CHAPTER 6

MEANINGFUL PRACTICE: ADAPTIVE LEARNING, WRITING INSTRUCTION, AND WRITING RESEARCH

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Robert Connors' in uential 2000 essay, " e Erasure of the Sentence" documented decisive events in the   eld's history to explain how sentence rhetorics disappeared from writing studies conversations—despite empirical evidence of their e ectiveness. Demonstrating the intersections between scholars' anxieties about repeated practice, the imitation of models, the risk of imposing a universal construct of cognition on diverse students, and suspicions about the value of empirical research, Connors showed that these concerns led us to abandon cognitive research studies investigating how writers develop a strong prose style at the sentence level. To do so, he reviewed not only the substantial body of empirical research demonstrating the e ectiveness of sentence rhetorics in improving the sophistication, complexity, and nuance of students' prose but also the theoretical arguments that eventually shifted the   eld's focus away from this research. While he noted that "the reasons for the erasure of the sentence are multiple and complex," Connors argued that three themes underlay the   eld's

abandonment of sentence rhetorics, themes that have importantly in uenced writing studies in the decades since (2000, p. 110).

 e rst of these themes involved the shift in writing instruction and research from form to content. It arose from anxieties that emphasizing style, or form, suppressed creativity and adequate attention to content (Mo ett, 1968; Rouse, 1979). e second theme entailed a suspicion of approaches to learning seen as emerging from behaviorist psychology, suspicions Connors characterized as "anti-automatism or anti-behaviorism" (2000, p. 113). Noting the intense distrust of behaviorist psychology among most humanists of the 1960s and 1970s, when sentence rhetorics had attained prominence, Connors explained that critiques of sentence rhetorics pedagogies viewed them as "inherently demeaning to students" because these exercises were intended "to build 'skills' in a way that was not meant to be completely conscious" (2000, p. 113). Critics argued that this approach undermined creativity and conscious choice making. Finally, Connors discussed 1980s critiques of empirical research as focused problematically on individual cognition, to the seeming exclusion of the extensive social in uences on writing and humanist perspectives. Indeed, as Marcus Meade (this volume) notes, "individual cognition, as a focus of inquiry within composition, took a back seat to considerations of social factors."

Although Connors emphasized the eld's decreased interest in writers' development of sentence-level stylistic expertise—a loss that we agree has serious negative implications—we view the eld's turn away from *practice* as equally signi cant, and equally negative. We appreciate the concerns about creativity and content raised by critics of sentence rhetorics and certainly agree that socio-cultural factors crucially shape thinking and writing, but we contend that the suspicion of writing practice "meant to tap into non-conscious behavioral structures" (Connors, 2000, p. 113) is misplaced. Speci cally, we hold that, taken together, recent research ndings on adult neuroplasticity, theories of situated cognition, and research on the role of practice in writing development suggest two salient points. First, both conscious choice and practice honing non-conscious capacities play crucial roles in writing development. Second, this practice must be integrated thoughtfully into learning situated in socially meaningful settings.

Although we believe that many curricula and pedagogical approaches can support e ective writing practice, here we explore the potential bene ts—and challenges—of integrating research-based adaptive learning platforms for writing into dynamic, well-designed writing courses to facilitate such practice. We show how such integration may better support writers' growth and extend existing research methods for investigating how writers develop pro ciency. To do so, we summarize research on adult neuroplasticity, theories of situated cognition, and the role of practice in writing development, considering their im-

plications for writing development and instruction. We then discuss how our focus on practice relates directly to three of the eight habits of mind outlined in the *Framework for Success in Postsecondary Writing* (developed by the leading professional organizations within the field of writing studies—the Council of Writing Program Administrators [CWPA], the National Council of Teachers of English [NCTE], and the National Writing Project [NWP]; see CWPA 2011, in reference list) as key to students' growing capacity to write effectively across contexts. To consider the conceptual and procedural writing knowledge that adaptive platforms might usefully help students to develop, we summarize findings from our prior multi-institutional research study of post-secondary writers' growth in and beyond general education writing courses, highlighting three specific knowledge areas, and link them to the three habits of mind that we believe can also be fostered by integrating adaptive platforms. Based on this work and a review of studies of adaptive platforms designed by researchers (not commercial vendors), we argue that writing studies researchers and teachers should seek to join the cross-disciplinary research teams now developing adaptive platforms for writing instruction and investigating their outcomes.

