeled peers in the ability to compose texts? *Learning Disabilities: A Contemporary Journal*, *13*(2), 157–175.

Roitsch, J., Gumpert, M., Springle, A., & Raymer, A. M. (2020). Writing instruction for students with learning disabilities: Quality appraisal of systematic reviews and meta-analyses. *Reading & Writing Quarterly*, *37*(1), 32–44. https://doi.org/10.1080/10573569.2019.1708221

Rose, P. (2019). *Writing interventions for students with specific learning disabilities* [Master's thesis, California State University]. https://scholarworks.lib.csusb.edu/etd/960

Saddler, B., & Graham, S. (2007). The relationship between writing knowledge and writing performance among more and less skilled writers. *Reading & Writing Quarterly: Overcoming Learning Difficulties, 23*(3), 231–247. https://doi.org/10.1080/10573560701277575

Singer, B. D., & Bashir, A. S. (2018). Wait … what??? Guiding intervention principles for students with verbal working memory limitations. *Language, Speech, and Hearing Services in Schools*, *49*(3), 449–462. https://doi.org/10.1044/2018_LSHSS-17-0101

Stewart, A. A., & Swanson, E. (2022). Supporting reading comprehension for students with inattention. *Teaching Exceptional Children*, *56*(5), Article e4005992210874. https://doi.org/10.1177/00400599221087434

Stull, A. T., & Mayer, R. E. (2002). Learning by doing versus learning by viewing: Three experimental comparisons of learner-generated versus author-provided graphic organizers. *Journal of Educational Psychology, 99*(4), 808–820. https://doi.org/10.1037/0022-0663.99.4.808

Swanson, H. L., & Sachse-Lee, C. (2000). A meta-analysis of single-subject-design intervention research for students with LD. *Journal of Learning Disabilities*, *33*(2), 114–136. https://doi.org/10.1177/002221940003300201

Torres, C., & Black, R. S. (2018). Culturally responsive self-regulated strategy development in writing for college students with disabilities. *Multiple Voices for Ethnically Diverse Exceptional Learners*, *18*(1), 42–59. https://doi.org/10.56829/2158-396X.18.1.42

Vannest, K. J., & Ninci, J. (2015). Evaluating intervention effects in single-case research designs. *Journal of Counseling & Development*, *93*(4), 403–411. https://doi.org/10.1002/jcad.12038

Vannest, K. J., Parker, R. I., Gonen, O., & Adiguzel, T. (2016). *Single case research: Web-based calculators for SCR analysis* (Version 2.0). [Web-based application]. Texas A & M University. http://singlecaseresearch.org/calculators/tau-u

Videen, J., Deno, S., & Marston, D. (1982). *Correct word sequences: A valid indicator of proficiency in written expression* (Report No. 84). Office of Special Education and Rehabilitative Services. https://eric.ed.gov/?id=ED225112

