Improving Middle School Writing:

Evidence from a Quasi-Experimental Pilot of the Writing Pathway Program

Produced by:

Heather Harris
Herkimer Consulting

Steve Graham
Arizona State University

Gustaf B. Skar
Norwegian University of Science and Technology

Alan Huebner
University of Notre Dame

Commissioned by:

www.writingpathway.org

July 2025

Table of Contents

The Problem

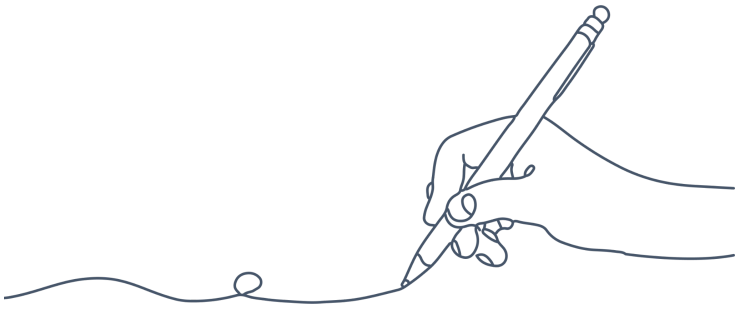
The United States is facing a national literacy crisis with **7 out of 10 students not proficient in reading** (NAEP, 2024). Reading and writing are inextricably linked as students develop mastery of the English language (e.g., Berninger, Abbott, Graham, & Richards, 2002; Berninger et al., 2006), yet writing is often deprioritized or used narrowly for standardized test preparation, and it tends to be underutilized as a tool for learning across content areas in K-12 education (NCTE Position Statement, 2021). As a result, many K-12 students have too few opportunities to write about content, even though writing to learn would deepen their understanding of the curriculum (Knipper & Duggan, 2006). Moreover, when students begin undergraduate studies, they are woefully underprepared to write well and struggle—a trend exacerbated by the COVID-19 pandemic and the emergent use of ChatGPT (Fontenelle-Tereshchuk, 2024).

To serve students well, action is required. However, writing interventions can be costly and time-consuming, especially because they require teachers to create practice materials that align with specific content. These time demands often limit teachers' ability to tailor the curriculum to meet the realistic constraints of the classroom, including structured class time, curricular pacing, and alignment with topics and subject matter (Bhowmik & Kim, 2021). While high-quality instructional materials (HQIM) offer an important step toward more rigorous instruction, they are frequently so dense with content that writing instruction—especially sustained practice with feedback—gets pushed to the margins or even omitted completely. This is a missed opportunity: writing is a powerful but underused lever for building coherence both across disciplines (horizontal) and through grade levels (vertical). In

a meta-analysis of writing interventions for grades 6–12, Graham and colleagues (2023) found that **teaching writing not only improves writing outcomes, but also enhances reading performance**. Yet many teachers are underprepared to teach writing, having received minimal training in writing instruction during their teacher preparation programs (Kiuhara et al., 2009; Myers et al., 2016; Sundeen, 2015).

In addition to the teaching constraints, scoring student papers and providing meaningful feedback is a difficult and time-consuming process. However, individualized feedback on writing is one of the surest ways to impact student growth and skill development (Hattie & Timperly, 2007). Consistency in scoring is also challenging across different writing tasks, teacher raters, and even among students in the same classroom (Kim et al., 2017; White, 2025). Combined, these factors make it difficult for teachers to determine the best next instructional steps to scaffold the development of students' writing skills.

Traditional writing interventions typically necessitate substantial classroom time, resources, and professional development for teachers, which are often unavailable in underfunded schools and difficult to implement at scale. However, innovative solutions may address these challenges by providing high-quality materials that streamline writing practices and do not necessitate extensive teacher training in writing pedagogy. For example, Artificial Intelligence (AI) tools that can integrate writing practice opportunities into content-area instruction may help maximize instructional time and improve students' writing skills across subjects. These technological tools, such as the AI-powered tools embedded in the Writing Pathway, have the potential to enable teachers to create more effective writing materials and interventions that support all students in improving their writing skills.



The Solution

Recent advances in large language models (LLMs) offer a new opportunity to strengthen writing instruction and use writing to learn. For the first time, new LLM or AI-powered technology allows opportunities for content generation to be integrated with curricula, for individualized scoring and feedback, and for guidance in lesson planning that scaffolds students' writing skills (Maine, 2024). In other words, these tools make it feasible to integrate writing practice into any subject by generating custom prompts and scaffolded exercises tied to their content area and extending teachers' capacities to provide feedback tailored to the needs of their entire class. This technological shift is uniquely timely, as it arrives just as schools need scalable ways to remediate pandemic-era learning loss and enhance students' writing skills. However, aligning new technologies with the evidence on writing instruction best practices is no easy task.

The Writing Pathway is among the few **AI-assisted writing tools that offer teachers high-impact writing strategies in a clear and customizable scope and sequence**. The Writing Pathway platform combines evidence-based strategies with AI tools that save teachers' time by creating writing practice aligned to any curriculum in grades 3-12. The platform is designed to support teachers by making it easy to embed effective strategies to scaffold key writing skills and build

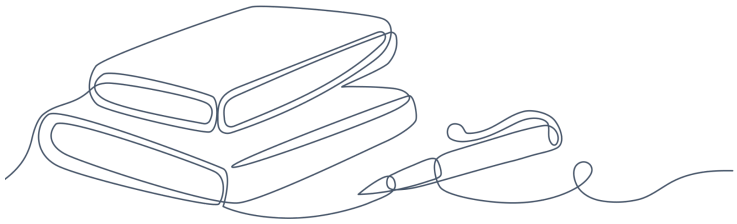
students' knowledge (e.g., Gallagher et al., 2017; Graham et al., 2016; 2020; 2023; Olson et al., 2012). It encompasses comprehensive writing practice (e.g., sentence, paragraph, and multi-paragraph responses), grammar instruction (i.e., foundational mechanical skills), sentence and strategy instruction (e.g., practice writing stronger sentences with particular syntactic structures), and prewriting and planning activities (e.g., outlining and conceptual organizing).

The Writing Pathway is a free platform that includes a streamlined library of 180 skills–intentionally limited to align with instructional time constraints and reduce teacher overload.[1] Skills can be selected to create course-aligned writing instruction exercises. Once a teacher using the Writing Pathway selects a writing skill (e.g. transitions), they can ask the platform to generate practice with that skill that is also aligned to their content by simply typing the content in the "Lesson Content" field (e.g. The Industrial Revolution), and/or uploading a document or text for the AI to pull from. By auto-generating exercises and answer keys based on the content of a teacher's current lesson, **the Writing Pathway enables teachers to easily create grade-level-appropriate practice exercises in seconds** (see Appendix for annotated examples).

Although the Writing Pathway was developed with intentional feedback from teachers to make writing instruction easier, practical, and more effective, investigating its efficacy as an intervention in the classroom was a necessary next step. Consequently, **a pilot study was conducted to evaluate student growth following one year of use in a variety of middle school classrooms**. The goal of the

[1] It is important to note that during the study period, participating teachers primarily accessed an earlier version of the Writing Pathway platform. While they had access to AI-generated materials for sentence-level skills, the AI tools for paragraph and multi-paragraph skills were not yet available. Instead, teachers were provided with exemplars, lesson guidance, and other static resources (rather than the full suite of dynamic tools now integrated into the platform).

study was to evaluate whether student writing ability grew when teachers used the Writing Pathway compared to traditional writing instruction.



Methods

The study evaluated the impact of the Writing Pathway application when embedding writing skills in academic curriculum, compared to “business as usual” writing instruction in a comparison group. Seventh and 8th grade teachers were invited to participate in a Writing Pathway curriculum intervention for one academic year, with around 50% opting to join. Recruited teachers were then asked to recommend other teachers with similar backgrounds and teaching environments to serve in a constructed comparison group. Teachers in both groups were asked to identify one of their classes of average ability to be the focus of the study.

The study occurred over the 2023-2024 academic year. Teacher participants in the Writing Pathway intervention were asked to consistently make a “good faith” effort to include Writing Pathway skills and materials in their lesson planning. In contrast, teachers in the comparison group made no changes to their curriculum or teaching plans.