A LENS FOR RECONSIDERING PRACTICE: ADULT NEUROPLASTICITY

e value of practice highlighted in Connors' reprise of work on sentence rhetorics is reinforced by research in the last decade demonstrating the heretofore unsuspected neuroplasticity of the adult brain. Neuroscientists' accounts for lay readers (e.g., Doidge, 2007; Schwartz & Begley, 2002) emphasize the role of practice in eliciting changes in perceptual, affective, and behavioral habits, as well as in dispositions, which are typically seen as quite resistant to change.

ese accounts each summarized studies showing how stroke victims with motor loss previously thought irrecoverable regained motor skills through sustained practice that rerouted neural pathways to brain segments not typically linked to motor control of affected regions. ey also highlighted studies showing how students with dyslexia benefit from practicing with recordings of slowed speech to learn to identify sound units they cannot ordinarily hear, then practicing with increasingly quicker speech until they can eventually hear these units when articulated at a normal rate of speech, with changes in neural structures (as shown through brain scans) paralleling changes in perceptual ability. Norman Doidge (2007) described research demonstrating marked differences in the balance between focused vs. holistic views between Easterners' and Westerners' perceptual habits and in their related neurological structures. Not only consistent practice but even consistently *visualizing* specific practice (e.g., of piano scales) produced

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SITUATED COGNITION

 e importance of this intersection appears in recent work on situated cogni-
tion, a theoretical framework positing that cognition is fundamentally shaped
by both bodily experience (as distinct from strictly mental experience) and by
emotional, socio-cultural, physical, and other environmental factors (Clancey,
2009; Robbins & Aydede, 2009). More traditional theories of cognition un-
derstand it from a Cartesian perspective (Mills, 1998), viewing it as a set of
mental operations distinct from, and una ected by, the body; as an individual
phenomenon una ected by socio-cultural context; and as an internal process
una ected by physical and other environmental factors. In contrast, theorists
of situated cognition view it as emerging from a complex interplay among the
brain, the body, and the environment (physical, socio-cultural, economic, etc.)

 ese foundational components function in mutually constitutive ways, a view
highlighted in Talbot's (in press) argument that social and material circumstanc-
es shape the writer's cognition and composing process. Although traditional
theories of cognition tend to view in uence as hierarchical and linear, with the
mind in uencing the body and then the environment, situated theories posit
a more iterative process in which each component shapes the others, with no
one taking primacy. As William J. Clancey explained, "the systems comprising
cognition are in principle complexly related. Physiological, conceptual, and or-
ganizational systems are mutually constraining—not causally nested" (2009, p.
19) and "cognitive processes are causally both social and neural" (p. 12).

 Further, situated cognition theorists have de ned knowledge as dynamically
constructed, remembered, and reinterpreted in social contexts.   rough inter-
actions among brain, body, and environment, individuals actively build knowl-
edge, rather than passively receiving it. For example, situated cognition theorists
argue that objects can play a role in cognition, as in the use of writing to record,
revisit, and later use information not recalled directly. Because knowledge is ac-
tively constructed in this way, knowledge provides not objective understanding
but rather a means of organizing and adapting to the world.   at is, individuals
interact with the world to achieve particular goals and construct knowledge in
the process. Even supposedly pure knowledge emerges from such interactions
and therefore o ers a speci c perspective, rather than an objective view. Be-
cause such interactions ground learning, learning occurs not only through after-
the-fact re ection but also through action (Clancey, 2009).   us knowledge is
transformed as people learn, because learning inherently involves adaptation and
interpretation based on the learner's perspective. Rather than knowledge moving
statically from one context to another as individuals traverse environments, as
traditional theories posit, knowledge is "improved in action, not simply trans-

ferred and applied" (Clancy, 2009, pp. 16-17). Read in light of ndings from research on adult neuroplasticity, situated cognition theory implies that while practice is crucial to learning and the development of expertise, participation in rich social contexts—where knowledge is adapted to pursue particular socially de ned goals—is equally crucial. Next we discuss the role of practice, particularly deliberate practice (de ned below), to foster writing growth.

