A Descriptive Analysis of Teachers' Writing Instruction Using Project Topeka, An Automated Essay Scoring Tool

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Acknowledgments

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Executive Summary

Despite the widespread acknowledgment of the significance of strong writing skills for students' future learning and postsecondary success, research consistently shows that students receive inadequate writing instruction, both in terms of amount and quality. Initiated in 2019, Project Topeka aimed to offer support to teachers in their writing instruction and assist them in providing students with increased practice in argumentative writing.

Project Topeka features a platform that provides middle school teachers with access to comprehensive resources for argumentative writing, including lesson plans, prompt questions, and curated resources (e.g., articles, videos). Through this platform, students have the opportunity to submit essays and receive instant feedback and scores across four dimensions of argumentative writing from an automated essay scoring (AES) tool. In our research, we explore whether having a system like this, with pre-loaded lessons and materials and built-in grading and feedback, both of which would help offset teachers' limited planning and grading time, would lead teachers to giving students more and better writing opportunities.

This research project draws on surveys and interviews from teachers who implemented Project Topeka from September 2021 to May 2022. We investigate the following questions:

- How do teachers use Project Topeka tools and resources?

- Does participation in Project Topeka change teachers' instruction in argumentative writing? If so, in what ways?

Our findings reveal that teachers often struggle to provide extended writing opportunities due to insufficient resources and support. Limited writing curricula and time for teaching, grading, and providing timely feedback hinder teachers from assigning more essays. Instead, they primarily assign short-response tasks, reserving extended writing assignments for only 1–2 times per year. When assigning essays, teachers typically break down the essay into manageable components and emphasize discrete steps of the writing process, with a focus on prewriting activities.

During Project Topeka implementation, we found that teachers did not actually assign more essays to students. Of the implementing 246 teachers, only 27 completed a full writing cycle, spanning from prewriting to revision, with their students. In their instruction, teachers continued to break down the essay into manageable parts, provided targeted lessons for each component, and engaged students in relevant activities, placing emphasis on prewriting.

Nevertheless, Topeka offered some benefits to teachers. The instant scores and feedback provided by the system enabled teachers to dedicate more time to conferencing with students about their writing, and to promptly identify and address areas where students needed additional instruction and resources.

Moreover, teachers reported an improved sense of preparedness and understanding in teaching argumentative writing and the writing process following the use of Topeka. This finding aligns with previous research indicating that teachers with more confidence and training in writing instruction are more likely to allocate additional time to teaching writing and provide students with increased writing

opportunities. AES and artificial intelligence (AI) tools like Topeka have the potential to serve as forms of professional learning for teachers in writing instruction. If teachers continue to build their confidence and preparation in teaching writing and maintain long-term use of Topeka, it would be valuable to explore how they integrate it into their instructional practices. Such investigations could shed light on potential changes in writing instruction and increases in opportunities for students to write extensively.

Introduction

Writing is important and foundational for learning. Writing improves not only how well students read, but also how well they comprehend what they read (Graham & Hebert, 2011; Graham et al., 2018). Additionally, students understand and retain information better in other disciplines such as science, social studies, and mathematics when they are asked to write about them (Bangert-Drowns et al., 2004; Graham & Hebert, 2011; Graham & Perrin, 2007; National Commission on Writing, 2003). The ability to write well is also crucial for students' future success (e.g., college, career, socializing and communicating with others) (National Commission on Writing, 2004 & 2005; Benjamin & Wagner, 2021).

Despite widespread agreement about how important writing skills are for students' learning and postsecondary success, research indicates that most students experience insufficient writing instruction, both in terms of quantity and quality (Graham, 2019; Applebee & Langer, 2011). Like any other subject, writing has to be explicitly taught (Calkins, 2014) in order for students to learn how to organize their thoughts, develop ideas, support them with evidence, revise, and master conventions. For students to become better writers, they need ample opportunity for practice, so they can engage in in-depth writing, receive feedback, and revise (Calkins, 2014; National Council of Teachers of English, 2018; Benjamin & Wagner, 2021).

However, the majority of teachers do not devote enough time to teaching writing. One reason is that teachers simply do not have enough instructional time, which is influenced by policies and priorities that are outside of their control. Writing instruction often competes with reading instruction for time and attention (Applebee & Langer, 2011; Calkins, 2014). On average, teachers report spending less than one hour a day teaching writing (Graham, 2019). Applebee and Langer's study (2011) of writing instruction in middle and high school English classes found that only 6 percent of instructional time was spent on teaching writing strategies and studying models, and 4 percent on evaluating writing. In a 50-minute period, teachers would, on average, engage students in just over three minutes of instruction focusing on explicit writing strategies. Teachers' knowledge and beliefs about writing also influence the quality and quantity of their writing instruction. That is, teachers dedicate less time to writing when they are unprepared to teach it, lack confidence in their ability to teach it, dislike teaching it, and do not consider it an important skill (Brindle et al., 2016; Kiuhara et al., 2009).

Paradoxically, students are writing more today compared to 30 years ago; however, they seldom engage in extended writing (Applebee & Langer, 2011). Instead, short-response writing, what Graham (2019) refers to as writing without composing, seems to be the typical writing assignment, in line with what tends to be tested, the emphasis in Common Core State Standards (CCSS) on informative text and paraphrasing, and limited teacher planning time for grading. Teachers report that assigning extended writing more often means having more papers to read, grade, and provide feedback on (Applebee & Langer, 2011). By the time one assignment is graded, the class has already moved on to another assignment, and the feedback on those papers is then irrelevant. In general, most teachers assign only 1–2 extended writing assignments per year (Graham, 2019) and middle and high school students are expected to produce about 1.6 pages a week of extended writing for English (Applebee & Langer, 2011).