In addition to adopting the Writing Pathway throughout the year, teachers in the treatment group were asked to: fill out a beginning and end of the year survey

asking about teaching efficacy; complete a daily survey reporting on their writing instruction implementation; participate in monthly remote professional learning meetings with the Writing Pathway team; and administer a pre- and post- writing assessment. For their time, teacher participants received a $2,000 stipend. Teachers in the comparison group were asked to: complete the same beginning and end of year teaching efficacy survey; complete a weekly writing implementation survey; and administer the same pre- and post-assessment. They were compensated with a $450 stipend.

To evaluate the growth of students' writing, student participants responded to NAEP writing prompts, which were then scored using Measurement Incorporated's MI Write automated writing evaluation (AWE) tool. The scored NAEP writing prompts served as pre- and post-assessment measures. Writing was scored on a 24-point rubric aligned with Education Northwest's 6+1 Trait Writing Model. The MI Write scoring algorithm was developed to accurately assess students in grades 3-12, and previous research has found strong validity evidence for large-scale implementation in evaluating student writing outcomes (e.g., Huang & Wilson, 2021; Potter & Wilson, 2021; Wilson et al., 2021; Wilson & Rodrigues, 2020).

Results

Twenty-one teachers from eight schools participated in the pilot study. Among them, 12 teachers were in the treatment group, which included five 7th-grade teachers and seven 8th-grade teachers. The comparison group included 9 teachers; five were 7th-grade teachers and four were 8th-grade teachers. The final student samples included writing from 101 7th-grade students and 160 8th-grade students in the treatment group, compared to 97 7th-grade and 83 8th-grade comparison group students.

Overall, the treatment and comparison groups were similar in the proportion of students attending Title 1 schools (0.23 and 0.25, respectively). However, groups did vary on a few factors including the number of students taught in each section, the number of students receiving Special Education services, the number of ELL students, and the average number of years of teaching experience for teachers (see Table 1).

Table 1
Baseline Characteristics Between Overall Treatment and Comparison Groups

	Treatment		Comparison	
	M	**SD**	**M**	**SD**
Average number of students in section	26.67	3.39	25.44	3.43
Average number of years teaching experience	18.25	9.07	15.78	8.27
	Percent		**Percent**	
Percent of students male	50.32%		48.90%	
Percent of students receiving Special Education Services	13.75%		2.20%	
Percent of students identified as English Language Learners	13.13%		25.79%	

Fidelity of implementation data was collected from teachers via surveys and included information about the skills that were most frequently taught throughout the academic year. Teachers in the treatment group responded to a daily survey and teachers in the comparison group responded to a parallel weekly survey. Table 2 displays the frequency with which 10 focus skills were reportedly taught to students via these teacher surveys by grade and treatment condition. Overall, the response rate on teacher surveys for the comparison group was 88% (completing a weekly survey), and the response rate for teachers in the treatment condition was 78% (completing a daily survey).

Table 2

Fidelity of Implementation Summary and Percent of Time Writing Skills were Taught

	Skill	7th Treatment (n = 5)	7th Comparison (n = 5)	8th Treatment (n = 7)	8th Comparison (n = 4)
None	Did not work on the skills	34.65%	30.42%	49.96%	30.30%
1	Sentence construction	13.68%	12.64%	12.16%	9.32%
2	Opinion or informational paragraph skills with no provided sources	6.20%	10.84%	5.98%	8.54%
3	Writing argumentative paragraphs with paraphrased evidence from one source	7.37%	1.35%	3.73%	4.01%
4	Writing argumentative paragraphs with quoted evidence from one source	6.85%	6.46%	5.27%	7.13%
5	Writing opinion or informational essays with no provided sources	3.30%	3.02%	0.93%	4.98%
6	Writing an argumentative essay and incorporated one or two sources of evidence	9.30%	10.08%	9.64%	10.91%
7	Writing a research essay with multiple provided sources of evidence	7.91%	6.22%	2.69%	0.96%
8	Writing a fictional narrative	2.33%	4.49%	5.31%	14.23%
9	Writing a personal narrative	2.87%	5.51%	1.86%	1.92%
10	Grammar and writing mechanics	9.27%	24.68%	7.63%	16.31%

Note: The teachers in the treatment group filled out the survey daily, whereas teachers in the comparison group filled out the survey weekly.

Because the current study used a quasi-experimental design, a differences-in-differences (DiD) analysis was conducted using best practices from the literature (e.g., Wing et al., 2018). DiD analysis, rather than ANCOVA design, was chosen for several reasons. DiD is more robust than ANCOVA and other traditional methods when unmeasured and time-varying confounding variables cannot be statistically controlled for in the model (Zhou et al., 2016). Because there was self-selected participation with comparison group recruitment, there are likely

unmeasured confounding factors for the current study in addition to measured differences (e.g., number of students receiving Special Education services, number of English Language Learning students, number of years of teaching experience; see Table 1). DiD also relies on the parallel trends assumption (Gibson & Zimmerman, 2021), which in this case is the assumption that comparison group students participating in "business as usual" writing instruction would follow a similar growth trajectory as treatment group students over the course of the academic year. If the parallel trends assumption is not violated, changes in outcomes are likely attributable to the intervention. Finally, DiD is also resilient to the influences of regression to the mean—or the tendency for students who score exceptionally high or low on one occasion, on average, to score towards the mean score on the second occasion (Illenberger et al., 2019).

Regression towards the mean occurs when the correlation between scores at two time points is less than perfect (i.e., less than 1.0). The correlations between the pre-assessment and post-assessment were 0.68 for 7th grade and 0.50 for 8th grade, indicating repeated measures reliability was moderate and that regression to the mean likely contributed to changes in student scores across time. When the correlation between the pre-assessment and post-assessment scores is less than 1.0 (which is usually the case), researchers might obtain counterintuitive results using ANCOVA—a phenomenon known as "Lord's Paradox" (Locascio & Cordray, 1983). Table 3 displays the differences in total scores and subscores by student group. Note that the treatment groups of students both start lower on pre-assessment writing scores and end higher than the comparison group on post-assessment scores (also see Figures 1 and 2).

Table 3
Descriptive Statistics for Pre-assessment and Post-assessment Scores by Student Treatment Group

	7th Grade Treatment (n = 101)		7th Grade Comparison (n = 97)		8th Grade Treatment (n = 160)		8th Grade Comparison (n = 83)	
	M	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**
Conventions								
Pre-assessment Conventions	2.14	0.73	2.44	0.71	2.01	0.64	2.26	0.75
Post-assessment Conventions	2.47	0.74	2.47	0.79	2.47	0.65	2.09	0.74
Change Conventions	0.33	0.54	0.03	0.63	0.46	0.65	-0.17	0.62
Development of Ideas								
Pre-assessment Development Of Ideas	1.96	0.68	2.21	0.68	1.85	0.57	2.03	0.71
Post-assessment Development Of Ideas	2.30	0.72	2.23	0.74	2.27	0.59	1.89	0.69
Change Development Of Ideas	0.33	0.55	0.02	0.58	0.42	0.61	-0.13	0.59
Organization								
Pre-assessment Organization	1.90	0.67	2.14	0.65	1.81	0.57	1.94	0.67
Post-assessment Organization	2.26	0.69	2.14	0.69	2.20	0.57	1.85	0.67
Change Organization	0.36	0.55	0.00	0.57	0.38	0.60	-0.09	0.57
Sentence Fluency								
Pre-assessment Sentence Fluency	2.08	0.70	2.35	0.67	2.01	0.65	2.20	0.74
Post-assessment Sentence Fluency	2.47	0.74	2.37	0.74	2.41	0.62	2.06	0.73
Change Sentence Fluency	0.38	0.53	0.02	0.58	0.40	0.62	-0.14	0.59
Style								
Pre-assessment Style	2.11	0.73	2.41	0.73	1.99	0.63	2.19	0.77
Post-assessment Style	2.46	0.77	2.44	0.79	2.46	0.63	2.04	0.76
Change Style	0.35	0.55	0.03	0.63	0.46	0.64	-0.15	0.63
Word Choice								
Pre-assessment Word Choice	2.14	0.76	2.42	0.74	2.01	0.64	2.24	0.78
Post-assessment Word Choice	2.50	0.78	2.47	0.80	2.49	0.66	2.12	0.77
Change Word Choice	0.36	0.57	0.05	0.62	0.48	0.66	-0.12	0.63
Total Score								
Pre-assessment Total Score	12.35	4.24	13.97	4.14	11.69	3.66	12.85	4.40
Post-assessment Total Score	14.46	4.42	14.12	4.51	14.29	3.69	12.06	4.34
Change Total Score	2.12	3.20	0.15	3.53	2.60	3.71	-0.79	3.57

Note: Change scores in the above table are calculated as post-assessment scores minus pre-assessment scores and that the standard deviation for change scores is the standard deviation on these calculated change scores.