SCHOLARSHIP ON PRACTICE

Writing is a complex activity that requires intense cognitive e ort; Ronald T. Kellogg (2006) compared the cognitive demands experienced by writers while composing to those experienced by expert chess players while evaluating multiple possible moves in the middle stages of a chess game (pp. 392-393). For novice writers, the cognitive demands are severe. Cognitive psychologists who study the stages of skill acquisition note that the cognitive e ort required for any newly learned skill is highest for novices. Research on skill acquisition identi es three stages for learning: First, the beginner must not only learn the basics of the new domain, s/he must also apply concentrated e ort to generating the required actions and avoiding egregious errors (Ericsson, 2006, p. 684). Second, learners perform at an acceptable level through much less e ort; third, the learners' "performance skills become automated, and they are able to execute these skills smoothly and with minimal e ort" (Ericsson, 2006, p. 684). Practice helps learners move through these stages.

Cognitive psychology research has suggested that repeated practice can help reduce demands on both executive attention (the "mindful and conscious attention that we bring to a task" [Cassity, 2013, p. 21]) and working memory, by helping writers to partially automate certain writing processes—albeit within limits (Kellogg & Whiteford, 2009). Kellogg and Alison P. Whiteford noted that in writing, practice can "reduce, not eliminate, the demands of component processes . . . to free attention for their coordination and control . . . practice allows one to be mindful of the whole task, rather than its components, and to be free to respond exibly and adaptively to the unpredictable needs of the moment" (2009, p. 252). Expert writers adapt successfully to varying rhetorical situations across contexts because they have both content knowledge and some internalized writing knowledge. us they need not devote working memory to either. By helping novice writers to internalize knowledge of some writing components, like planning or syntactic constructions, sustained practice can reduce their cognitive load so they can respond with exible adaptation to unexpected needs as they learn to write in new contexts.

In particular, Kellogg and Whiteford (2009) advocated "deliberate practice," in which the learner targets individual components of the desired skill for im-

THE ROLE OF THE *FRAMEWORK:* HABITS OF MIND

e *Framework* (CWPA et al., 2011) discusses eight habits of mind: active, positive approaches to learning that help students adapt their writing knowledge in new contexts. Of those eight habits of mind, adaptive learning programs are particularly well designed to cultivate three: exibility, persistence, and metacognition. *Flexibility* entails recognizing di erent rhetorical situations and adapting to their audiences, purposes, and contexts. Adaptive learning platforms can encourage exibility by helping students explore di erent problem types within writing. For instance, an adaptive learning system for teaching genre awareness in GEW courses could present various genres from across disciplines to help students learn to recognize, analyze, and adapt to di erent rhetorical situations. *Persistence* involves sustained attention to a task over time. Adaptive learning systems use immediate feedback on student attempts to practice a particular component skill to help students recognize when they need additional practice. Finally, *metacognition* entails using re ection on one's writing choices to "improve writing on subsequent projects" (CWPA, 2011). Adaptive platforms could teach metacognitive re ection, sca olding students' engagement in increasingly complex metacognitive thinking about writing tasks and their self-regulatory strategies (e.g., monitoring writing processes and outcomes, choosing alternate processes as needed, and evaluating their texts). By structuring students' practice in ways that promote persistence, exibility, and metacognitive self-regulation, adaptive platforms could promote these three habits of mind in ways that support writers' growth. We turn next to speci c component writing skills that adaptive platforms could foster through sca olded instruction and practice.

FACTORS IN KNOWLEDGE TRANSFER/ADAPTATION

We focus on three component skills that our prior research has suggested promote writing transfer: genre awareness, use of sources, and metacognition. Speci cally, we draw on ndings from the rst phase of e Writing Transfer Project, a two-year, cross-institutional, multi-modal study of writing transfer factors in postsecondary education. We found that students from all four diverse participating universities gained writing pro ciency while taking general education writing (GEW) courses during the study's rst semester. However, most students at all four universities lost writing pro ciency while taking disciplinary writing courses during the study's second year, although some students did gain pro ciency. We measured writing gains/losses through blind ratings of pre- and post-GEW writing samples and disciplinary course writing samples.

One factor—genre awareness, de ned as a sophisticated understanding of

genre as a social action, one directed toward a specific audience for a specific purpose—predicted gains from pre- to post-semester GEW writing samples.