Project Topeka supports teachers with writing instruction and facilitates more opportunities for students to write. Project Topeka features a platform through which middle school teachers could access lesson plans, prompt questions, and curated resources (e.g., articles, videos) on argumentative writing. Through this system, students could submit essays and receive immediate artificial intelligence (AI) generated feedback and scores on four dimensions of writing (Claim & Focus, Support & Evidence, Organization, and Language & Style) from an automated essay scoring (AES) tool. Our work explores, in part, whether having a system like this, with pre-loaded lessons and materials and built-in grading and feedback, both of which would help offset teachers' limited planning and grading time, would succeed in giving students more and better writing opportunities. Therefore, in this study, we draw on teacher surveys and interviews to answer the following research questions:

- How do teachers use Project Topeka tools and resources?

- Does participation in Project Topeka change teachers' instruction in argumentative writing? If so, in what ways?

Methods

Study Context

Project Topeka was available from March 2020 to June 2022 to any middle school teacher who taught writing. Project Topeka offered teaching materials in the form of six argumentative writing prompts and associated resources (e.g., articles, videos) and instructional units with lesson plans on pre-writing, writing, and revision. The platform also enabled students to draft essays in response to the assigned prompt, submit their work, and receive an immediate score generated by an AES tool. The tool also provided AI-generated feedback aligned with specific argumentative writing dimensions, which students could use to revise and resubmit until they reached a top score.

Digital Promise recruited teachers teaching English language arts (ELA) in middle schools to implement Topeka with their students in three waves: January–March 2020, September–December 2020, and September 2021–May 2022. In each wave, teachers were asked to assign at least one prompt to students. In addition to using Topeka with students, teachers were invited by Digital Promise to participate in optional research activities—pre- and post-implementation surveys, and interviews about how they used Topeka resources in their classrooms.

Project Topeka implementation officially opened on March 2, 2020, but more than 90 percent of the participating teachers were in schools that closed by March 13, 2020 due to the COVID-19 pandemic. A high percentage of teachers were able to start using Topeka, but in the end, a majority did not complete a full prompt with their students during the first implementation wave. In the second wave (fall 2020), most teachers were teaching virtually or in a hybrid setting. Remote learning came with a number of challenges: low student attendance and engagement. Not all students logged online for learning, and when they did, numerous students did not turn on their cameras, participate, or complete their work. Teachers also had difficulty engaging students virtually because they were simultaneously learning how to use technology to teach while supporting students to use technology to

learn. In schools that offered hybrid learning, the logistics of keeping students safe (e.g., constant cleaning, social distancing, and intentionally shortened bell schedules) reduced in-person instructional time significantly. Supplemental initiatives like Topeka were set aside during remote and hybrid learning so that teachers could focus on teaching foundational skills and supporting social-emotional learning. It was not until the third wave (school year 2021–22) that the vast majority of students returned to in-person learning and were able to use Topeka in the classroom.

Data and Sample

In each wave, we administered a pre- and post-implementation survey to teachers active on the Topeka system to investigate typical writing instruction—what writing instruction looked like before Project Topeka—and to learn about the opportunities for extended writing instruction, particularly argumentative writing afforded by using Topeka. We also conducted interviews with teachers to learn more about how they used Topeka resources in their writing instruction and the influence of Topeka on their overall teaching and student learning. Because findings were consistent across the three waves of implementation, we draw learnings from the most recent implementation period (Wave 3, 2021–22) in this report. Exhibit 1 shows the number of respondents by data collection activity for Wave 3.

Exhibit 1. Survey and Interview Respondents for Wave 3 Implementation

	Wave 3 (September 2021–May 2022) sample size
Pre-implementation survey	246
Post-Prompt 1 survey	27
Pre- Post-Prompt 1 survey analysis	21
Post-Prompt 2 survey	9
Teacher interviews	27

Note: In Wave 3, we implemented post-prompt 1 and 2 surveys instead of one post-implementation survey as we had in prior waves. The post-prompt 1 survey was administered to teachers who successfully assigned one writing prompt to their students. The post-prompt 2 survey was administered to teachers who assigned 2 writing prompts.

In Wave 3, the vast majority of surveyed teachers who implemented Topeka were female and white (Exhibit 2). They were also quite veteran, with over 70 percent having at least 10 years of teaching experience and nearly 60 percent with more than 10 years of ELA teaching experience.

Exhibit 2. Background Characteristics of Survey Respondents in Wave 3

	Pre-implementation survey respondents (*n* = 246)	Post-prompt 1 survey respondents (*n* = 21)
Female	92%	91%
Non-white	19%	19%
Novice (less than 3 years)	2%	0%
More than 10 years teaching	71%	86%
More than 10 years teaching ELA	58%	76%

Source: Digital Promise, Project Topeka pre-implementation and post-prompt 1 teacher surveys, September 2021–May 2022.

Analytic Method

For the pre- and post-implementation surveys, we used the R statistical software package to analyze the data. We conducted descriptive analyses (i.e., frequencies and means as appropriate) for each survey item. We also conducted additional correlational analyses between teachers' understanding of argumentative writing, and teachers' confidence in teaching argumentative writing and years of ELA teaching experience. To compare teachers' preparation in teaching argumentative writing at the beginning and end of Topeka implementation, we conducted a paired *t*-test (*n* = 21).

For teacher interviews, we captured notes and audio recordings. After each round of data collection, we conducted thematic analysis using a structured debriefing form. Our team read and re-read interview transcripts; summarized key points as codes that describe the content; and systematically clustered codes into themes in an iterative process. For each theme, we coded which participant provided evidence supporting the theme. We also triangulated the interview data with the survey data to further confirm or disconfirm emergent themes.