Figure 1

Change in Pre-assessment to Post-assessment Scores for 7th Grade by Condition

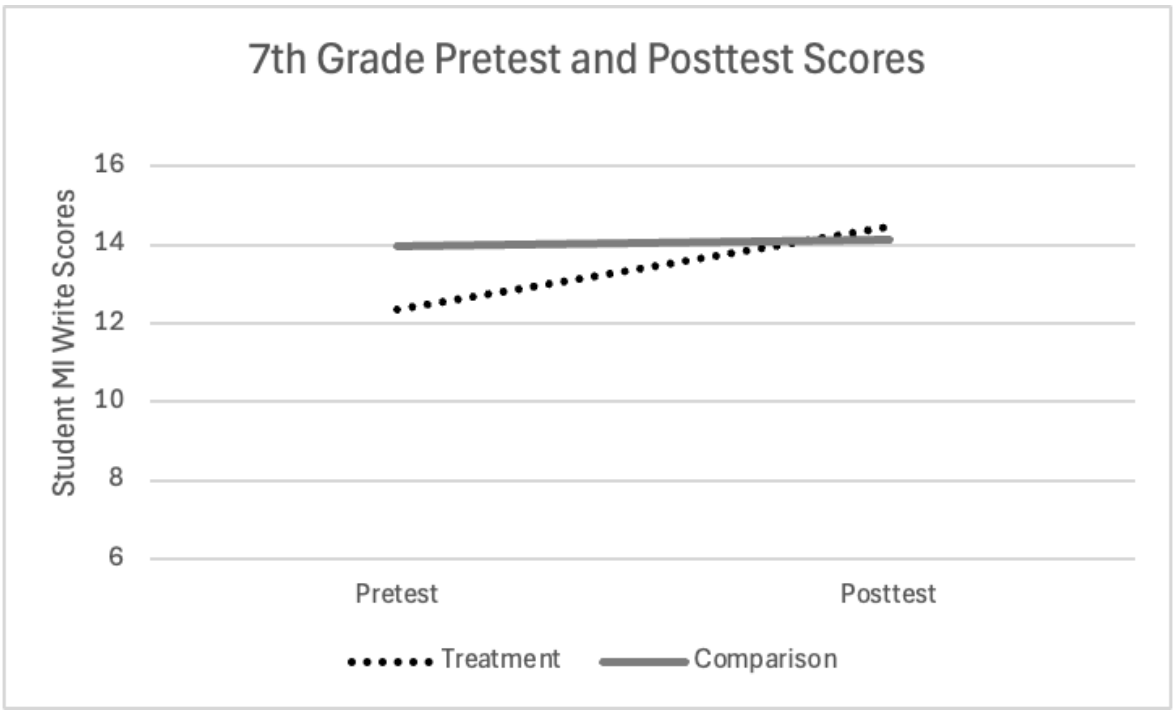
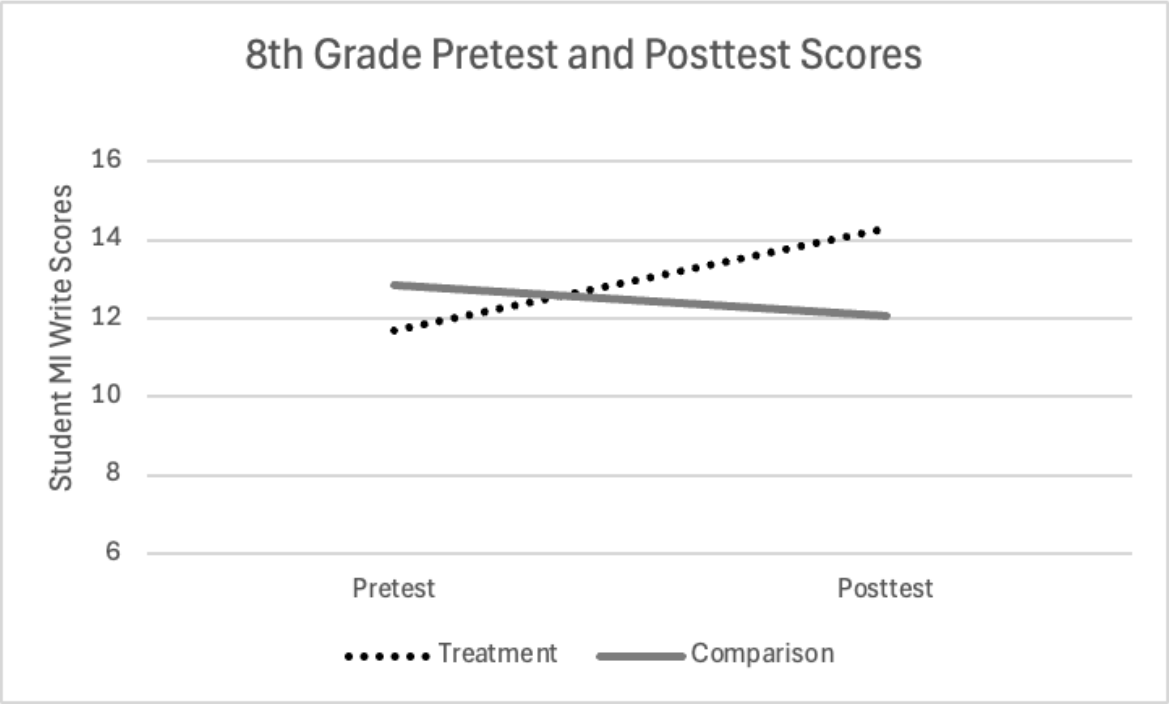


Figure 2

Change in Pre-assessment to Post-assessment Scores for 8th Grade by Condition



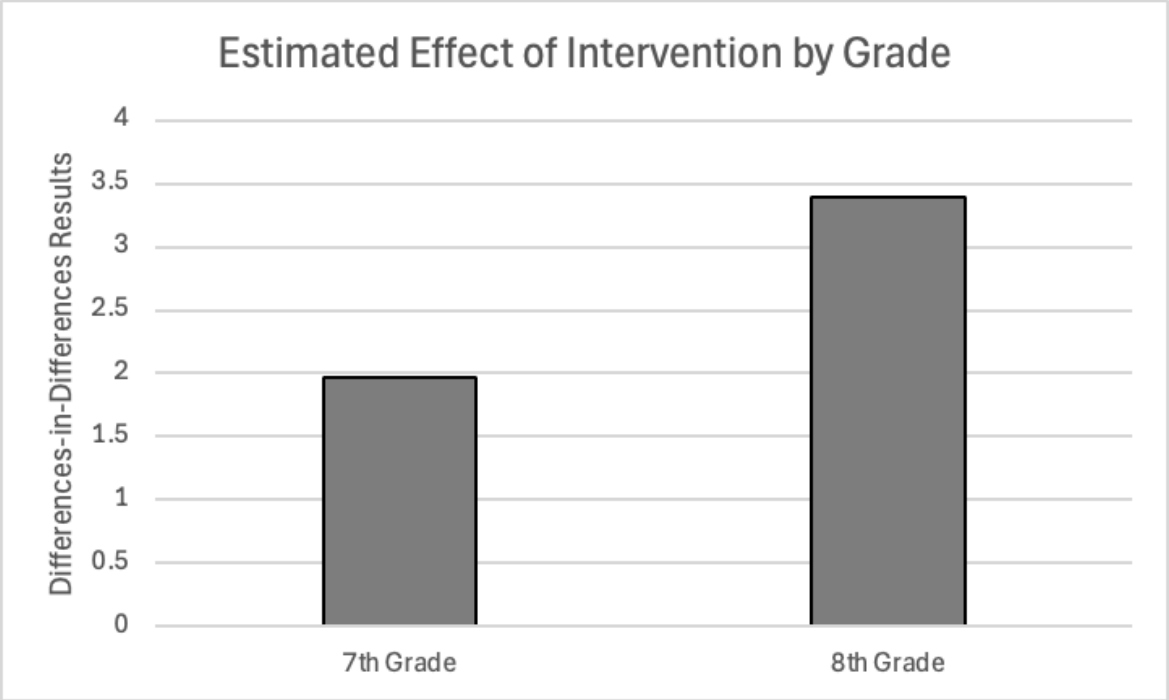
Students in the current study are nested within teachers and classrooms and may share similarities in their writing samples, simply by virtue of being enrolled in the same class. Therefore, the intraclass correlation coefficient (ICC) was calculated using restricted maximum likelihood estimation (REML) to evaluate the level of dependency. Overall, differences at the class level accounted for a substantial amount of variability in student performance scores; the ICC was 0.31 for 7th grade and 0.41 for 8th grade. One approach to accounting for clustering would be hierarchical linear modeling. However, when conducting hierarchical linear modeling the number of clusters (e.g., classrooms) should be over 30, which was not the case in the current study. Therefore, cluster robust standard errors (CRSE; Huang, 2016) were employed to account for clustering.