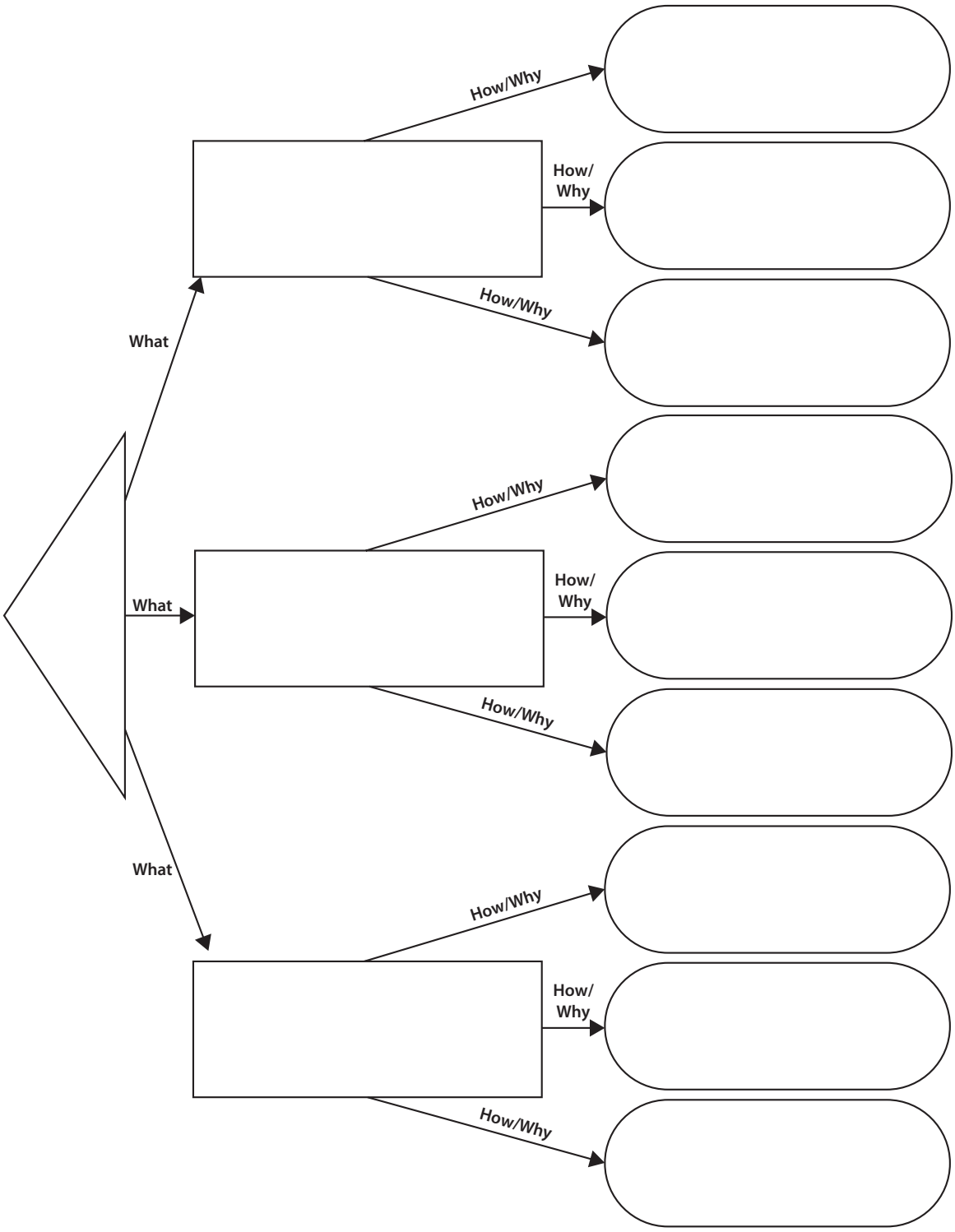
White, S., Kim, Y. Y., Chen, J., & Liu, F. (2015). *Performance of fourth-grade students in the 2012 NAEP computer-based writing pilot assessment: Scores, text length, and use of editing tools* (NCES 2015–119). U.S. Department of Education Institute of Education Sciences. https://eric.ed.gov/?id=ED562627

Wiest, G. M., Rosales, K. P., Looney, L., Wong, E. H., & Wiest, D. J. (2022). Utilizing cognitive training to improve working memory, attention, and impulsivity in school-aged children with ADHD and SLD. *Brain Sciences*, *12*(2), Article e141. https://doi.org/10.3390/brainsci12020141