Findings

In this section, we start with a description of teachers' perspectives on students' readiness for writing and their own preparedness to teach writing. We then delve into the writing approaches teachers typically use in their writing instruction. We conclude with an examination of how teachers' writing instruction changed, if at all, under Topeka and whether students were given increased and improved writing opportunities.
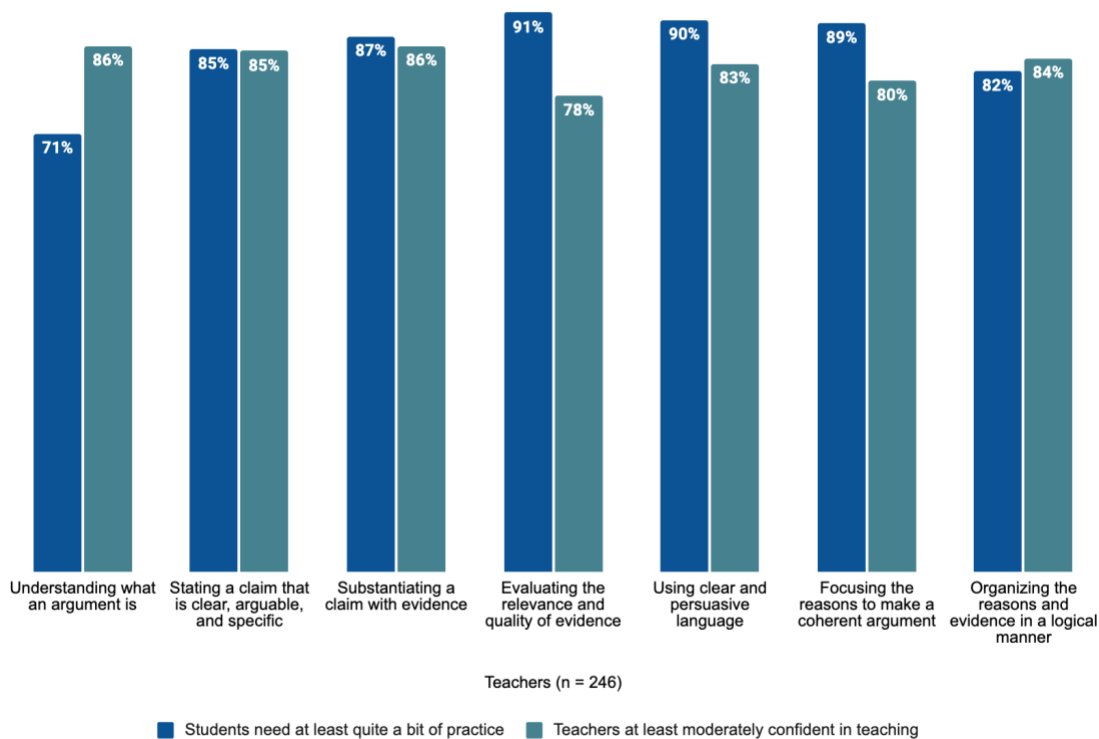
Teachers' Perceptions about Students' Writing Needs and Their Own Preparedness for Writing Instruction

Interviews and surveys reveal that teachers recognize the significance of writing in students' education and their future success beyond the school years. Specifically, most teachers agree that students need writing skills to succeed in high school and college (87%), and that writing is an important skill for students' future careers (79%). However, teachers also expressed concerns about students' challenges in producing sufficient, meaningful, and well-structured writing. After experiencing up to two years of distance learning, teachers reported a decline in students' writing stamina and motivation— struggling to put words together to construct coherent sentences.

Teachers expressed that their students needed more assistance in various elements of argumentative writing—the writing genre covered in Project Topeka. Most teachers reported their students needed at least quite a bit of practice in stating a claim that is clear, arguable, and specific and substantiating that claim with evidence (Exhibit 3). Students also needed additional practice evaluating the pertinence and quality of such evidence, focusing reasons to create a coherent argument, organizing reasons and evidence logically, and using clear and persuasive language in their writing.

Nonetheless, teachers generally felt well-prepared in their own writing instruction to address such students' writing needs. A significant majority of teachers expressed at least a moderate level of confidence in teaching the different dimensions of argumentative writing (Exhibit 3). Teachers felt particularly confident in guiding students to understand the concept of an argument (86%); state a clear, arguable, and specific claim (85%); and substantiate a claim with evidence (86%). Conversely, teachers reported slightly less confidence in teaching students to evaluate the relevance and quality of evidence (78%), an area which they rated as highest in student needs (91%).

Exhibit 3. Teacher Confidence in Teaching and Student Needs in Argumentative Writing

Understanding what an argument is: 71% / 86%
Stating a claim that is clear, arguable, and specific: 85% / 85%
Substantiating a claim with evidence: 87% / 86%
Evaluating the relevance and quality of evidence: 91% / 78%
Using clear and persuasive language: 90% / 83%
Focusing the reasons to make a coherent argument: 89% / 80%
Organizing the reasons and evidence in a logical manner: 82% / 84%

Teachers (n = 246)

■ Students need at least quite a bit of practice   ■ Teachers at least moderately confident in teaching

Note: Student needs items on a 5-point scale where 1 = No practice; 2 = A little bit more; 3 = Quite a bit more; 4 = A lot more. Teacher confidence items on a 4-point scale where 1 = Not at all confident; 2 = Somewhat confident; 3 = Moderately confident; 4 = Very confident.

Source: Digital Promise, Project Topeka pre-implementation teacher survey, September 2021–February 2022.