To evaluate the difference in outcomes for 7th grade students, a linear regression analysis with CRSE adjustment was performed to assess the effect of condition (Treatment vs. Comparison; coded as “1” and “0” respectively) and Assessment Time (pre- vs. post-assessment) on the outcome variable of Total Writing Score. The data was set up as panel data with the pre-assessment Total Score coded as “0” and the post-assessment score coded as “1.” Consequently, Total Score was predicted using Assessment Time (0/1), Treatment Condition (0/1), and an interaction between Assessment Time and Treatment Condition. The interaction term indicates the estimated treatment effect for DiD analyses, which indicated that the writing instruction condition significantly predicted the outcome, $F(3, 392) = 4.76$, $p < .01$, accounting for approximately 3.5% of the variance, $R^2 = 0.035$, Adjusted $R^2 = 0.028$. The interaction between Treatment Condition and Assessment Time had a positive and statistically significant effect on the outcome, $\beta = 1.97$, $SE = 0.87$, $t = 2.25$, $p < .01$, indicating that participants in the 7th grade treatment group scored, on average, 1.97 points higher ($d = 0.59$) than those in the comparison group.

The same linear regression analysis with CRSE adjustment was also conducted for 8th grade. The model again included the effect of condition (Treatment vs. Comparison; coded as “1” and “0” respectively) and Assessment Time (pre- vs. post-assessment) on the outcome variable of Total Writing Score. The results were also statistically significant, $F(3, 482) = 47.03$, $p < .001$, with the model explaining approximately 7.5% of the variance in the outcome, $R^2 = 0.075$, Adjusted $R^2 = 0.069$. The interaction between Treatment Condition and Assessment Time again had a positive and statistically significant effect on the outcome, $\beta = 3.40$, $SE = 0.79$, $t = 4.28$, $p < .001$. This indicates that 8th grade participants in the treatment condition had scores that were, on average, 3.40 points higher ($d = 0.93$) than those in the comparison group following the writing intervention.

Figure 3

Differences-in-Differences Results for 7th Grade and 8th Grade



Conclusion

Overall, the current pilot study provides promising evidence that the Writing Pathway can be implemented within the realistic constraints of a classroom. The intervention is associated with large positive outcomes for students whose teachers participated in the intervention (d = 0.59 for 7th grade; d = 0.93 for 8th grade), which translates to a **17.9 percentile increase in average scores in the 7th grade and a 32.4 percentile increase in average scores for 8th grade students** compared to starting scores on the pre-assessment. Moreover, these large positive effects of the current study suggest there are potentially notable benefits to using the Writing Pathway over traditional writing instruction methods. Additionally, the

upcoming addition of a new feature—which offers teachers formative data about their class and tailored suggestions for how to use the Writing Pathway based on that data—has the potential to make the tool even more powerful by giving teachers targeted, actionable ways to design instruction that meets their students' specific needs.

Despite the positive findings, there are notable limitations to the current study. Research is needed to evaluate how professional development and teacher training impact program outcomes. Additionally, a larger scale study than the present study would allow researchers at the Writing Pathway to evaluate incremental gains in writing scores based on the fidelity of program implementation and amount of instruction time dedicated to practicing skills. For example, the current study focused on predominantly ELA teachers; however, student writing score gains may be larger if the Writing Pathway is used across multiple teachers and content areas.

Because around half of the teachers who were invited to participate in the study chose to do so, there are self-selection factors which could also contribute to positive student gains. For example, more engaged or motivated teachers may have chosen to participate in the intervention, and their high level of engagement might also contribute to positive student outcomes in the classroom. Future research evaluating the Writing Pathway should include randomized controlled designs or more rigorous quasi-experimental designs to account for the systematic bias due to confounding factors.

The current study is also limited in both the number and types of schools represented, as well as geographic location. To evaluate the impact the Writing Pathway intervention might have on a general population of students, future

research should include students from more diverse backgrounds, geographies, and schools.

Finally, because the intervention may lead to differential outcomes for different subpopulations of students, research is needed to evaluate the program based on known student subgroups. These groups include students receiving Special Education services, students in English Language Learning programs, students attending Title 1 schools, and evaluations on the fairness and efficacy of the program for students with other background characteristics (e.g., race/ethnicity, gender, disability, etc.).

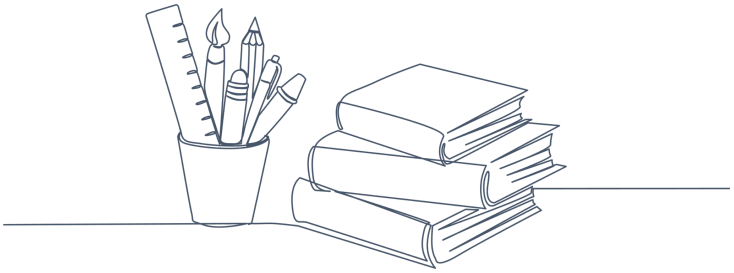
How You Can Help

Support Research. The current study was a pilot with promising results. However, more research is needed to conduct robust research and evaluate the effectiveness of the Writing Pathway in a large population of students. The release of a new tool which provides teachers with actionable classroom-level diagnostic information for tailoring instruction provides another opportunity to evaluate the efficacy of the Writing Pathway program. Collecting data and running rigorous research studies requires additional resources. If you support this mission and would like to help enable our ongoing research program, please contact Phil Weinberg (phil.weinberg@teachinglab.org).

Partner with the Writing Pathway. As the research program at the Writing Pathway continues to grow, additional research will be conducted using student outcomes data shared with our organization. If you are interested in partnering with the Writing Pathway to share deidentified student data and become a research

partner, please reach out to Sherry Lewkowicz (sherry.lewkowicz@teachinglab.org) to learn more about these opportunities. You can also get in touch with the Writing Pathway here if you have feedback or inquiries.

Spread the Word. If you have used the Writing Pathway in your classroom and you've had a good experience, please help us spread the word. **Our mission is to provide teachers with easy-to-use tools which solve real roadblocks to providing high-quality writing instruction in the classroom**.



About

The Writing Pathway

The Writing Pathway, developed within Teaching Lab Studio, is a flexible platform that leverages generative AI to support teachers with writing instruction. With a clear, researched scope and sequence, a diagnostic to pinpoint high-leverage skills, and AI-powered tools that instantly generate high-quality curriculum-aligned practice for any subject, grades 3-12, the platform fosters coherence in a school system. It positions writing as both a driver of deeper learning and a means for students to build the capacity to express ideas clearly, confidently, and frequently. Learn more at www.writingpathway.org.

Teaching Lab Studio

Teaching Lab Studio incubates high-impact ideas made possible by the dramatic progress in generative AI. We believe that AI-enabled supports and tools can unlock the potential of both educators and learners in ways that haven't been imagined,

especially for those furthest from opportunity. Learn more at www.teachinglabstudio.com.

