



# Learning Experience Design (LXD) Research & Consulting

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Examining the effectiveness of *Zaner-Bloser Handwriting*:

School-level third-grade handwriting proficiency in Alabama, Spring 2023

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## Introduction

Despite the ever-increasing presence of and dependence on digital tools, handwriting remains an integral part of student achievement. Studies determined that the presentation effect, which refers to the phenomenon in which grades can be lowered by legibility issues despite adequate content production, affects students in subjects beyond English language arts (Santangelo & Graham, 2016). The ability to write fluently without heavy cognitive investment from students in how to shape the letters and words empowers them to better steep themselves in responding to the task rather than stumble over penmanship issues on top of considering their answers (Santangelo & Graham, 2016).

Deficiencies in handwriting ability can deter cross-curricular student confidence. Because students are expected to independently generate text in all subjects to varying degrees, ensuring proper letter formation while completing these tasks can increase the mental load on children to a degree that can be a discouraging hurdle. Considering the link between handwriting acumen and achievement in both early literacy and math skills, *Zaner-Bloser Handwriting* introduces concepts that go beyond the page (Dinehart, 2015).

Highlighting the importance of both task and skill-based instruction, *Zaner-Bloser Handwriting* includes multicomponent practice opportunities with organic teacher, peer, and self-evaluations–factors that lead to greater overall writing mastery (López-Escribano et. al, 2022). Studies show that handwriting instruction, which includes repeated, memorable steps and visual cues lead to greater mastery than focusing on motor skill based tasks, such as those using manipulatives like blocks or Play-Doh to teach letter shapes (Berninger et al., 1997). Including an objective means for self-evaluation, this program empowers learners to own their work by self-correcting and while spurring deeper internalization of the standards required for mastery, engaging both cognitive and metacognitive strategies to boost academic achievement that goes beyond handwriting (Dent & Koenka, 2016). By approaching handwriting as a skill not solely dependent on building motor skills prior to introducing relevant letter formation concepts, Zaner-Bloser orients students as young as prekindergarten to the adequate production of writing strokes, which studies have shown to be a greater indicator of math and reading achievement over nonacademic object manipulation tasks (Dinehart & Manfra, 2013).

*Zaner-Bloser Handwriting* offers both core and intervention resources to bolster handwriting ability, thereby increasing academic confidence. Understanding that handwriting proficiency bears on multiple subjects, Zaner-Bloser provides a research-backed system to teach students penmanship. By using repeated, manageable steps and clear, logical terminology that remains consistent through the

entirety of their lesson suite, students are able to focus on producing letters efficiently and effectively, ultimately increasing the automaticity of handwriting tasks and decreasing the mental load required to generate text.

Zaner-Bloser partnered with Learning Experience Design (LXD) Research to evaluate the impact of *Zaner-Bloser Handwriting* in the state of Alabama among treatment schools. Using the lens of per capita expenditures, LXD Research explored the relationship between the time of adoption and financial investment per student. A correlational analysis was conducted to understand the impact of adoption timing and rates on student handwriting proficiency in Alabama in Spring 2023.

## Method

### Data sources: School-reported proficiency rates and sales data

In an effort to understand the handwriting proficiency in Alabama, each elementary school in Alabama reported Grade 3 handwriting proficiency rates to the state in Spring 2023. This reporting included handwriting proficiency data of Grade 3 students (i.e., the number of Grade 3 students who are proficient in handwriting by spring of 2023) and the total number of Grade 3 students in each respective school. LXD Research requested and received the data from the state for analysis, and used the data set to calculate the percentage of handwriting proficiency for each participating school.