Three factors—measured by coding students' reflective texts—predicted changes in writing proficiency from post-GEW to disciplinary writing samples. Prior knowledge, or students' references to using high school writing knowledge in post-secondary settings, correlated *negatively* with gains in writing proficiency from GEW to disciplinary writing. In contrast, two other factors correlated positively with writing proficiency gains from GEW to disciplinary writing. The first we call "sources applied," as it involves the ability to apply a scholarly source as a conceptual tool to analyze, evaluate, or interpret a separate object of study. The second entails the ability to describe writing processes used for a specific writing task (as opposed to a general writing process).

We interpret the negative correlation between use of prior knowledge and writing proficiency gains from GEW to disciplinary writing as possibly indicating students' return to important but often formulaic writing conventions learned in high school (Kiuhara, Graham, & Hawkin, 2009). As Mary Jo Rei and Anis Bawarshi's (2011) work shows, college freshmen who apply high school writing strategies wholesale tend to be less successful in college writing courses than students who adapt such high school strategies to meet the demands of a new context. Thus we suggest that high reliance on unmodified prior knowledge may indicate that students don't recognize the need for such adaptation or don't know how to undertake it. To interpret the positive impact of sources applied, which Joseph Bizup (2008) describes as "methods source" use, we draw on Michael Carter's (2007) work with metagenres, or genre types (like the lab report or analysis paper) shared by several disciplines. Because applying a source as a conceptual lens for analyzing other texts or objects of study is a component writing skill used across many academic disciplines—academic metagenres—we're not surprised that facility in it predicted writing proficiency gains for students moving into disciplinary courses. Finally, we suggest that the ability to describe writing processes used in a specific composing task may predict writing proficiency gains (as opposed to awareness of a generalized writing process, which did not predict such gains) because this component skill helped students to reflect metacognitively on how well their strategies were helping them to effectively address the particular rhetorical situation, audience, purpose, and context of a given writing task.

The three component skills in writing development that predicted growth in writing proficiency—genre awareness, sources applied, and metacognitive reflection on a specific writing task—link directly to the three habits of mind discussed above—flexibility, persistence, and metacognition. Flexibility supports the development of genre awareness, as defined above (and vice versa).

Persistence is required to learn challenging conceptual and procedural knowledge, including an understanding of genre as social action and how to use a source as a lens for analyzing another object of study. Metacognition that uses reflection to improve one's process in subsequent writing tasks both supports, and benefits from, metacognitive attention to the writing process used in a particular composing task.

As we argue below, because adaptive platforms can foster persistence, flexibility, and metacognitive development, they could encourage students' development of both the three component skills and the three linked habits of mind we've highlighted.

ADAPTIVE LEARNING OVERVIEW: PERILS AND PROMISE

To illustrate the potential value of integrating adaptive learning platforms into robust writing courses, we discuss computer-based writing instruction to date, including research findings on its limitations and efficacy. We wish to highlight a crucial point about these studies: researchers emphasize that computer-based writing instruction is not intended to replace instructors but rather to support well designed classroom instruction (Blumenstyk, 2016; A. Gibson, personal communication, April 26, 2016). We see adaptive platforms as potential vehicles for helping students to cultivate the analytical, synthetic, and metacognitive abilities that our prior research suggests predict successful transfer of writing knowledge into new contexts and, potentially, as vehicles for instructors' professional development.

We begin with Laura K. Allen, Matthew E. Jacovina, and Danielle S. Mc-Namara's (2016) useful overview of research on computer-based writing instruction, which also introduces the authors' own adaptive learning platform, Writing Pal (W Pal). Like many other researchers in this domain, Allen et al. emphasize that developing effective adaptive platforms for writing entails substantially greater challenges than doing so for disciplines teaching well-defined problems, such as many science, technology, engineering, and math (STEM) fields, because writing is an ill-defined domain, or one in which problems do not have a single definitive answer. The authors address some of these challenges in summarizing research on three distinct but connected modes of computer-based writing instruction: Automated Essay Scoring, Automated Writing Evaluation, and adaptive learning platforms.

The first—and most criticized—mode of computer-based writing instruction, Automated Essay Scoring (AES), focuses strictly on summative assessment, often in high-stakes testing, without providing instruction or formative feedback. Although Allen et al. (2016) claim high levels of reliability and validity for

AES systems generally, they do acknowledge critiques showing that students can subvert AES scoring through various approaches that exploit AES scoring features but do not produce high-quality texts, for instance, by repeating the same paragraph throughout an entire essay or by using syntactic sophistication and terms relevant to prompt content. Nonetheless, the authors contend that the AES system that functions within W Pal measures both super cial features (e.g., numbers of words in sentences and sentences in paragraphs) and more substantive features (e.g., semantic cohesion and use of rhetorical devices). However, the authors agree with critiques arguing that AES has signi cant validity concerns because such systems are, as yet, unable to measure meaningful aspects of writing such as creativity and development of speci c ideas or whole arguments.