Teaching Lab

Teaching Lab is a national curriculum-based professional learning and coaching organization with a mission to fundamentally shift the paradigm of teacher professional learning for educational equity. Founded in 2016 in Washington, D.C., Teaching Lab specializes in curriculum-based professional learning and job-embedded coaching for educators at all levels of school systems. Our unique model aligns with our Head, Heart, Habits, and Equity framework: Head (grounded in curriculum and learning science), Heart (focused on building a strong educator community and motivation for evidence-based practices), Habits (focused on engaging educators in cycles of learning), and Equity (focused on advancing educational equity). Our professional learning is nationally recognized and a part of the Rivet Education Professional Learning Partner Guide. Currently, Teaching Lab supports over 50 school systems across 20 states, reaching 10,000 educators per year. Learn more at www.teachinglab.org.

References

Berninger V. W., Abbott, R. D., Abbott, S. P., Graham S., & Richards T. (2002). Writing and reading: Connections between language by hand and language by eye. Journal of Learning Disabilities. Special Issue: The Language of Written Language, 35(1), 39–56

Berninger, V. W., Abbott, R. D., Jones, J., Wolf, B. J., Gould, L., Anderson-Youngstrom, M., ... & Apel, K. (2006). Early development of language by hand: Composing, reading, listening, and speaking connections; three letter-writing modes; and fast mapping in spelling. Developmental neuropsychology, 29(1), 61-92.

Bhowmik, S., & Kim, M. (2021). K-12 ESL Writing Instruction: A Review of Research on Pedagogical Challenges and Strategies. Language & Literacy (Kingston, Ont.), 23(3), 165–202.

Fontenelle-Tereshchuk, D. (2024). Academic writing and ChatGPT: Students transitioning into college in the shadow of the COVID-19 pandemic. Discover Education, 3(1), 1–10.

Gallagher, H. A., Arshan, N., & Woodworth, K. (2017). Impact of the National Writing Project's College-Ready Writers Program in High-Need Rural Districts. Journal of Research on Educational Effectiveness, 10(3), 570–595.

Gibson, L., & Zimmerman, F. (2021). Measuring the sensitivity of difference-in-difference estimates to the parallel trends assumption. Research Methods in Medicine & Health Sciences, 2(4), 148–156.

Graham, S., Bruch, J., Fitzgerald, J., Friedrich, L., Furgeson, J., Greene, K., Kim, J., Lyskawa, J., Olson, C. B., & Smither Wulsin, C. (2016). Teaching secondary students to write effectively (NCEE 2017-4002). Washington, DC: National Center for Education Evaluation and Regional Assistance (NCEE), Institute of Education Sciences, U.S. Department of Education. Retrieved from the NCEE website: https://ies.ed.gov/ncee/wwc/PracticeGuide/22.

Graham, S., Kim, Y.-S., Cao, Y., Lee, J. won, Tate, T., Collins, P., Cho, M., Moon, Y., Chung, H. Q., & Olson, C. B. (2023). A Meta-Analysis of Writing Treatments for Students in Grades 6-12. Journal of Educational Psychology, 115(7), 1004–1027.

Graham, S., Kiuhara, S. A., & MacKay, M. (2020). The Effects of Writing on Learning in Science, Social Studies, and Mathematics: A Meta-Analysis. Review of Educational Research, 90(2), 179-226.

Hattie, J., & Timperley, H. (2007). The Power of Feedback. Review of Educational Research, 77(1), 81–112.

Huang, F. L. (2016) Alternatives to Multilevel Modeling for the Analysis of Clustered Data, The Journal of Experimental Education, 84(1), 175-196, DOI:

10.1080/00220973.2014.952397

Huang, Y., & Wilson, J. (2021). Using automated feedback to develop writing proficiency. Computers and Composition, 62, 102675.

Illenberger, N., Small, D. S., & Shaw, P. A. (2019). Regression to the Mean's Impact on the Synthetic Control Method: Bias and Sensitivity Analysis. arXiv preprint arXiv:1909.04706.

Locascio, J. J., & Cordray, D. S. (1983). A Re-Analysis of" Lord's Paradox". Educational and Psychological Measurement, 43(1), 115-126.

Kiuhara, S. A., Graham, S., & Hawken, L. S. (2009). Teaching writing to high school students: A national survey. Journal of Educational Psychology, 101(1), 136–160. https://doi.org/10.1037/a0013097

Kim, G. Y., Schatschneider, C., Wanzek, J., Gatlin, B., & Al Otaiba, S. (2017). Writing Evaluation: Rater and Task Effects on the Reliability of Writing Scores for Children in Grades 3 and 4. Reading and writing, 30(6), 1287–1310.

Knipper, K. J., & Duggan, T. J. (2006). Writing to Learn Across the Curriculum: Tools for Comprehension in Content Area Classes. The Reading Teacher, 59(5), 462–470.

Maine, J. L. (2024). Exploring AI's Impact on Our Post-Pandemic Educational System. In Exploring Technology-Infused Education in the Post-Pandemic Era (pp. 444-461). IGI Global.

Myers, J., Scales, R. Q., Grisham, D. L., Wolsey, T. D., Dismuke, S., Smetana, L., ... Martin, S. (2016). What About Writing? A National Exploratory Study of Writing Instruction in Teacher Preparation Programs. Literacy Research and Instruction, 55(4), 309–330.

National Assessment of Educational Progress. (2024). Explore Results for the 2024 NAEP Reading Assessment. nationsreportcard.gov. Retrieved 5/1/2025 from https://www.nationsreportcard.gov/reports/reading/2024/g4_8/

National Council of Teachers of English. (2021). NCTE Position Statement on Writing Instruction in School. NCTE.org. Retrieved 5/1/2025 from https://ncte.org/writing-instruction-in-school/?utm_source=chatgpt.com

Olson, C., Kim, J., Scarcella, R., Kramer, J., Pearson, M., van Dyk, D., Collins, P., & Land, R. (2012). Enhancing the interpretive reading and analytical writing of mainstreamed English learners in secondary school: Results from a randomized field trial using a cognitive strategies approach. American Educational Research Journal, 49(2), 323-355.

Potter, A., & Wilson, J. (2021). Statewide implementation of automated writing evaluation: Analyzing usage and associations with state test performance in grades 4-11. Educational Technology Research and Development, 69(3), 1557-1578.

Sundeen, T. H. (2015). Writing Instruction for Adolescents in the Shadow of the Common Core State Standards. Journal of Adolescent & Adult Literacy, 59(2), 197–206.

White, M. (2022). What's in a Score? A decomposition of observation scores across various sources to better understand what contributes to scores. Practical assessment, Research, and Evaluation.

Wilson, J., Huang, Y., Palermo, C., Beard, G., & MacArthur, C. A. (2021). Automated feedback and automated scoring in the elementary grades: Usage, attitudes, and associations with writing outcomes in a districtwide implementation of MI Write. International Journal of Artificial Intelligence in Education, 31, 234-276.