Teachers' Reported Typical Writing Instruction

Despite recognizing the importance of writing, teachers typically offer limited extended writing opportunities. A majority of teachers give extended writing assignments (i.e., persuasive essay, personal narrative, research paper, argumentative writing citing evidence) only 1–2 times per year, and even fewer offer them more frequently (Exhibit 4). In fact, nearly a quarter of teachers never assign persuasive essays and research papers to students. Of the extended writing opportunities the survey asked about, teachers assign argumentative writing citing evidence most frequently, consistent with what is emphasized in the CCSS and included in most state standardized tests. In contrast, students primarily complete worksheets or short-answer responses, with half of teachers assigning them at least weekly and another 31 percent assigning them monthly. Consequently, it is understandable that only half of the surveyed teachers expressed satisfaction with the amount of essay writing they can give to their students, suggesting a desire to offer more extended writing.

Exhibit 4. Frequency of Extended Writing Opportunities in English Language Arts
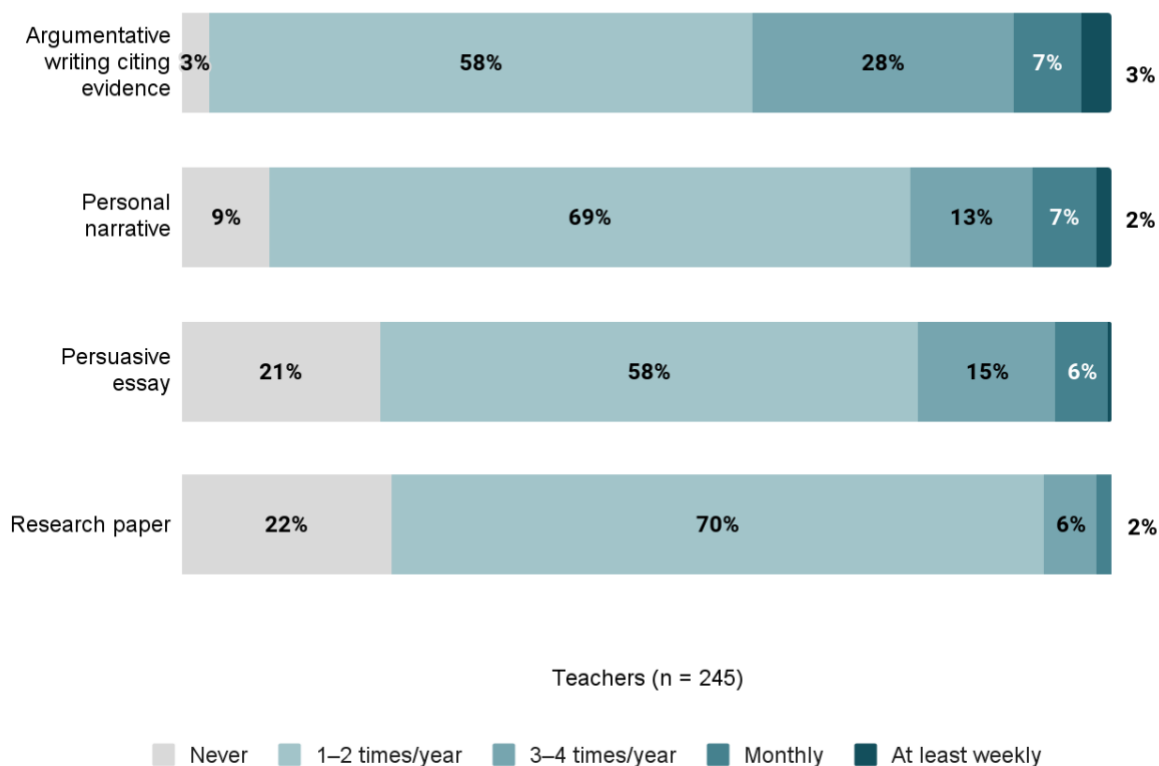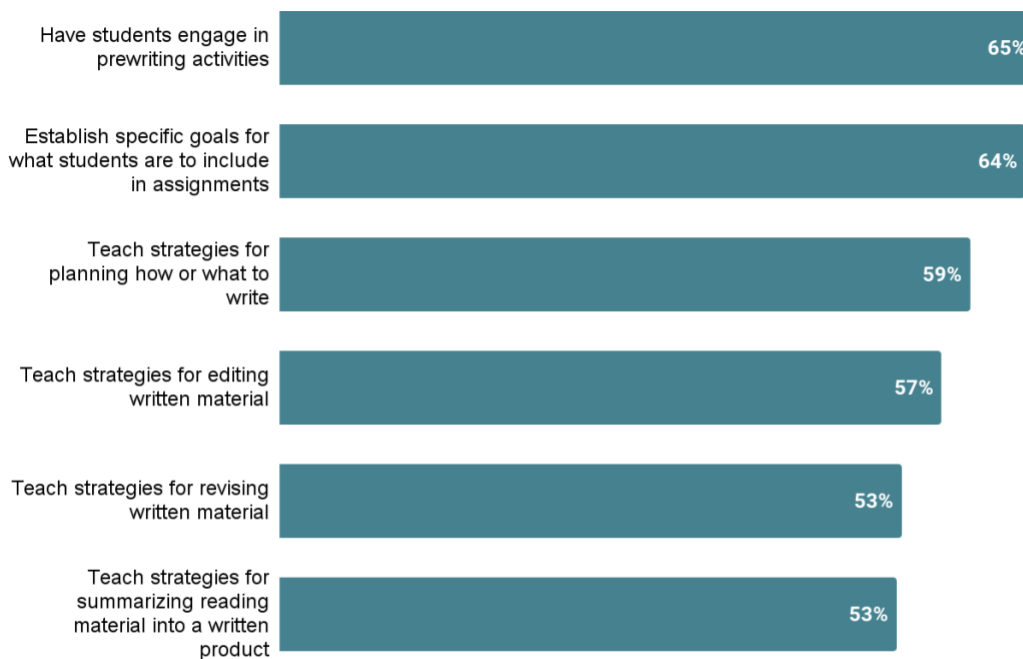

Teachers (n = 245)

Never | 1–2 times/year | 3–4 times/year | Monthly | At least weekly

Source: Digital Promise, Project Topeka pre-implementation teacher survey, September 2021–February 2022.