In addition, to estimate the usage and dosage of *Zaner-Bloser Handwriting* products, school-level sales data between 2019 and 2022 were analyzed. The Zaner-Bloser sales data reported the total investment by the school on *Zaner-Bloser Handwriting* products by year. As Zaner-Bloser interventions between 2019 and 2022 would be most likely to predict the Spring 2023 proficiency rates of learners in Grade 3, yearly sales amounts in those years were aggregated to show the total investment on Zaner-Bloser products. However, a higher per-school investment does not necessarily equate to a higher dosage per student, as resources might be more spread out in schools with larger student populations. Therefore, the per-student, per-year investment in Zaner-Bloser products by schools was calculated by the following formula:

$$\frac{\text{(Sum of 2019-2022 investment)}}{\text{((number of students in Grade 3)*4*3)}}$$

The 4 in the denominator reflected the 4 years between 2019 and 2022, while the 3 in the denominator reflected the approximation of the number of students in Grade K–2, based on the assumption that each grade level from kindergarten to Grade 3 has approximately the same number of students in participating schools.

Similar to the calculation of investment between 2019–2022, to understand whether previous investment of schools and subsequent educator training had an impact on 2023 Grade 3 proficiency rates, average per-year, and per-student investments of 2016–2018 were also computed.

The analysis has excluded some data for various reasons. Firstly, although sales data from 2023 was available, the data was excluded from the analysis as Zaner-Bloser products sold in 2023 would not necessarily have been implemented in time to influence 2023 proficiency rates. Secondly, only schools that had a sales account with Zaner-Bloser were included in the analysis. Although schools might have provided learners with Zaner-Bloser products through other means, such as district-level purchases, these purchases were not identifiable at the school level, and were thus excluded. Thirdly, schools that spent less than \$1 per student per year (calculated by the formula outlined above) between 2019 and 2022 were considered non-users and excluded from the analysis. This decision was made because it could not be known whether schools were investing in other handwriting products or interventions. As such, including them in the analysis would introduce a potentially confounding factor that could not be controlled for. Lastly, as the raw dataset shared with the research team contained double-entries (i.e., more than one teacher has reported proficiency levels for the same school) and schools in different districts with the same name, double-entries, and schools that cannot be uniquely identified were excluded.

### Implementation Description

After implementing Lexi’s Law in August 2016, *Zaner-Bloser Handwriting* was used by schools and districts in Alabama. Schools assess and report their Grade 3 proficiency rates to the state each spring. As *Zaner-Bloser Handwriting* also includes materials for K–2 students, implementing Zaner-Bloser between 2019 and 2022 could have impacted students’ handwriting proficiency in Grade 3 in Spring 2023. The table below summarizes the correspondence between intervention years and students measured in Spring 2023.

*Table 1. Implementation of Zaner-Bloser Handwriting and its alignment with data collection*

	Grade of students measured in Spring 2023			
	K	1	2	3
Corresponding School Year	Academic Year 2019–2020	Academic Year 2020–2021	Academic Year 2021–2022	Academic Year 2022–2023

## **Intervention Program Description**

Zaner-Bloser’s handwriting product suite includes materials that approach handwriting instruction in a thorough yet accessible way. With emphasis on automaticity, efficiency in producing script, legibility, and student engagement, these resources were designed to create a powerful tool that sets a strong foundation for students’ future success beyond ELA-related subjects.

Starting with pencils in hands from the first lesson in prekindergarten, *Zaner-Bloser Handwriting* introduces relevant writing skills immediately, a proven means of increasing both legibility and writing capabilities of learners (Santangelo & Graham, 2016). Rather than depending on play-based activities or manipulatives as a means to increase motor skills before tackling handwriting, lessons feature grade-appropriate activities and approachable, memorable language to drive achievement in writing from the start (Dinehart & Manfra, 2013).

The use of consistent terminology throughout the curriculum empowers both educators and students by putting the importance on the task of the day rather than introducing multiple concepts simultaneously, which can increase mental load for young writers. The Four Basic Strokes are consistent in both manuscript and cursive instruction, which groups letters by similar characteristics based on the movements needed to produce them. Zaner-Bloser’s Four Keys to Legibility—Shape, Size, Spacing, and Slant—provide an objective standard for educators to provide clear feedback and empower students to perform self-checks that adhere to curriculum guidelines.