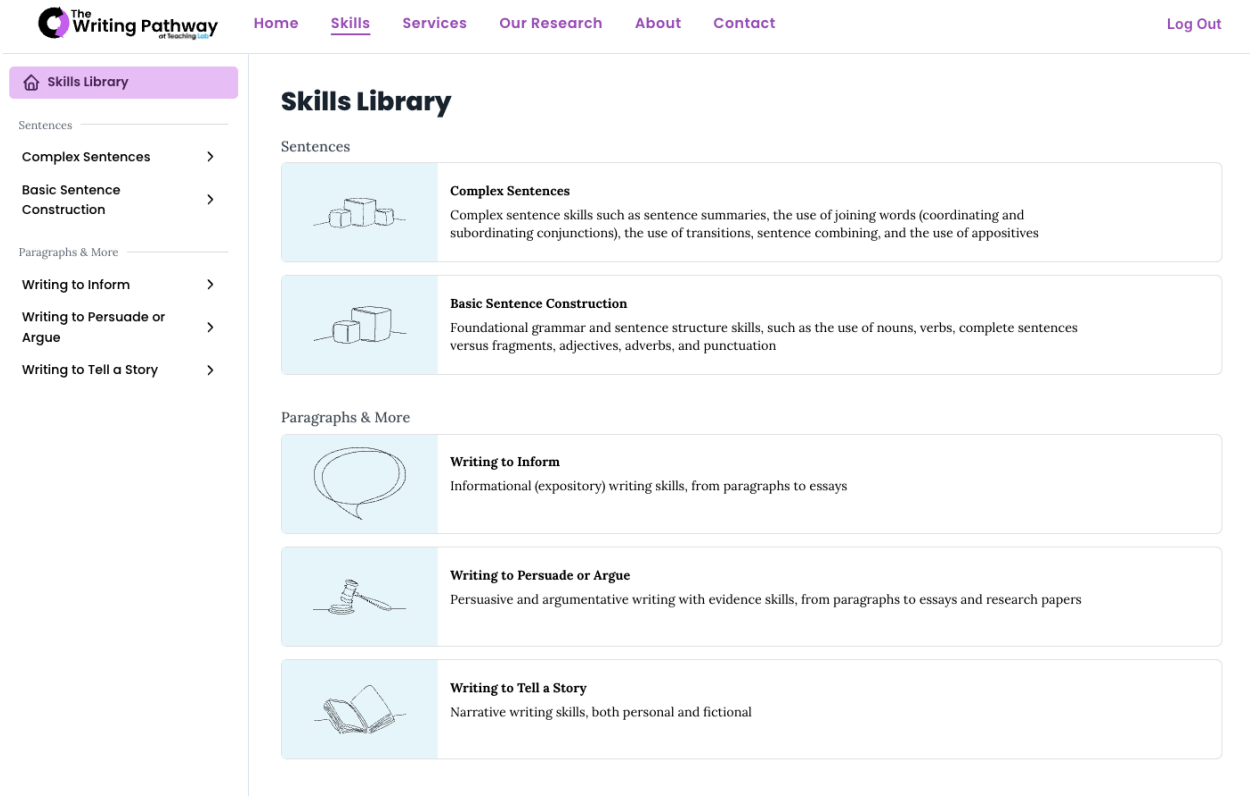
Wilson, J., & Rodrigues, J. (2020). Classification accuracy and efficiency of writing screening using automated essay scoring. Journal of School Psychology, 82, 123-140.

Wing, C., Simon, K., & Bello-Gomez, R. A. (2018). Designing Difference in Difference Studies: Best Practices for Public Health Policy Research. Annual Review of Public Health, 39(1), 453–469.

Zhou, H., Taber, C., Arcona, S., & Li, Y. (2016). Difference-in-Differences Method in Comparative Effectiveness Research: Utility with Unbalanced Groups. Applied Health Economics and Health Policy, 14(4), 419–429.

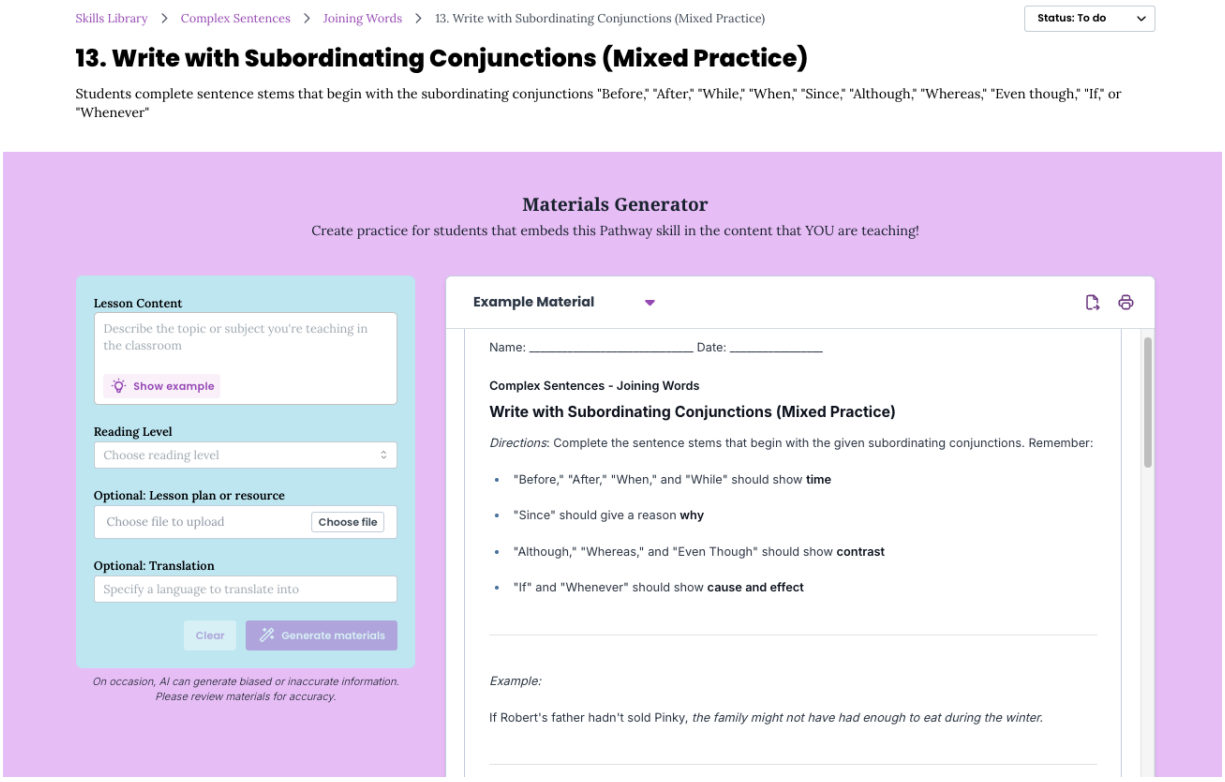
Appendix

Exhibit 1A. In the Writing Pathway's Skills Library, educators can search and filter 180 individual skills related to writing sentences, paragraphs and multiple-paragraph compositions and narratives. The skills are organized into 19 modules, which are categorized into "Sentences" ("Basic Sentence Construction" and "Complex Sentences") and "Paragraphs & More" ("Writing to Inform," "Writing to Persuade or Argue," and "Writing to Tell a Story").



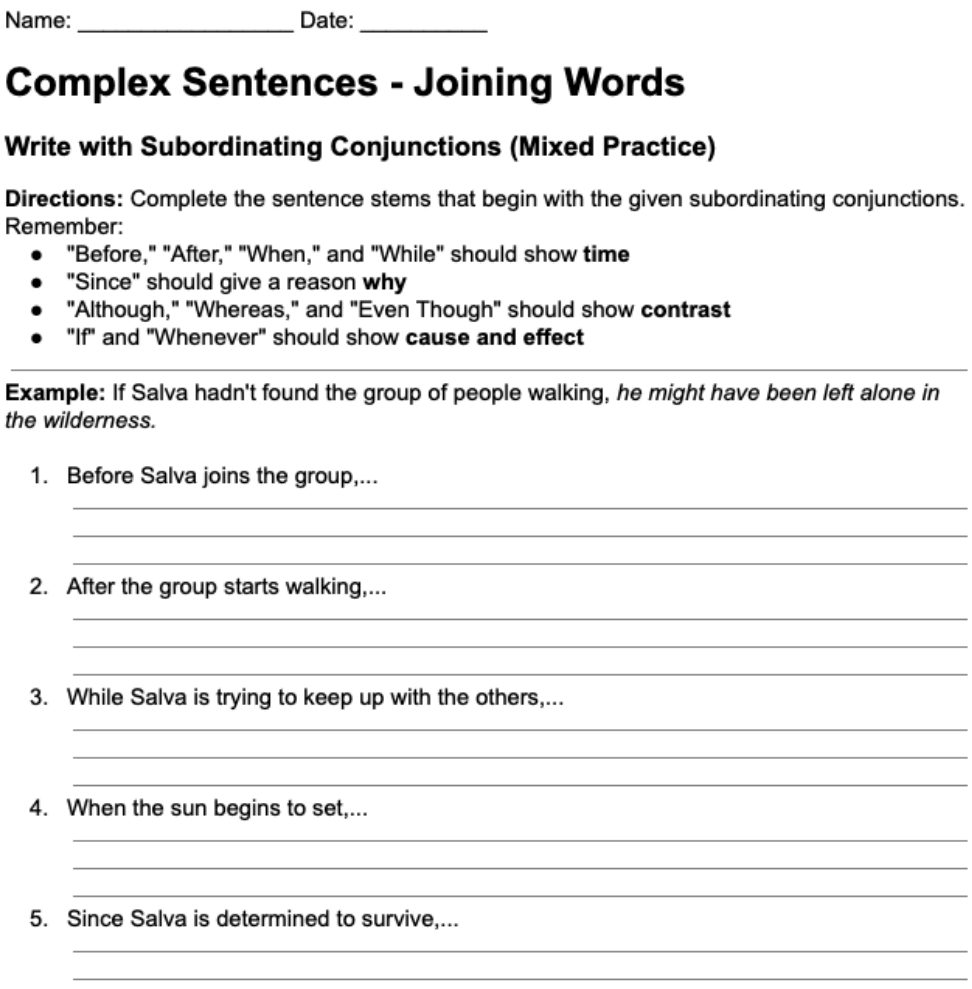
Alt Text: A screenshot of the Writing Pathway platform's Skills Library, which is organized into 2 categories: "Sentences" and "Paragraphs & More." "Sentences" is made up of 2 modules: "Complex Sentences" and "Basic Sentence Construction;" "Paragraphs & More" is made up of 3 modules: "Writing to Inform," "Writing to Persuade or Argue," and "Writing to Tell a Story."