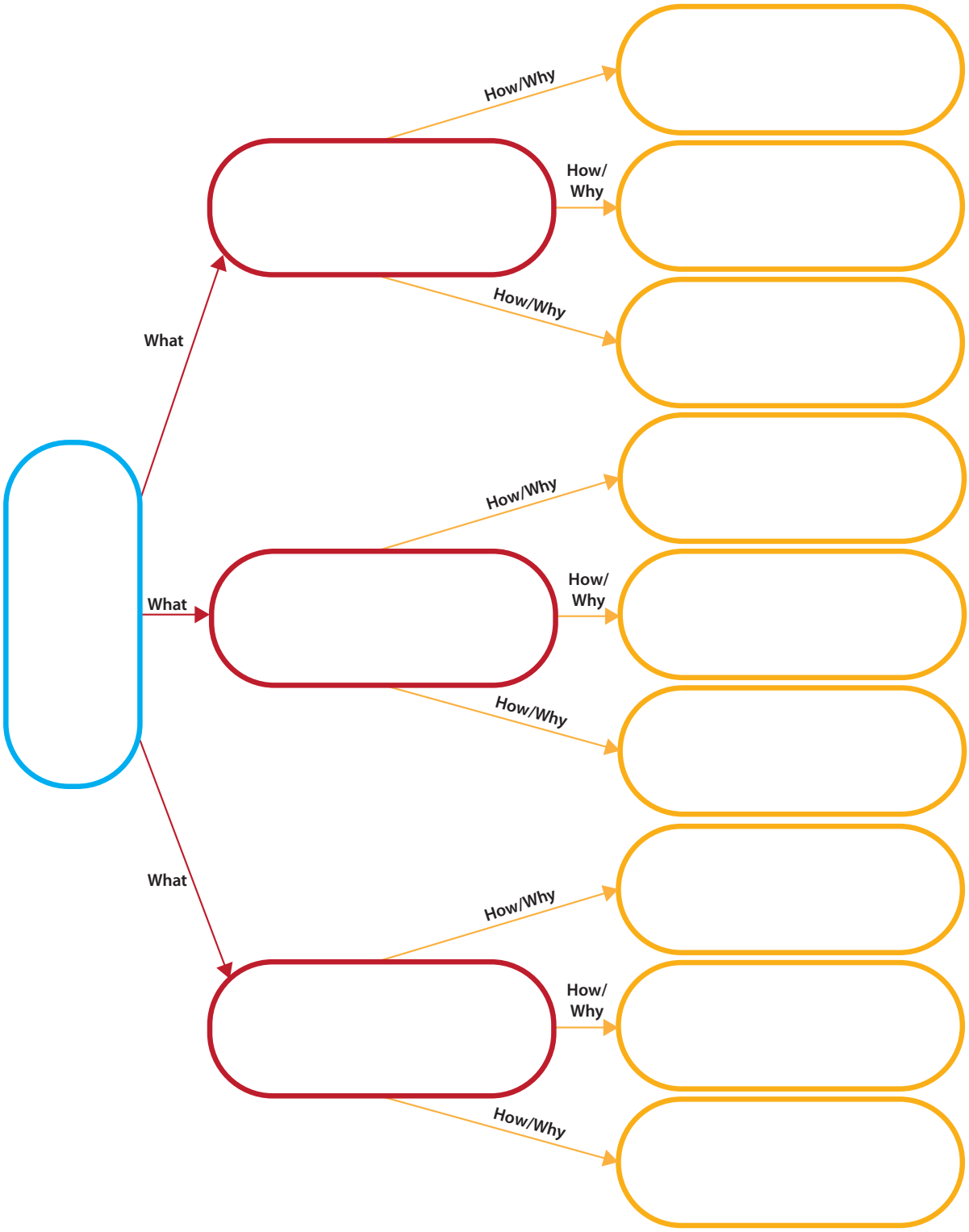
Appendix A

Graphic Organizers

Shapes



Colors


How/Why
How/
Why
How/Why
What
How/Why
What
How/
Why
How/Why
What
How/Why
How/
Why
How/Why

Appendix B

Colors

Sentence Types and Characteristics

	Characteristics	Label
Topic Sentence	States main idea	Blue
	Keeps the idea general/broad	
	Only 1 main idea	
Detail Sentence	Gives specific information about the topic	Pink
	Answers the "what" question	
Explanation Sentence	Gives information about the detail	Yellow
	Answers the "why" or "how" question	
Conclusion Sentence	General statement about the topic	Blue
	Similar idea of topic sentence using different words	
	Wraps up the paragraph	
	Signals reader paragraph is ending (or transitioning to new paragraph)	
	Typically, the last sentence	
	May include the author's general feeling/attitude	

Shapes

Sentence Types and Characteristics

	Characteristics	Label
Topic Sentence	States main idea	Triangle
	Keeps the idea general/broad	
	Only 1 main idea	
Detail Sentence	Gives specific information about the topic	Rectangle
	Answers the "what" question	
Explanation Sentence	Gives information about the detail	Oval
	Answers the "why" or "how" question	
Conclusion Sentence	General statement about the topic	Triangle
	Similar idea of topic sentence using different words	
	Wraps up the paragraph	
	Signals reader paragraph is ending (or transitioning to new paragraph)	
	Typically, the last sentence	
	May include the author's general feeling/attitude	

Supplemental Materials

Knowledge Assessment

Circle one answer for each question.

1. How many sentence types should be included in a paragraph?
   a. Two: the topic sentence and the explanation sentence
   b. Four: The topic, detail, explanation, and conclusion sentences
   c. Five: The topic, detail, explanation, general, and conclusion sentences

2. Which of the following describes explanation sentences?
   a. Explanation sentences give information about the detail sentence.
   b. Explanation sentences are general sentences that do not include details.
   c. Explanation sentences wrap up the paragraph.