Unlike AES systems, Automated Writing Evaluation (AWE) systems provide both opportunities to practice and formative, as well as summative, holistic feedback on drafts. Allen et al. (2016) highlight prior research suggesting that AWE systems promote persistence and improved writing quality for students, despite challenges in providing speci c feedback tied to particular aspects of students' drafts (Gikandi, Morrow, & Davis, 2011; Grimes & Warschauer, 2010;), an important issue given that generalized feedback has proven less useful in prompting e ective revisions. e W-Pal platform o ers such holistic feedback.

Finally, in addition to the holistic practice and feedback that AWE systems o er students, Allen et al. (2016) emphasize that Intelligent Tutoring Systems (ITS), or adaptive platforms, provide writing content and strategy instruction, opportunities to practice component skills (e.g., drafting conclusions), and tailored performance feedback that also directs students to relevant instructional materials. In addition to providing holistic feedback, W Pal o ers students tailored performance feedback on component skills. Writing samples scored by experts underlie platforms' feedback algorithms. Some adaptive systems, like W Pal, address boredom—reported by students participating in some adaptive platforms—by using a game-based approach, which has been shown by prior research to improve engagement. e authors highlight ongoing research investigating which types of feedback best promote writing development and more e ective revision for particular students. For instance, because some research suggests that more e ective writers use more exible strategies for improving a text's cohesion across di erent writing tasks, adaptive platforms' feedback might be tailored to provide less exible writers with prompts to experiment with more diverse approaches to establishing cohesion. While adaptive platforms generally do not address content and further research is needed to optimize feedback for individual students, research to date shows promise.

Further research on adaptive platforms bears out this promise. Using a robust model of revision, with an emphasis on global, substantive changes, rather

than super cial editing, Jacovina et al. (2015) investigated how students using the W Pal adaptive platform transformed their drafts. Although holistic essay scores improved minimally across essays for the students participating in the 10-week summer program under study, use of the W Pal platform prompted students to make more global revisions and fewer super cial revisions in several areas, including elaboration (by adding details, examples, and other content); organization (clearer introduction-body-conclusion structures); cohesion; and semantic pro ciency (as demonstrated by decreased word repetition). Pointing out that students undertook substantive revisions in all eight of the essays they drafted, the authors highlight as an example a student whose initial draft began with a strong introduction but moved into an under-developed body and conclusion. After receiving W Pal feedback suggesting that the body of the essay needed elaboration, the student requested and received additional optional feed-

the same gains controls did while completing only half the practice. e authors concluded that students were apparently learning to monitor their writing strategies more e ectively based on instruction and feedback from the adaptive platform and that this improved monitoring explains participants' achievement of gains that equaled those of controls, despite participants' more limited practice time. In their report on development of a platform designed to provide formative feedback on students' re ective writing, Buckingham Shum et al. (2016) emphasized the goal of helping students to engage in metacognitive thinking focused on adapting and extending knowledge when moving from academic to pre-professional contexts. Andrew Gibson and Kirsty Kitto's (2015) discussion of their e orts to provide automated formative feedback intended to improve students' re ective writing focused on metacognitive strategies, particularly monitoring and control as means to promote more e ective self-regulation of learning. Finally, a discourse analytics tool designed to provide instructors and researchers with data on students' discourse moves in online collaborative learning interactions also has the potential to provide individualized, context-sensitive formative feedback to students about the cognitive strategies enacted in their collaborative discourse moves (Rosé et al., 2008).

We agree with concerns raised about the perils of using AES for high-stakes summative writing assessment and the contention that all three modes of computer-based writing instruction require further development. Still, the promise of adaptive platforms for providing formative feedback designed to extend—not replace—e ective in-class writing instruction suggests that writing studies scholars and researchers might fruitfully engage more deeply with the research on computer-based writing instruction described above. Below we argue for the potential value of seeking to join the group of cross-disciplinary researchers working to develop and investigate the e ects of adaptive platforms for writing instruction.