Exhibit 1B. The Materials Generator for the skill “Write with Subordinating Conjunctions (Mixed Practice).” Note that the student-facing practice (shown on the right side of the image below) is a sample. Once a user completes the “Lesson Content” and “Reading Level” fields, they can click “Generate Materials” and get customized student-facing material (see next image for example).



Alt Text: A screenshot of the Writing Pathway platform for the “Write with Subordinating Conjunctions (Mixed Practice)” skill. There is a description of the skill at the top, with a “Materials Generator” below that. The “Materials Generator” has a box with fields on the left for the user to interact with, and a box on the right showing a sample student-facing worksheet.

Exhibit 1C. The student-facing practice generated by the Materials Generator for the skill "Write with Subordinating Conjunctions (Mixed Practice)." The user input *A Long Walk to Water, Ch.* 3 (a text in EL Education's 7th grade ELA curriculum) in the "Lesson Content" field and "*7th-8th grade*" in the "Reading Level" field. Users can edit this output on the Pathway platform or in Google Docs, or wherever they export the document.



Name: _____ Date: _____

Complex Sentences - Joining Words

Write with Subordinating Conjunctions (Mixed Practice)

Directions: Complete the sentence stems that begin with the given subordinating conjunctions. Remember:

- "Before," "After," "When," and "While" should show **time**
- "Since" should give a reason **why**
- "Although," "Whereas," and "Even Though" should show **contrast**
- "If" and "Whenever" should show **cause and effect**

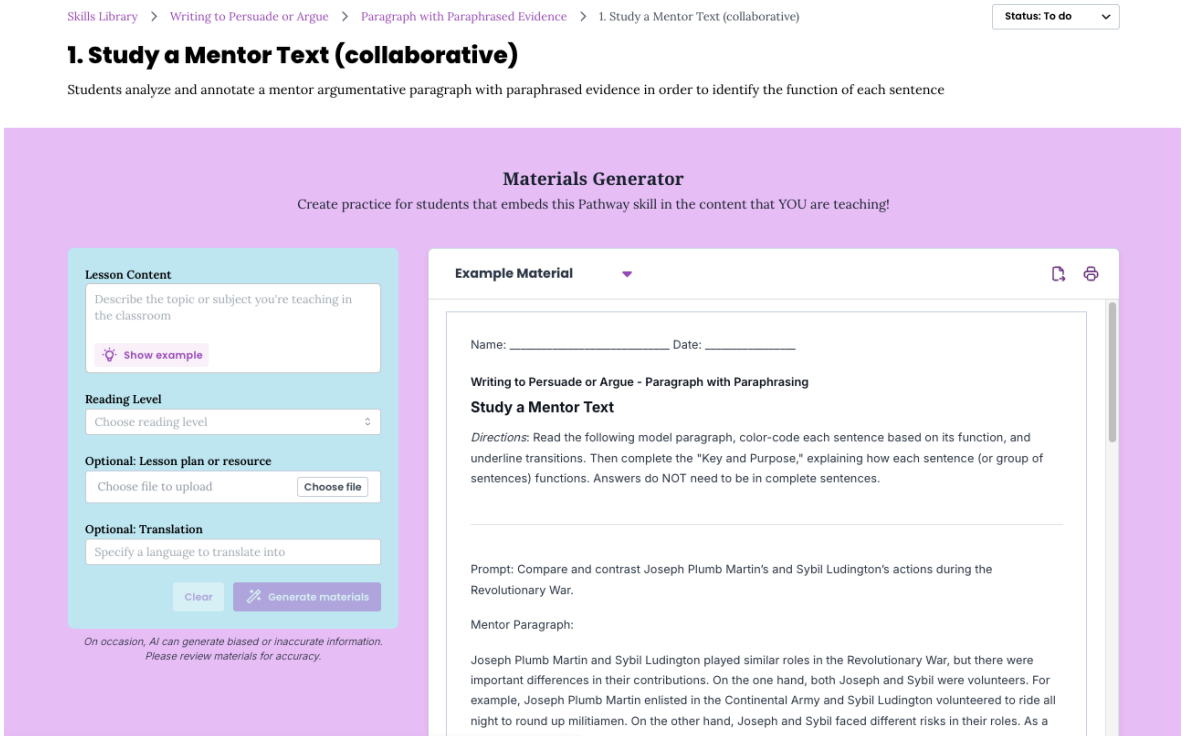
Example: If Salva hadn't found the group of people walking, *he might have been left alone in the wilderness.*

1. Before Salva joins the group,...
2. After the group starts walking,...
3. While Salva is trying to keep up with the others,...
4. When the sun begins to set,...
5. Since Salva is determined to survive,...

Alt Text: *A screenshot of the student-facing practice generated by the Writing Pathway's Materials Generator. The worksheet is titled "Complex Sentences - Joining Words - Write with Subordinating Conjunctions (Mixed Practice)." It includes directions, an example, and 5 practice items that ask*

students to complete a sentence stem that begins with a subordinating conjunction (e.g. "Before Salva joins the group, _____")

Exhibit 2A. The Materials Generator for the skill "Paragraph with Paraphrased Evidence - Study a Mentor Text." Note that the student-facing material shown on the right is a sample. Once a user completes the "Lesson Content" and "Reading Level" fields, they can click "Generate Materials" and get customized student-facing material (see next image for example).



Alt Text: *A screenshot of the Writing Pathway platform for the "Paragraph with Paraphrased Evidence - Study a Mentor Text" skill. There is a description of the skill at the top, with a "Materials Generator" below that. The "Materials Generator" has a box with fields on the left for the user to interact with, and a box on the right showing a sample student-facing worksheet.*

Exhibit 2B. The student-facing practice generated by the Materials Generator for the skill “Paragraph with Paraphrased Evidence - Study a Mentor Text.” The user input “*Industrial Revolution*, *effects*” in the “Lesson Content” field and “*9th-10th grade*” in the “Reading Level” field. Users can edit this output on the Pathway platform or in Google Docs, or wherever they export the document.

Writing to Persuade or Argue – Paragraph with Paraphrased Evidence
Study a Mentor Text (collaborative)

Directions: Read the following model paragraph, color-code each sentence based on its function, and underline transitions. Then complete the "Key and Purpose," explaining how each sentence (or group of sentences) functions. Answers do NOT need to be in complete sentences.

Prompt: Evaluate the positive and negative effects of the Industrial Revolution on society.
Mentor Paragraph:

> The Industrial Revolution fundamentally transformed society, producing both significant advancements and profound challenges. On the one hand, industrialization spurred unprecedented economic growth and technological innovation. For instance, factories enabled mass production, which made goods more affordable and accessible to a wider population. On the other hand, the rapid expansion of industry led to harsh working conditions and environmental degradation. Many laborers, including children, endured long hours in unsafe factories, while urban pollution increased dramatically. Despite these drawbacks, the Industrial Revolution ultimately set the stage for modern economic development and social reform.