To scaffold writing for students and help them write, teachers break down an essay and explicitly teach steps of the writing process (from prewriting to revision). When assigning essays, teachers need to break the essay down into manageable parts (e.g., introduction, thesis statement, body paragraphs, conclusion) and teach lessons around those components. They also explicitly teach and provide practice at each step of the writing process (from prewriting to revision). For a given step of the writing process, more than half of surveyed teachers reported teaching it at least monthly (Exhibit 5). The most frequently taught discrete steps are establishing goals for what to include in the written assignments and prewriting. To help students plan for writing, interviewed teachers typically engage their students in various activities, including annotating text, creating outlines, completing a graphic organizer to lay out the thesis and supporting reasons, and selecting quotes and evidence to incorporate into the essay.

On the other hand, teachers reported teaching strategies for revising written material and summarizing reading material least frequently. About half of surveyed teachers ask students to complete one revision of a writing assignment on which they provide feedback before submitting it, and only 39 percent require two revisions. Teachers shared in the interviews that revision is difficult for them to teach and for students to do. Unable to provide real-time feedback that students can use to make edits to their

essay, some teachers have utilized peer editing as a way for students to get feedback; however, they found this process to be ineffective because students often lack the skills to evaluate their own writing, let alone provide valuable feedback to their peers. Therefore, students have few opportunities to revise and typically only complete one revision before submitting an essay.

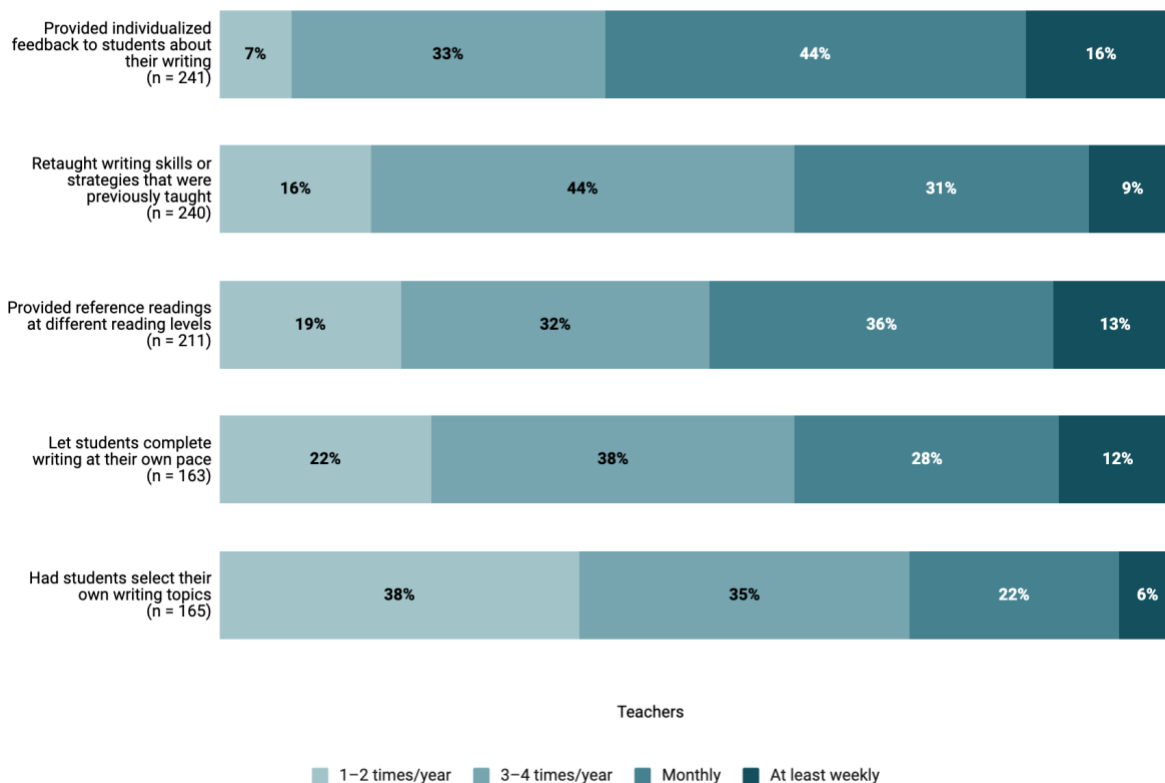**Exhibit 5. Percentage of Teachers Teaching Writing Process Steps at Least Monthly**

Teachers (n = 244)

Note: Survey items on 5-point scale, where 1 = Never; 2 = 1–2 times/year; 3 = 3–4 times/year; 4 = Monthly; 5 = At least weekly.

Source: Digital Promise, Project Topeka pre-implementation teacher survey, September 2021– February 2022.