3. Which of the following describes the main idea of a paragraph?
   a. The main idea should be included in the topic sentence.
   b. The main idea can have more than one idea.
   c. The main idea should include details.

4. What is the purpose of a conclusion sentence?
   a. The conclusion sentence gives information about the detail sentence.
   b. The conclusion sentence tells the "What" information about the main idea.
   c. The conclusion sentence wraps up the paragraph.

5. Which of the following describes a detail sentence?
   a. A detail sentence should be included in the topic sentence.
   b. A detail sentence tells the "What" information about the main idea.
   c. A detail sentence wraps up the paragraph.

6. Which of the following describes a topic sentence?
   a. A topic sentence should include more than one idea.
   b. A topic sentence answers the "How" or "Why" of a detail sentence.
   c. A topic sentence lets the reader know what the paragraph will be about.

7. Which type of sentence explains the "What" of a main idea?
   a. Topic sentence
   b. Conclusion sentence
   c. Detail sentence

8. Which type of sentence is similar to the topic sentence?
   a. Topic sentence
   b. Conclusion sentence
   c. Detail sentence

9. Which type of sentence answers the "how" or "why" of the detail sentence?
    a. Explanation sentence
    b. Topic sentence
    c. Conclusion sentence

10. Which two sentence types are broad and do not include specific information?
    a. Detail and topic sentences
    b. Explanation and conclusion sentences
    c. Topic and conclusion sentences

Use the sentences in the following paragraph to answer questions 11 – 14. When you answer the questions, you should look back at this paragraph to help you make the best choice.

Dr. Martin Luther King, Jr. is an American hero. He was a good family man. He was married for 15 years and had four kids. He was brave. When African-American people were being treated badly, he stood up for them. He wasn't worried that he might get hurt. He was also a smart man. He went to school and college for a long time. He also learned to become a church reverend. Dr. King will be remembered for a lot of years.

11. Which of the following is a detail sentence?
    a. He was married for 15 years and had four kids.
    b. He was also a smart man.
    c. Dr. King will be remembered for a lot of years.

12. Which of the following is the topic sentence?
    a. He was married for 15 years and had four kids.
    b. He was also a smart man.
    c. Dr. Martin Luther King, Jr. is an American hero.

13. Which of the following is an explanation sentence?
    a. He was married for 15 years and had four kids.
    b. He was also a smart man.
    c. Dr. King will be remembered for a lot of years.

14. Which of the following is the conclusion sentence?
    a. He was married for 15 years and had four kids.
    b. Dr. Martin Luther King, Jr. is an American hero.
    c. Dr. King will be remembered for a lot of years.

Use the sentences in the following paragraph to answer questions 15 – 18. When you answer the questions, you should look back at this paragraph to help you make the best choice.

Learning to play a musical instrument is a good thing to do. When you first start, you have to be patient with yourself. It takes a long time to get good at something new. If you make mistakes, you have to give yourself a break. You have to keep on learning for months and sometimes years. You also have to practice when you are learning to play an instrument. This helps you get better and better. Practice can be hard, but you have to keep doing it a lot. You might even get bored sometimes. There are benefits to learning an instrument too. It can help your brain be healthy. It can help you with your math skills too. Learning to play a new instrument is worth the work.

15. Which of the following is a detail sentence?
    a. You also have to practice when you are learning to play an instrument.
    b. Practice can be hard, but you have to keep doing it a lot.
    c. Learning to play a musical instrument is a good thing to do.

16. Which of the following is the topic sentence?
    a. It can help you with your math skills too.
    b. Learning to play a new instrument is worth the work.
    c. Learning to play a musical instrument is a good thing to do.

17. Which of the following is an explanation sentence?
    a. You also have to practice when you are learning to play an instrument.
    b. This helps you get better and better.
    c. Learning to play a musical instrument is a good thing to do.

18. Which of the following is the conclusion sentence?
    a. You also have to practice when you are learning to play an instrument.
    b. Practice can be hard, but you have to keep doing it a lot.
    c. Learning to play a new instrument is worth the work.