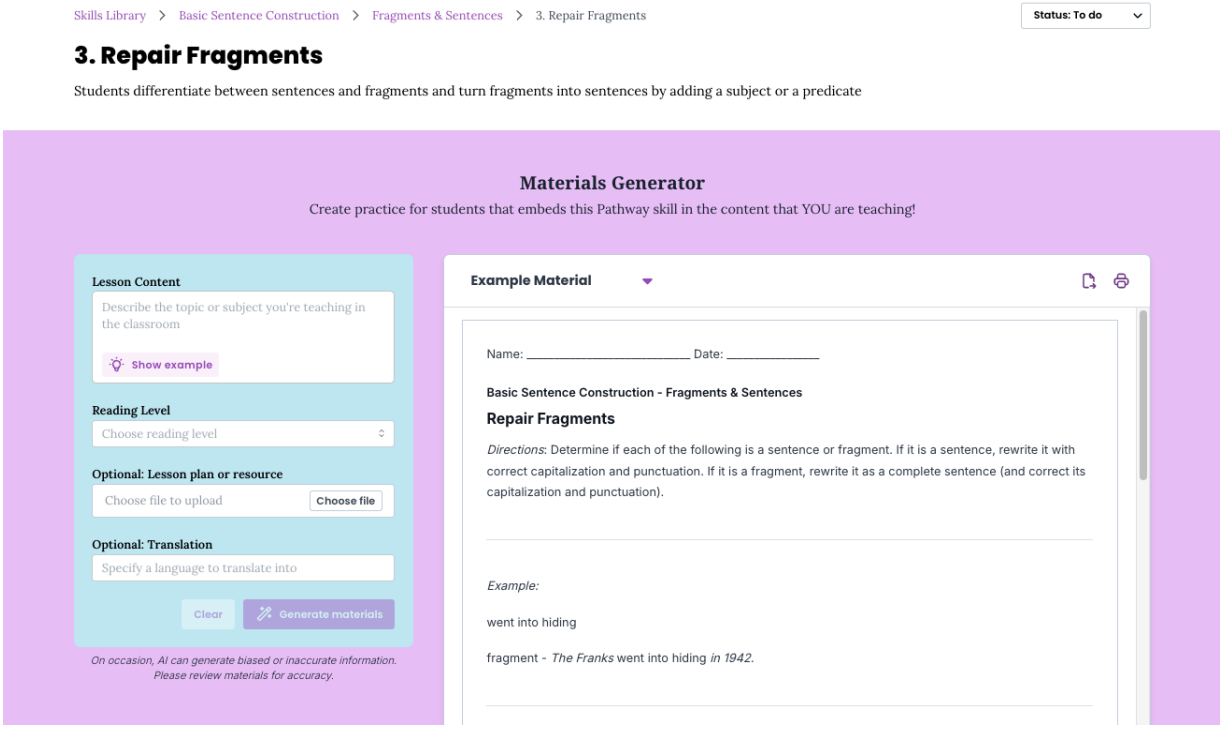
Key and Purpose of Each Part of Paragraph:

Claim:

- **Similarity/Positive Transition (On the one hand):**
- **Analysis 1:**
- **Evidence 1:**
- **Contrast/Negative Transition (On the other hand):**

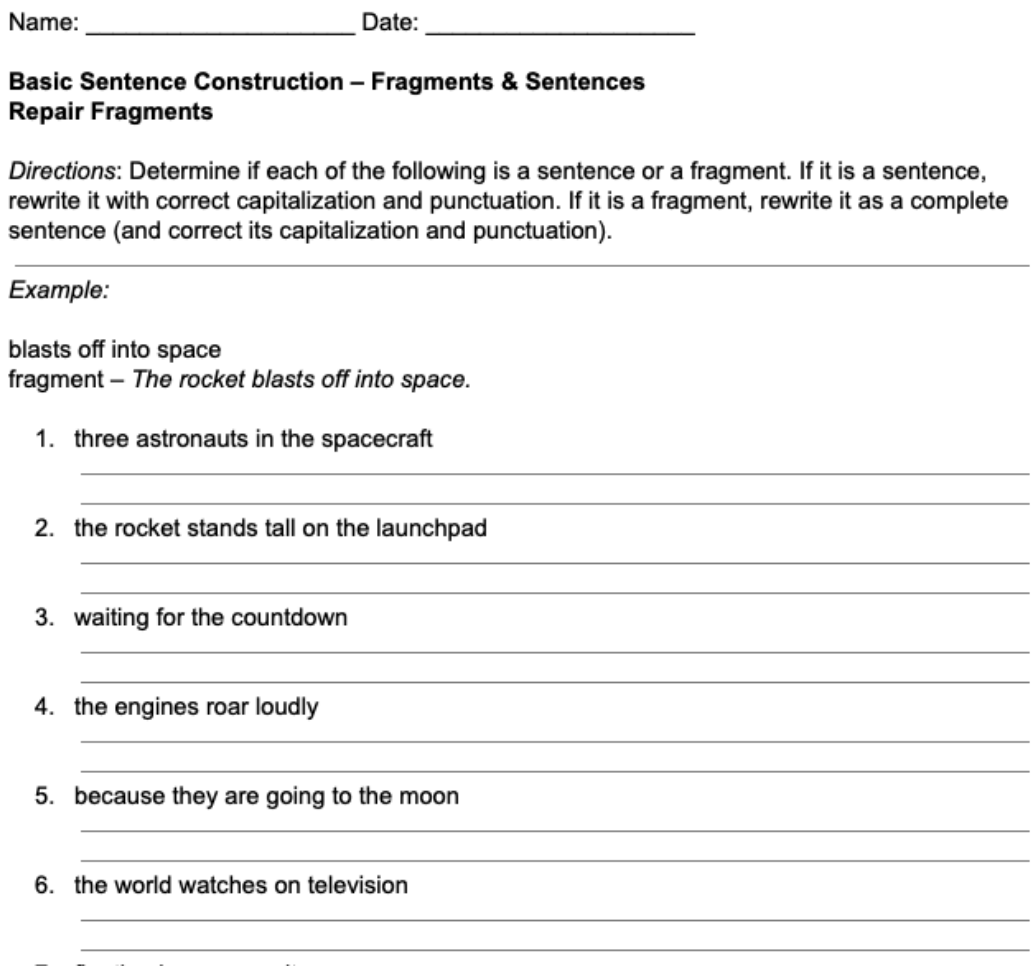
Alt Text: *A screenshot of the student-facing practice generated by the Writing Pathway's Materials Generator. The worksheet is titled "Writing to Persuade or Argue - Paragraph with Paraphrased Evidence - Student a Mentor Text (collaborative)" It includes directions, a mentor or model paragraph, and space for students to deconstruct the provided mentor paragraph.*

Exhibit 3A. The Materials Generator for the skill "3. Repair Fragments." Note that the student-facing material shown on the right is a sample. Once a user completes the "Lesson Content" and "Reading Level" fields, they can click "Generate Materials" and get customized student-facing material (see next image for example).



Alt Text: *A screenshot of the Writing Pathway platform for the "Repair Fragments" skill. There is a description of the skill at the top, with a "Materials Generator" below that. The "Materials Generator" has a box with fields on the left for the user to interact with, and a box on the right showing a sample student-facing worksheet.*

Exhibit 3B. The student-facing practice generated by the Materials Generator for the skill "3. Repair Fragments." The user input ""*Moonshot: The Flight of Apollo 11*" *by Brian Floca*" (a text used in Wit & Wisdom's 3rd grade ELA curriculum) in the "Lesson Content" field and "*3rd-4th grade*" in the "Reading Level" field. Users can edit this output on the Pathway platform or in Google Docs, or wherever they export the document.



Name: _____ Date: _____

Basic Sentence Construction – Fragments & Sentences
Repair Fragments

Directions: Determine if each of the following is a sentence or a fragment. If it is a sentence, rewrite it with correct capitalization and punctuation. If it is a fragment, rewrite it as a complete sentence (and correct its capitalization and punctuation).

Example:

blasts off into space
fragment – *The rocket blasts off into space.*

1. three astronauts in the spacecraft
2. the rocket stands tall on the launchpad
3. waiting for the countdown
4. the engines roar loudly
5. because they are going to the moon
6. the world watches on television

Alt Text: *A screenshot of the student-facing practice generated by the Writing Pathway's Materials Generator. The worksheet is titled "Basic Sentence Construction - Fragments & Sentences - Repair Fragments." It includes directions, an example, and 6 practice items that ask students to identify a*

phrase as a fragment or sentence and then repair it if it is a fragment (e.g. "three astronauts in the spacecraft")