To address individual student writing needs, teachers employ various instructional strategies. Despite the fact that they are unable to give input to students in real time, teachers reported giving each student personalized feedback on their writing frequently, with 60 percent doing so at least monthly (16% at least weekly) (Exhibit 6). Teachers also differentiate writing instruction for students by providing reference materials at different reading levels and allowing students to complete writing assignments at their own pace, with 40–49 percent doing so at least monthly. Understanding that students might need further reinforcement, teachers reteach writing skills or strategies that were previously taught (40% at least monthly and 44% 3–4 times a year). Some interviewed teachers mentioned modeling writing and examining writing samples with students—activities which they believe establish clear expectations for the quality of writing students should strive for.

Exhibit 6. Frequency of Teachers Implementing Specific Instructional Strategies

Strategy	1–2 times/year	3–4 times/year	Monthly	At least weekly
Provided individualized feedback to students about their writing (n = 241)	7%	33%	44%	16%
Retaught writing skills or strategies that were previously taught (n = 240)	16%	44%	31%	9%
Provided reference readings at different reading levels (n = 211)	19%	32%	36%	13%
Let students complete writing at their own pace (n = 163)	22%	38%	28%	12%
Had students select their own writing topics (n = 165)	38%	35%	22%	6%

Teachers

■ 1–2 times/year   ■ 3–4 times/year   ■ Monthly   ■ At least weekly

Source: Digital Promise, Project Topeka pre-implementation teacher survey, September 2021–February 2022.

Reasons Teachers Do Not Offer More Extended Writing Opportunities

Despite teachers' desire to provide more extended writing opportunities for their students, various constraints within their contexts prevent them from doing so.

One major constraint is insufficient necessary writing resources and support available to teachers. In interviews, some teachers claimed that during the years they have been teaching, the expectations for extended writing have generally decreased, with a greater emphasis currently being placed on short responses or fill-in-the-blank writing tasks. They also shared that state testing has moved away from requiring students to compose five-paragraph essays to now constructing short-answer responses, and what teachers emphasize in their writing instruction now reflects this shift in expectations.

Even when teachers do assign extended writing, their school or district does not necessarily support it with resources, professional development, and curricular expectations. Less than half of surveyed teachers (45%) reported having a writing curriculum that sufficiently addresses the elements of argumentative writing. In the absence of a proper writing curriculum, a majority of teachers (90%) had to find resources and create lessons on their own or with their colleagues to supplement and teach

writing adequately. The additional work of finding and preparing resources (e.g., sample essays, articles) discourages some teachers from teaching writing, as indicated in the teacher interviews.

The limited instructional time available within the school day poses a challenge for teachers in teaching writing and assigning longer writing tasks more frequently. Writing is typically not allotted its own time in the school day, but instead is included in an ELA block or period where teachers are also required to cover literature units, vocabulary, grammar, and conventions. Thus, unsurprisingly only 38 percent of surveyed teachers reported having enough instructional time for students to plan, write, revise, and edit multiple drafts of lengthier written products. Extended writing assignments like argumentative writing typically require students to research articles and other sources to use, further taking away time from the practice of writing itself. Moreover, the time needed to grade and provide feedback on papers also discourages most teachers (90%) from assigning extended written products more frequently.

Teachers' Reported Writing Instruction Using Project Topeka

Project Topeka aimed to alleviate teachers' planning burdens by providing them with ready-made lesson plans, writing prompts, and associated resources, and to save teachers time by providing timely individualized scores and feedback to students on their argumentative writing. We next considered in our analysis the extent to which having access to the Topeka supports led to any changes in teachers' practices or perceptions of writing.

Teachers maintained a similar approach to their typical writing instruction when using Project Topeka, breaking down the essay into manageable parts and providing targeted lessons on each component. Consistent with their reported approaches outside of Topeka, approximately three-quarters of surveyed teachers taught a lesson before introducing students to the Topeka prompt. The lessons emphasized skills such as evaluating and citing sources, paraphrasing evidence, understanding claims, structuring coherent arguments, organizing paragraphs, and using effective transitions. After introducing the prompt, most teachers proceeded to teach discrete steps of the writing process and had students work on a range of activities, including reading and annotating the articles, completing graphic organizers or outlines, and engaging in prewriting and other short writing exercises. According to some teachers, the pieces produced by students through these individual activities gradually built upon one another, ultimately leading to the development of a longer essay. For one teacher in particular, the argumentative essay represented as a culmination of the foundational skills that her students had acquired throughout the writing process,

> *I don't think I ever had, whether it be a pandemic or not, students come in and immediately start to write a five-paragraph essay that's beyond [w]hat they're capable of doing.... Normally we would start out just bare bones. This is one good paragraph and transition to maybe a three-paragraph essay with an introduction, a body paragraph, and a conclusion, and then stretch it to the five paragraphs. And we would hone... those amazing five-paragraph papers at the end of the year. Really, that last quarter is where...they would be perfected.*

Few teachers assigned and had students successfully complete one argumentative writing essay during Topeka. Of the 246 teachers who started using Project Topeka in September 2021, only 27completed one full writing cycle with their students. This cycle included prewriting, writing, utilizing the AES tool for feedback, revising based on the feedback, and submitting the final essay by the end of the implementation period (February 2022). Even fewer teachers (*n* = 13) completed two writing cycles with their students within that time frame. Bounded by standards and curriculum, teachers were unable to assign more argumentative writing essays. Some interviewed teachers shared that they had already planned their argumentative writing unit, pulled in Topeka for students to use to write, and then quickly moved on to the next unit without assigning additional essays.

Nevertheless, Topeka afforded teachers the opportunity to conference with students one-on-one or in small groups about their writing—more often than they previously could. As discussed earlier, students typically receive teacher feedback on their writing after an essay is submitted when the feedback is no longer actionable. However, during Topeka, students received immediate scores and feedback on four argumentative dimensions as soon as they ran their essay through the AES tool. Teachers found that because the tool saved them time in reading and providing feedback, and enabled students to work independently for longer with the AES-generated feedback, they had more time to conference with their students. Indeed, all surveyed teachers reported having meetings with at least some students on a draft of their essay, with approximately one-third saying that they held conferences with most or all students who were struggling with writing.