Answer Key

1. B
2. A
3. A
4. C
5. B
6. C
7. C
8. B
9. A
10. C
11. B
12. C
13. A
14. C
15. A
16. C
17. B
18. C

Rubric

Total Score**: /22**

	2 Points	**1 Point**	**0 Points**
Topic Sentence	Contains one main idea.	N/A	Contains more than one idea.
	Main idea is clear.	Main idea is somewhat clear.	Main idea is unclear.
	Main idea is broad.	Main idea is somewhat broad.	Main idea is not broad.
Detail sentences	Paragraph contains three or more detail sentences.	Paragraph contains two detail sentences.	Paragraph contains fewer than two detail sentences.
	Three detail sentences relate to the main idea.	Two or fewer detail sentences relate to the main idea.	No details relate to the main idea.
Explanation sentences/ ideas	Each detail has two or more explanations	Each detail has one or more explanations	Not all details have an explanation.
	If there are 3 details and 2 details have 2 (or more) explanations.	If there are 3 details and 2 details have 1 (or more) explanations.	N/A
	Each explanation idea relates to its detail sentence.	Some explanation ideas relate to their detail sentences.	Few explanation ideas relate to their detail sentences.
Conclusion sentences	Conclusion is clear.	Conclusion is somewhat clear.	Conclusion is missing or is unclear.
	Conclusion is broad.	Conclusion is somewhat broad.	Conclusion is not broad.
	Conclusion restates ideas of topic sentence.	Conclusion somewhat restates ideas of the topic sentence.	Conclusion does not restate ideas of the topic sentence.

Paragraph Writing Prompts (Readability Grade Level)

1. When you go home, you have many things you can do. What is your favorite activity outside of school? Write a paragraph telling why this activity is your favorite. (6.0)

2. Each class in a school has different ways of doing things. If a new student came into your classroom today, what would be important for this new student to know? Write a paragraph telling the new student important things to know about your class. (6.2)

3. We have all had great teachers who have impacted our lives in a special way. Who is your favorite teacher? Write a paragraph explaining why this teacher is so special. (5.2)

4. Listening to music can make people happy. What is your favorite kind of music? Write a paragraph telling why this kind of music is your favorite. (5.9)

5. Many students use YouTube every day, but adults don't understand it. What type of video do you watch most often? Write a paragraph telling adults about one type of video. (6.7)

6. Giving to charity can be a good experience for the person giving. If you had $100 to give away, who would you give it to? Write a paragraph exampling who you would give the money to and why. (5.8)

7. Some people get very excited about watching sporting events or playing sports. What is your favorite sport? Write a paragraph explaining why this is your favorite sport. (5.1)

8. People find many reasons to celebrate. What is your favorite celebration? Write a paragraph explaining your favorite celebration. (6.9)

9. A hero is a person you look up to or admire. Who is your hero? Write a paragraph explaining why this person is your hero. (4.1)

10. The first cartoon shown at a theater was Mickey Mouse in 1928. Think up a cartoon character of your own. Write a paragraph describing your character. (6.8)