MOBILIZING THE POTENTIAL OF ADAPTIVE LEARNING FOR WRITING STUDIES

Based on the potential of adaptive platforms, recent discoveries about how practice drives adult neuroplasticity, the principles of situated cognition, and the value of meaningful practice, we argue that, integrated thoughtfully, research-based adaptive platforms could provide the eld with tools that o er rich potential for (1) improving writing instruction, (2) extending research on writing development, and (3) contributing to writing instructors' professional development.

We believe that weaving such platforms into dynamic writing classrooms can promote writers' growth. Adaptive systems can help to encourage deliberate

practice and so help writers to more e ectively self-regulate relevant cognitive and other learning-related behaviors. By mobilizing the potential of environmental resources (e.g., samples of various genres), physical and cognitive activity

tices shaped to meet the needs of diverse local writing program contexts. Second, adaptive platforms will provide keystroke data tracking students' uses of adaptive modules' materials and digital data on the levels at which they achieve each module's learning outcomes.   ese data could usefully be analyzed in conjunction with data on related phenomena: rating data assessing the quality of students' texts and revisions, survey data measuring their self-e cacy for writing and engagement with writing courses, and re ective data gauging their understanding and integration of key conceptual and procedural writing knowledge.

   ird, the keystroke data could also be used to measure di cult-to-study capacities such as self-regulation strategies and students' development of the key habits of mind discussed in this article. Finally, adaptive learning platforms o er opportunities to study the rich social contexts that well-designed writing courses establish. By collecting qualitative data on students' in-class engagement and comparing that data with evidence of students' uses of adaptive platforms to develop pro ciency in key component skills, such as genre analysis, investigators can learn which features of such social contexts appear to motivate students to practice to develop greater pro ciency in these component skills.

   Finally, the use of well-designed adaptive modules has important implications for instructors' professional development, from both individual and programmatic perspectives. Using adaptive modules to teach conceptual and procedural writing knowledge can sca old professional development for instructors with little expertise in the module's subject matter (e.g., teaching genre awareness). Because instructors can use the modules with minimal preparation and learn from the modules and their students' responses to module prompts, integrating a module on knowledge areas unfamiliar to the instructor o ers an engaging, e ective, and e cient means to develop teaching expertise in a new area.   is approach substantially reduces the extensive revision of course materials typically involved in such an endeavor, a point suggested by our process of developing and testing paper prototypes of the adaptive modules we hope to construct.

      ree co-authors piloted our paper prototypes of adaptive modules for Sources Applied, Genre, and Metacognition. Each module guided students' development in its knowledge area. Co-authors who piloted the prototypes found that their use enriched teaching—prompting one co-author to revise his course for future semesters and a second to integrate the metacognition module into an honors writing course. Co-authors found that adding the modules required little modi cation of their existing courses, although they did link course assignments to the modules' content. Each of the three courses was quite distinct, due to local contextual factors. While two co-authors were teaching revised writing about writing curricula (each di erent from the other and each adapted to t its local context), a third took a theme-based approach.   is curricular range, cou-

pled with the successful use of the modules across these diverse courses in three distinctly di erent institutions with divergent writing programs, sta ng, and student demographics, demonstrates the modules' capacity to support learning in various curricula and contexts.

is capacity, coupled with modules' potential to foster development of both key conceptual and procedural writing knowledge, on the one hand, and key habits of mind, on the other, means that data from adaptive modules might also usefully inform programmatic assessments and professional development e orts. e use of keystroke data showing students' engagement with adaptive modules and their level of mastery of each learning outcome in each module could complement existing textual, qualitative, and quantitative data used in programmatic assessments. Similarly, encouraging instructors to cultivate teaching expertise in new areas by incorporating well-designed adaptive modules into their courses could e ectively supplement professional development workshops, instructor communities of practice, and the like. In sum, while the use of adaptive platforms raises legitimate concerns that must be carefully addressed, we see high potential value for writing studies researchers and teachers in seeking to join cross-disciplinary collaborations with other researchers working to design adaptive platforms for writing instruction. In addition to the substantial bene ts to students' writing growth that may be gained by integrating such platforms thoughtfully into well-constructed writing courses, researchers may glean new and valuable types of data, while writing program administrators may obtain expanded approaches to assessment and professional development for instructors.

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