Teachers needed to mediate the immediate AES feedback students received about their writing during the conferences. Generally, teachers agreed that students received more specific and individualized feedback on their writing during Topeka than what they usually provided, although a notable percentage disagreed (23%). Across the board, teachers reported that students responded positively to the feedback and were motivated to address it. One teacher shared, *"Once the feedback statements kicked in, that's when they engaged. I suddenly had kids who normally couldn't care less about anything who found a way in with this, wanted to fix the feedback and the score; it was bite-sized enough for them to tackle it."* In this instance, even a student who was less enthusiastic about writing showed a desire to address the feedback and improve their essay.

Nevertheless, almost all teachers (96%) indicated that students were confused about how to revise their essay based on the feedback they received. Students would read a comment in their essay but were unsure what it was asking them to do to enhance their writing. For example, one student puzzled by the feedback said, *"It's saying I need to word my claim better or clarify my argument. I don't know how to do that. I don't know what that means."* As a result, nearly 80 percent of teachers needed to help students interpret the feedback and to provide more holistic feedback for students to actually improve their writing. This involved helping students, especially those struggling with writing, understand the feedback by translating it into language that was more suitable for their development and context, and then strategize how to revise their papers.

It [AES tool] gave me more time to sit one-on-one with the kids because 24 were working and I could pull one and give individualized help with the score and with their feedback. —Teacher

They all had [something] reading their essays, giving them pieces of feedback, and they could come to me to process the feedback… I have new vocabulary to explain how to revise writing. I also had to translate that to other kids using my own vocabulary. —Teacher
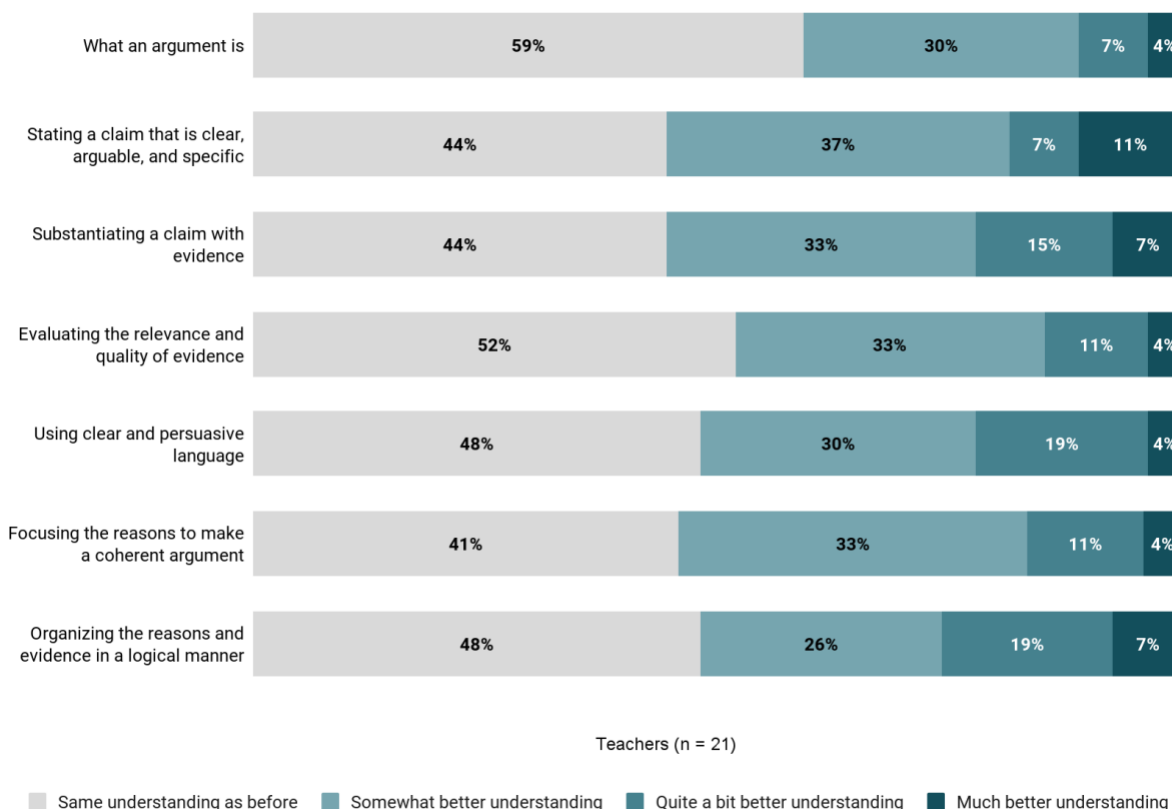
Topeka provided teachers with early data on student writing, enabling them to identify areas that required additional instructional time and resources more promptly. One teacher highlighted the significance of this aspect, stating, *"Helpful most of all was to get the targeted feedback and the scores on [argumentative writing] dimensions [claim and focus, support and evidence, organization, language and style] so I could see where to teach. That diagnostic saves a lot of time and directs my planning."* The scores and AES feedback served as a valuable tool for the teacher, guiding them in determining the next steps in their planning and instruction.