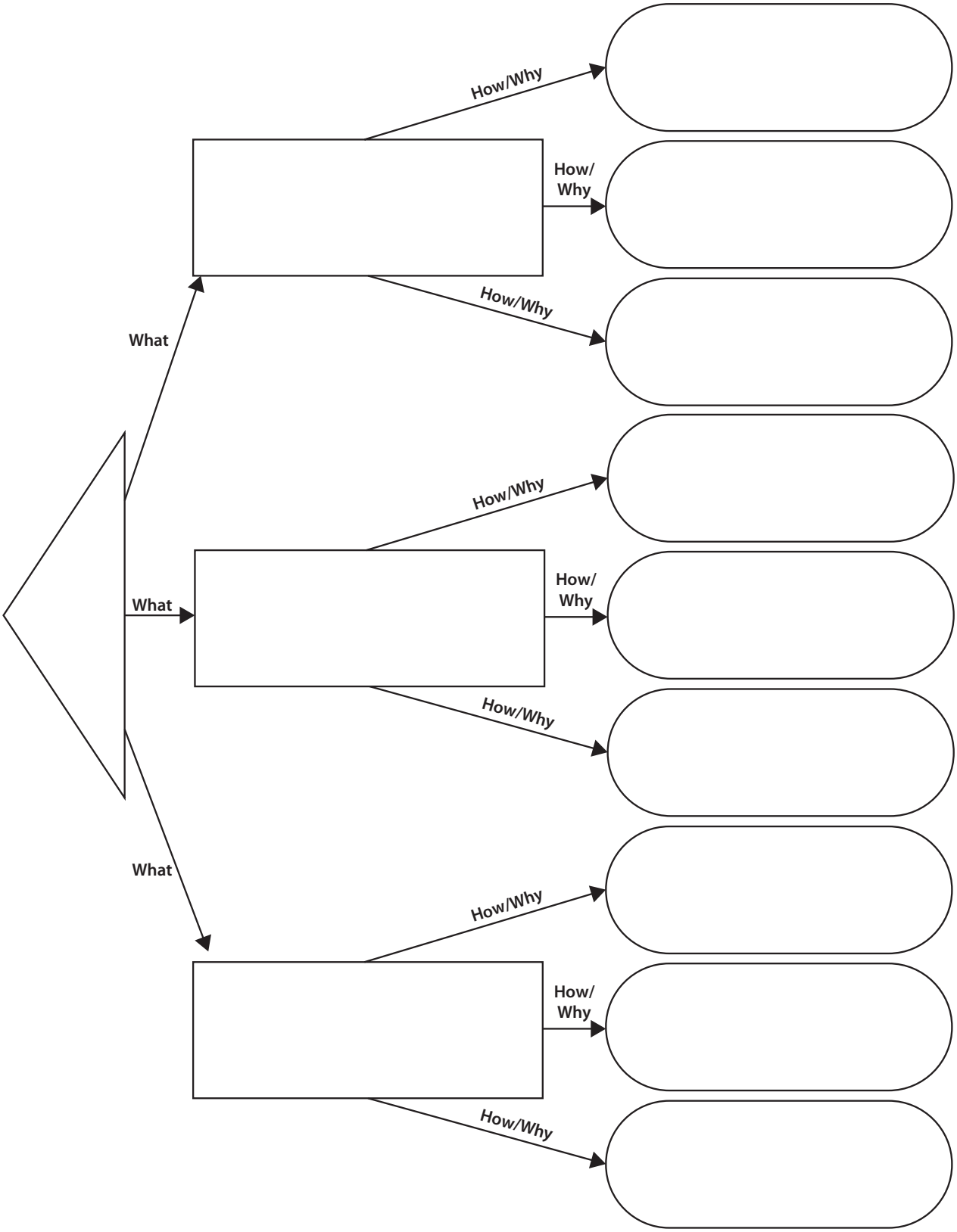
11. The third week in October is school lunch week. If you could create the perfect school lunch, what would it be? Write a paragraph that describes your perfect lunch. (3.3)