As students master handwriting, they are provided repeated opportunities to demonstrate their learning through writing tasks that challenge them to respond to prompts that span multiple genres, something that supports skills that appear on standardized tests (Graham & Santangelo, 2015). For students with developing skills in reading and writing, Zaner-Bloser tools are designed to support and expand their ability to respond to written cues in a low-pressure way—as the ultimate marker of achievement for these tasks lies in the ability to produce answers in handwriting that is legible.

## **Assessment Descriptions**

### ***School-administered writing proficiency test***

A multi-faceted rubric was provided by the state of Alabama for elementary schools to assess their students’ proficiency. After the schools administer the required tests and assessments, they report the proficiency numbers back to the state. The multi-faceted rubric contains eight key areas of

handwriting: Letter Formation, Placement, Letter Sizing, Spacing of Letters, Legibility, Speed, Neatness, and Spacing of Words. The full rubric is shown below:

<b>Overall Handwriting</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
Letter Formation	All the letters formed correctly	Most of the letters are formed correctly (more than 75%)	Some of the letters are formed correctly (50-75%)	Few of the letters are formed correctly (25-50%)	Less than 25% of the letters are formed correctly
Placement	All letters are oriented correctly on the lines	Most of the writing sample is oriented correctly on the lines. (more than 75%)	Some of the writing sample is oriented correctly on the lines (50-75%)	Little of the writing sample is oriented correctly on the lines (25-50%)	Less than 25% of the writing sample is oriented correctly on the lines
Letter Sizing	All letters are sized correctly	Most of the letters are sized correctly (more than 75%)	Some of the letters are sized correctly (50-75%)	Few of the letters are sized correctly (25-50%)	Less than 25% of the letters are sized correctly
Spacing of Letters	All letters are spaced correctly	Most of the letters are spaced correctly (more than 75%)	Some of the letter are spaced correctly (50-75%)	Few of the letters are spaced correctly (25-50%)	Less than 25% of the letters are spaced correctly
Legibility	All letters in the writing sample are legible	Most of the writing sample is legible (more than 75%)	Some of the writing sample is legible (50-75%)	Little of the writing sample is legible (25-50%)	Less than 25% of the writing sample is legible
Speed	Keep up with peers when completing handwritten assignments	Takes 25% longer than peers to complete handwritten assignment	Takes 50% longer than peers to complete handwritten assignment	Takes 75% longer than peers to complete handwritten assignment	Takes more than 75% longer than peers to complete handwritten assignment
Neatness	Writing assignments are always neat without erasures, torn paper or cross outs	Most (>75%) of the writing assignment is neat without erasures, torn paper or cross outs	Some (50-75%) of the writing assignment is neat without erasures, torn paper , or cross outs	Little (25-50%) of the writing assignment is neat without erasures, torn paper or cross outs	Less than 25% of writing assignment is neat without erasures, torn paper or cross outs
Spacing of Words	All words are spaced correctly	Most (>75%) of the words are spaced correctly	Some (50-75%) of the words are spaced correctly	Little (25-50%) of the words are spaced correctly	Less than 25% of the words are spaced correctly

### Sample Description

The state proficiency dataset included 54,244 Grade 3 students enrolled in 674 elementary schools in Alabama. With the aforementioned matching and exclusion criteria, the proficiency dataset was matched with school-level sales account data and 4,759 Grade 3 students from 54 elementary schools were included in the final analysis. These students were all in schools that invested at least \$1 per student per year between 2019 and 2022 on Zaner-Bloser products. The distribution of these students by their schools’ investment is shown below:

<b>Adoption level</b>	<b>Per student per year investment</b>	<b>Number of schools</b>	<b>Number of students</b>
Low	>\$1 and ≤\$5	41	3,729
Moderate	>\$5 and ≤\$10	9	844

High	>\$10	4	186
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## Analysis Plan

### *Statistical method*

Three statistical tests were conducted on the distribution. First, a standardized residual analysis of handwriting proficiency rate was conducted against the sample which was stratified into three bands (Low Adoption: >\$1 and ≤\$5 per student per year investment; Moderate Adoption: >\$5 and ≤\$10 per student per year investment; High Adoption: >\$10 per student per year investment).