In some classrooms, teachers utilized the class summary score data and AES feedback to facilitate class discussions on topics or areas where their students were struggling, such as transitions, repetitive writing, and grammar. Some teachers retaught lessons on incorporating supporting details logically and citing evidence while others showed sample papers that received a score of 1 versus a 4, for example, on all the argumentative writing dimensions and had students discuss what the author did well and could improve on. One teacher emphasized the usefulness of the sample papers, stating, *"The parts that were really helpful were the example papers... I pulled claim statements to compare them for the kids on the scores and contrast why some got a 1 and some got a 4. [It was] easy for them to see [the feedback], hard for them to apply; [it was] easy for them to see where theirs fell [in comparison].… "* In this example, the teacher was able to pull specific examples of writing from the sample papers for students to analyze the differences in AES scores and feedback, and understand the underlying reasons or factors contributing to those differences. This activity would have been much more difficult to do had the teacher needed to grade the class set and then curate the sample papers on their own.

Teachers reported a slight increase in their understanding of argumentative writing through the use of Topeka. Despite their high levels of confidence before implementing Topeka (Exhibit 3), teachers acknowledged that the tool helped them gain a better understanding of various elements of argumentative writing (Exhibit 7). Slightly more than half of teachers reported they understood the following components at least somewhat better: stating a claim that is clear, arguable, and specific; providing evidence to support that claim; using clear and persuasive language; marshaling reasons to create a compelling argument; and logically organizing reasons and evidence.

Additionally, we found in our analysis that teachers' reported improved understanding of argumentative writing does not correlate with years of ELA teaching experience, prior levels of confidence in teaching argumentative writing, or teacher-reported student needs in argumentative writing practice.

Exhibit 7. Teachers' Reported Change in Understanding of Argumentative Writing

	Same understanding as before	Somewhat better understanding	Quite a bit better understanding	Much better understanding
What an argument is	59%	30%	7%	4%
Stating a claim that is clear, arguable, and specific	44%	37%	7%	11%
Substantiating a claim with evidence	44%	33%	15%	7%
Evaluating the relevance and quality of evidence	52%	33%	11%	4%
Using clear and persuasive language	48%	30%	19%	4%
Focusing the reasons to make a coherent argument	41%	33%	11%	4%
Organizing the reasons and evidence in a logical manner	48%	26%	19%	7%

Teachers (n = 21)

■ Same understanding as before   ■ Somewhat better understanding   ■ Quite a bit better understanding   ■ Much better understanding

Source: Digital Promise, Project Topeka post-prompt-1 teacher survey, November 2021–May 2022.

After implementing Project Topeka, teachers felt more prepared to teach argumentative writing than they had before. At the end of implementation, teachers' self-reported rating increased to 3.4 from 2.7 at pre-implementation, where 1 = strongly disagree and 4 = strongly agree, $p < 0.001$. All implementing teachers who initially disagreed that they were prepared to teach writing expressed feeling prepared after trying Topeka, suggesting a tool like this could have indirect professional development potential for teachers who are often underprepared for writing instruction. For many teachers, Topeka also helped them improve in various aspects of teaching, including using data to inform instruction and target their feedback (85%), teaching the writing process (78%), and integrating reading and writing into writing instruction (67%).

Lessons Learned

Research has consistently highlighted the importance of writing skills for students to have in school and life, yet it remains a challenging subject for teachers to teach. Insufficient instructional resources and time for teachers to plan, read, and grade essays prevent them from giving more opportunities for students to write extensively. When students are assigned extending writing, they experience challenges with writing enough and revising, especially when teacher feedback is not immediate and actionable.

Our study explored the typical approaches teachers use to teach writing, the potential changes in their instructional practices, and the possibility of students having more opportunities for extended writing with access to a potentially time-saving system like the Project Topeka AES tool. The tool offered lesson plans, writing prompts, and curated resources for teachers, and instant scores and feedback for students' writing.

We learned that outside of Topeka, teachers typically do not expect students to compose essays as often as completing short responses or worksheets. Specifically, students complete short-response assignments at least monthly but write multi-paragraph essays (e.g., persuasive essay, research paper, argumentative essay) only 1–2 times per year. Despite having a time-saving tool like Topeka, teachers in our sample did not actually provide students with much more time to write because of the competing demands on instructional time (e.g., teaching multiple genres of writing, literature, grammar, and conventions). Across the board, teachers spent the same amount of time on argumentative writing with Topeka as they would without Topeka. Additionally, similar to their typical writing instruction, the bulk of teachers' instruction during Topeka was focused on prewriting and planning for writing, rather than revision.

Furthermore, our survey and interviews with teachers revealed that Project Topeka provided a few affordances: quick and direct feedback to students about their writing; access to class summary and individual student data for instructional planning; and time for teachers to conference with students to address their specific writing needs. Students struggled to understand and implement the instant feedback from the AES tool; however, the timely access to the feedback enabled teachers to respond promptly. With the time saved, teachers were able to conference with students, helping them interpret the feedback into more developmentally-appropriate comments and action steps for making changes to their essays.

One encouraging outcome of implementing Topeka was that participating teachers reported feeling more prepared to teach argumentative writing and had a better understanding of how to teach the writing process. Previous research indicates that many teachers do not have sufficient understanding of, or confidence in, writing themselves and the appropriate professional development or preparation to teach writing, reasons why they do not devote more time to teaching writing. In addition to being a time-saver, AES and AI tools like Topeka could potentially fill in knowledge gaps in writing instruction that some teachers might have. In fact, one teacher in our interviews felt using Topeka was a form of professional learning for her, finally giving her a set of writing vocabulary that she could now use with her students. Perhaps, if teachers built their confidence and preparation to teach writing first and continued to use Topeka beyond one year and over time, and we are able to further investigate, we

might better understand how teachers use the tool instructionally and see changes in writing instruction and students having more opportunities to engage in extended writing.

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