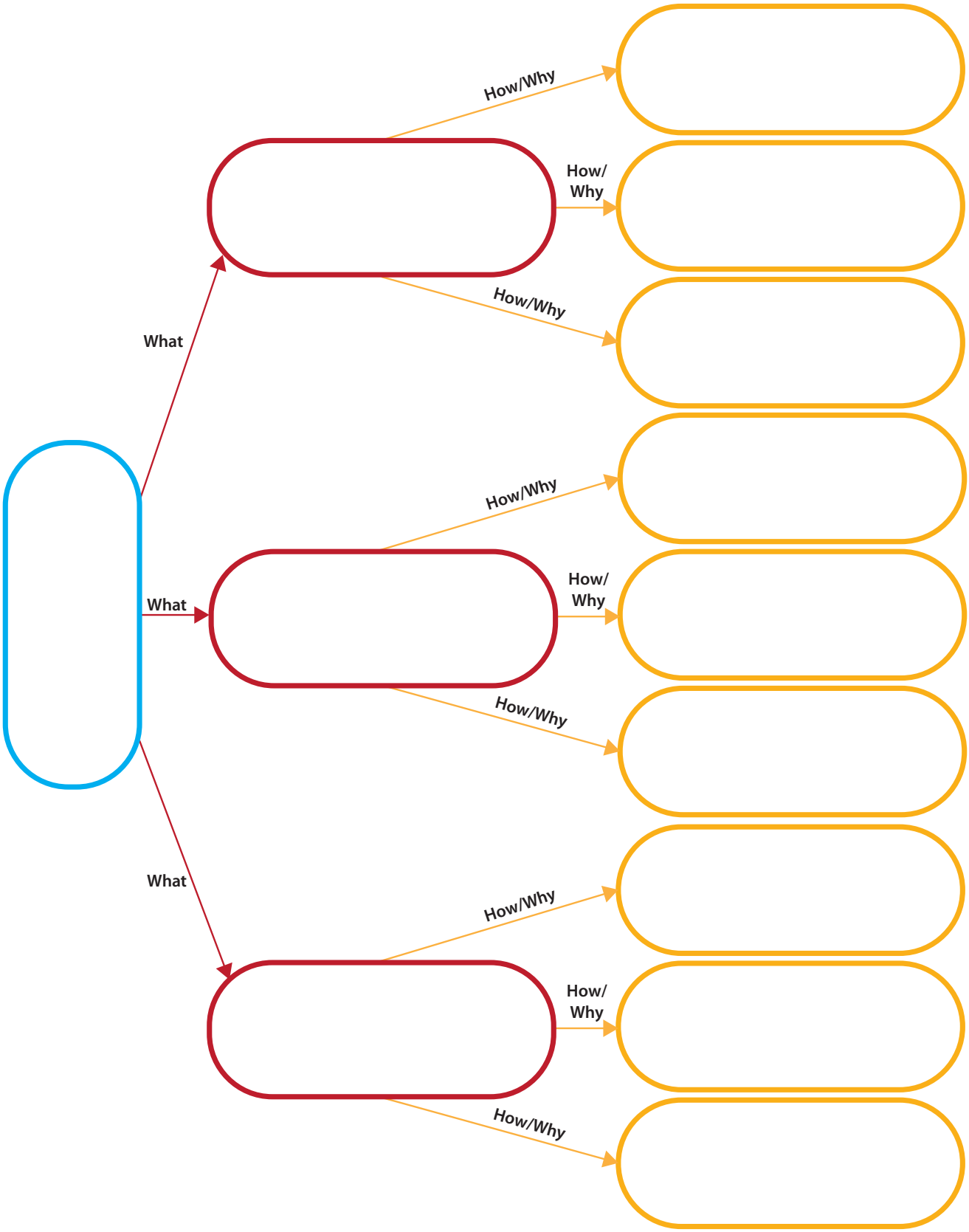
12. Some people remember parts of their dreams, but the places and people in the dreams can be unclear. What's the best dream you ever had? Write a paragraph that describes what you remember. (4.1)

13. In January, many people make resolutions, where they promise to do something different for the year that is starting. Think about something you would resolve to do. Write a paragraph about a resolution that you might make next January. (8.8)

14. Snowflakes each have their own unique pattern of different shapes. People are the same way. Each person is a little different than other people around them, making them unique. Write a paragraph telling about your unique qualities. (6.0)

Blank Graphic Organizers




How/Why
How/
Why
How/Why
What
How/Why
What
How/
Why
How/Why
What
How/Why
How/
Why
How/Why

Schedule

Note. Session lesson plan available upon request from Kathy.ewoldt@utsa.edu

Dyad Session Schedule			
Session	Dyad A	Dyad B	Dyad C
1	Pre-intervention knowledge assessment	Pre-intervention knowledge assessment	Pre-intervention knowledge assessment
2	Pre-intervention writing session	Pre-intervention writing session	Pre-intervention writing session
3	Pre-intervention writing session	Pre-intervention writing session	Pre-intervention writing session
4	Pre-intervention writing session	Pre-intervention writing session	
5	Intervention Lesson 1		
6	Intervention Lesson 2		
7	Intervention Lesson 3		
8	Intervention Lesson 4		Pre-intervention writing session*
9	Intervention Practice writing session 5	Pre-intervention writing session	
10	Intervention Practice writing session 6	Intervention Lesson 1	
11	Intervention Practice writing session 7	Intervention Lesson 2	
12	Post-intervention knowledge	Intervention Lesson 3	
13	Post-assessment writing session	Intervention Lesson 4	
14		Intervention Practice writing session 5	
15		Intervention Practice writing session 6	Pre-intervention writing session*
16			Intervention Lesson 1
17		Intervention Practice writing session 7	Intervention Lesson 2
18	Maintenance	Post-intervention knowledge assessment	Intervention Lesson 3
19		Post-assessment writing session	Intervention Lesson 4
20			Intervention Practice writing session 5
21	Maintenance		Intervention Practice writing session 6
22			Intervention Practice writing session 7
23		Maintenance	Post-intervention knowledge
24			Post-assessment writing session
25		Maintenance	
26			Maintenance
27			Maintenance