Next, a logistic regression of handwriting proficiency against per student per year investment of the students' respective school was conducted. After conducting the logistic regression, the odds ratio was calculated by taking the natural exponent of the coefficient of the per student per year investment.

Finally, to examine the effect of prior spending on proficiency, 2016–2018 investment per student per year investment and 2019–2022 per student per year investment were combined to stratify the sample into four different archetypes. The archetypes were defined as followed:

		2019–2022 per student per year investment		
		\$1-\$5 per student	\$5-\$10 per student	Over \$10 per student
2016–2018 per student per year investment	Less than \$10 per student	Casual Adoption	Moderate Adoption	High Adoption
	Greater than \$10 per student	Early Adoption		

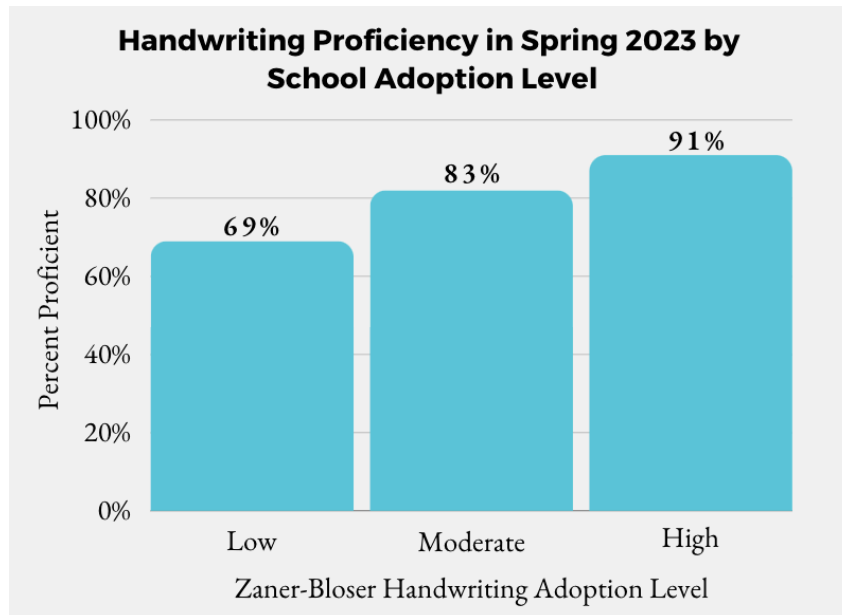
Note that the definition of moderate and high adoption is the same as the first statistical test, comparing low, moderate, and high adoption. The main difference between the two analyses was the separation of “Low Adoption” into “Casual Adoption” (schools that spent less than \$10 per year per student in the 2016-2018 period) and “Early Adoption” (schools that spent more than \$10 per year per student in the 2016-2018 period). With such archetypes, the research team can determine whether

high investment in prior years (e.g., due to professional development efforts or stockpiling learner materials) will lead to higher proficiency rates in subsequent years.

## Study Results

### *Standardized residual on handwriting proficiency rate against adoption*

After stratifying the schools into the three bands, the percentage of students who are proficient in the respective bands was reported below.



To understand whether the differences in proficiency levels are statistically significant, chi-square tests were conducted for each band. The result was as follows:

- Low *Zaner-Bloser Handwriting* Adoption (students in schools with  $\geq \$1$  and  $< \$5$  per student per year investment):  $X^2(1) = 547.61, p < .001$
- Moderate *Zaner-Bloser Handwriting* Adoption (students in schools with  $> \$5$  and  $\leq \$10$  per student per year investment):  $X^2(1) = 355.81, p < .001$
- High *Zaner-Bloser Handwriting* Adoption (students in schools with  $> \$10$  per student per year investment):  $X^2(1) = 127.51, p < .001$

As the p-values of all chi-square tests were  $< .05$ , we reject the null hypotheses, and can conclude that handwriting proficiency rates were significantly and positively predicted by the level of *Zaner-Bloser Handwriting* adoption.

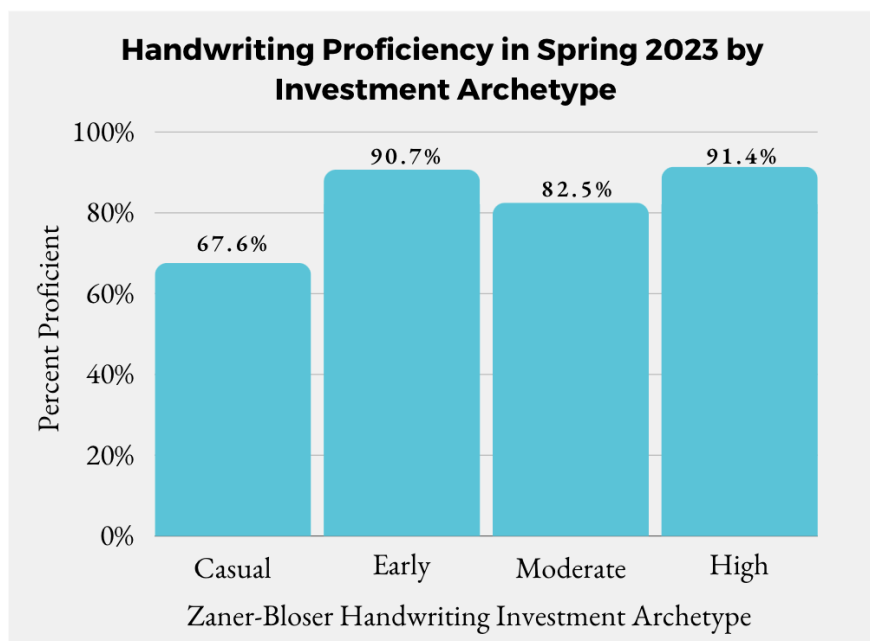
### ***Logistic regression of handwriting proficiency against per student per year investment***

Next, a logistic regression of handwriting proficiency against per student per year investment was conducted. A logistic regression was used because the outcome of handwriting proficiency was dichotomous (i.e., either “proficient” or “not proficient”) and the predictor (i.e., per student per year investment) was continuous.

The logistic regression showed a positive, statistically significant relationship between the per student per year investment and students’ proficiency:  $\beta = 0.168$ ,  $Z(4,757) = 10.93$ ,  $p < .001$ . With the coefficient of 0.168 for the per-student-per-year spending variable, the odds ratio for this variable was 1.183, indicating that each one-dollar increase in investment per student per year was associated with an 18% greater likelihood that a given student would be proficient in handwriting.

### ***Standardized residual on investment archetypes***

After separating the “Low Adoption” investment band from the first analysis into “Casual Adoption” and “Early Adoption,” the percentage of students who were proficient in the respective archetypes is reported below:



Chi-square tests were conducted for each archetype to understand whether the difference in proficiency levels is statistically significant.

The chi-square results were as follow:

- Casual *Zaner-Bloser Handwriting* Adoption (students in schools with  $\leq \$10$  per student per year investment in 2016–2018 and  $\geq \$1$  and  $< \$5$  per student per year investment in 2019–2022):  $X^2(1) = 428.11, p < .001$
- Early *Zaner-Bloser Handwriting* Adoption (students in schools with  $> \$10$  per student per year investment in 2016–2018 and  $\geq \$1$  and  $< \$5$  per student per year investment in 2019–2022):  $X^2(1) = 170.93, p < .001$
- Moderate *Zaner-Bloser Handwriting* Adoption (students in schools with  $> \$5$  and  $\leq \$10$  per student per year investment in 2019–2022):  $X^2(1) = 355.81, p < .001$
- High *Zaner-Bloser Handwriting* Adoption (students in schools with  $> \$10$  per student per year investment in 2019–2022):  $X^2(1) = 127.51, p < .001$

As the p-values of all chi-square tests were  $< .05$ , we reject the null hypothesis, and can conclude that handwriting proficiency rates were significantly and positively predicted by early and high levels of adoption of *Zaner-Bloser Handwriting* tools.

## Limitations

The data assessed in this analysis showed a positive, significant relationship between the school adoption level of *Zaner-Bloser Handwriting* and the handwriting proficiency of students. The state-wide requirement of handwriting instruction in Alabama provided the conditions for a natural experiment, which resulted in research limitations.

From a data quality standpoint, the proficiency data was self-reported by respective school leaders without any described processes to verify the accuracy and completeness of the data. Also, school investment in *Zaner-Bloser Handwriting* products was used to estimate the product usage. However, without understanding the grades or classes in which the product was being administered and the fidelity with which the product was being used in classrooms, the research team could not draw further conclusions about the causality between using the product and improvements in handwriting proficiency. Furthermore, the available data did not include student-level demographic variables, so these variables could not be controlled for in the current analyses. Lastly, the lack of population data in

Grades K–2 also introduced potential errors of estimation in calculating investment per year per student.

## **Conclusion and Next Steps**

*Zaner-Bloser Handwriting* provides teachers with a system of handwriting lessons that boosts cross-curricular student achievement and equips students with the knowledge of letter formation in a way that moves them towards increased focus on content rather than penmanship in isolation. With genuine writing opportunities that span genres, this curriculum enables students to build handwriting mastery that transcends subjects.

As shown, there was a positive and statistically significant correlation between the adoption archetype of the campus and the proficiency of learners in the Alabama schools featured in the study. According to the first analysis, schools meeting the high adoption archetype had an average of 22% more Grade 3 students testing as proficient in handwriting versus schools with lower adoption rates. Subsequent analysis demonstrated that high investment in years prior to the admission of learners assessed still positively impacted proficiency of learners in 2023. While high spending in school years outside of the auspices of this study could indicate additional stockpile learner materials or training, the finding could additionally reflect that investments in Zaner-Bloser products lead to positive effects on proficiency beyond years of direct intervention. However, noting that the “High Adoption” archetype (schools that spent more than \$10 per student per year) still had a higher proficiency rate than the “Early Adoption” archetype highlights the importance of consistent usage of the intervention.

This retrospective, correlational study resembles actions taken by district leaders determining how products work. District leaders often compile different data sources and consider them together as evidence of how students are progressing in order to make decisions about the next steps. It is recommended that future research employs a quasi-experimental or experimental design that assigns treatment or comparison groups, or monitors the implementation of the product. The correlational approach and comprehensive sample size of this study meets ESSA level 3 recognition by LXD Research.

## References

- Berninger, V. W., Vaughan, K. B., Abbott, R. D., Abbott, S. P., Rogan, L. W., Brooks, A., ... & Graham, S. (1997). Treatment of handwriting problems in beginning writers: Transfer from handwriting to composition. *Journal of Educational Psychology, 89*(4), 652.
- Dent, A. L., & Koenka, A. C. (2016). The relation between self-regulated learning and academic achievement across childhood and adolescence: A meta-analysis. *Educational Psychology Review, 28*, 425-474.
- Dinehart, L. H. (2015). Handwriting in early childhood education: Current research and future implications. *Journal of Early Childhood Literacy, 15*(1), 97-118.
- Dinehart, L., & Manfra, L. (2013). Associations between low-income children's fine motor skills in preschool and academic performance in second grade. *Early Education & Development, 24*(2), 138-161.
- Graham, S., Harris, K. R., & Santangelo, T. (2015). Research-based writing practices and the common core: Meta-analysis and meta-synthesis. *The Elementary School Journal, 115*(4), 498-522.
- López-Escribano, C., Martín-Babarro, J., & Pérez-López, R. (2022). Promoting handwriting fluency for preschool and elementary-age students: Meta-analysis and meta-synthesis of research from 2000 to 2020. *Frontiers in Psychology, 13*, 841573.
- Santangelo, T., & Graham, S. (2016). A comprehensive meta-analysis of handwriting instruction. *Educational Psychology Review, 28*, 225-265.