# Participatory Design of a Writing Analytics Tool: Teachers' Needs and Design Solutions

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**ABSTRACT:** Automated writing evaluation (AWE) tools can facilitate teachers' analysis of and feedback on students' writing. However, increasing evidence indicates that writing instructors experience challenges in implementing AWE tools successfully. For this reason, our development of the Writing Analytics Tool (WAT) has employed a participatory approach that includes teachers throughout all stages of design. WAT aims to generate writing analytics that are both useful to teachers and actionable by students. In this report, we discuss our participatory design approach and resulting insights, including (a) teachers' expressed instructional needs and goals, and (b) design solutions that were conceptualized to address both factors.

**Keywords:** Automated Writing Evaluation, Participatory Design, Writing Analytics Tool

## 1 INTRODUCTION

Automated writing evaluation (AWE) tools are computer-based systems designed to reduce teachers' workload by providing formative feedback to students on their writing (Wilson et al., 2021). Such systems typically use natural language processing (NLP) to analyze writing on basic features (e.g., grammar, mechanics, and punctuation) and more complex dimensions (e.g., cohesion and syntactic complexity). AWE systems then provide feedback to students that identifies potential targets and strategies for improvement. Studies have reported that AWE can assist teachers in improving students' writing quality and attitudes about writing (e.g., Wilson & Czik, 2016). However, several studies have documented teachers' challenges in using AWE tools to support writing instruction. For example, teachers may experience *increased* workload when the feedback provided by AWE systems is inaccurate, unclear, or otherwise difficult for students to interpret. In such cases, AWE implementation can have *negative* impacts on student writing (Palermo & Thompson, 2018; Wilson et al., 2021). When teachers have concerns about system accuracy or functionality, they may eliminate AWE tools (and related benefits) from their instruction.

For these reasons, our development of the Writing Analytics Tool (WAT) has embraced *participatory design methods* that incorporate teachers' insights and instructional goals throughout the process. WAT is an AWE system that aims to generate writing analytics that reveal meaningful features of students' writing for teachers, students, and researchers. In this paper, we outline the collaborative design

process used to identify teachers' needs and then describe potential design solutions that can make writing analytics more accessible to teachers.

## 2 PARTICIPATORY DESIGN

Participatory design emphasizes a collaboration between designers and teachers wherein the mutual expertise of both is *equally valued*. This process recognizes that design challenges and solutions are context-specific, and context experts are crucial members of the design team (Kuhn & Muller, 1993). Following these principles, we recruited a WAT Teacher Advisory Board (TAB) comprising six secondary writing teachers (i.e., 4 high school; 2 middle school) via their participation in the National Writing Project (NWP). The group possessed an average of 18.7 years of teaching experience (ranging from 9 to 25 years) and all of the teachers had professional experience in supporting writing instruction with technology.

Teachers participated in six recorded focus group sessions (60-90 minutes) conducted over Zoom. Each meeting followed a similar structure, but activities and discussion varied organically based on the topic (see Table 1 for a high-level summary). Discussions from prior sessions informed the topics of later sessions.

**Table 1: Focus Group Session Topics**

| Session | 1st | 2nd | 3rd | 4th | 5th | 6th |
|---|---|---|---|---|---|---|
| Topic(s) | personal introductions; overview of WAT project | information teachers need or desire for evaluation | features and challenges of student writing | core needs for WAT interface design | planning and developing writing assignments | providing feedback and dialog with students |

Teachers had multiple opportunities and modalities for expressing their needs, ideas, and goals. First, sessions were preceded by a pre-meeting survey that introduced session topics and promoted initial reflection. Survey responses could be revisited during the session to elicit further discussion. Second, each session included a shared digital document that teachers and developers could contribute to simultaneously (e.g., notes and commentary). Thus, teachers were able to express themselves in their own words, both in speech and in text. Third, each session included a "Writing into the Day" activity conducted within the shared document. Prompts for these exercises linked content from previous sessions to the current session, and prompts were often derived from teachers' own quotes from prior meetings. Fourth, virtual "breakout rooms" enabled focused small group discussions, which were then shared back to the larger group. These discussions focused on identifying "pain points" and teachers' AWE needs for overcoming these challenges.

## 3 NEEDS AND PROPOSED SOLUTIONS

As needs were uncovered, the design team identified potential solutions that were shared for teacher input and collaboration. Several sets of design needs and potential solutions emerged from the TAB focus groups and iterative dialog. For brevity, three examples are described below.

## 3.1 Need 1: Emphasizing teachers' roles and agency in AWE implementation

Teachers expressed concern about the accuracy and efficacy of AWE systems. In their view, current AWE systems are not contributing to students' deeper learning or writing skill development. They explained that students who use these tools often focus on the "scores" and make superficial changes rather than meaningfully improving their texts. TAB members argued that AWEs should supplement, not replace, teacher feedback. Specifically, teachers are better equipped to provide personalized and contextualized feedback that is aligned to students' needs, and thus their role and agency in crafting, framing, and delivering feedback must be paramount.

To address these needs, the writing analytic aspects of WAT were (re)conceptualized to emphasize *detecting* and *identifying* features of student writing, rather than *evaluating* or *scoring* such features. Using such information, teachers are free to communicate their own guidance or evaluation. For example (Figure 1), WAT can assess the level of text concreteness or abstraction. This pattern can be shown to teachers and students, and teachers can elaborate in a comment box (e.g., how to modify concreteness depending on instructional goals). Teachers can also provide evaluative framing by categorizing the current feature as positive, in need of improvement, or simply general information.

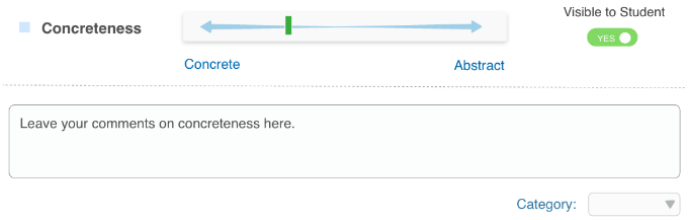


**Figure 1: Feedback interface**

## 3.2 Need 2: Supporting students' writing agency

A discussion about "writing as a process" revealed that teachers wanted AWE tools to also reinforce students' own agency in writing and revising. TAB members argued that automated feedback should not govern students' writing nor limit their independence. Resulting design solutions focused on helping students understand the meaning of selected metrics along with strategies for modifying such features of their writing. We thus added a "Library" that explains each metric and how it contributes to communicating with readers (Figure 2). Each metric is accompanied by considerations for revising (not shown in Figure 2). This functionality enables students to adopt a more informed and intentional approach.

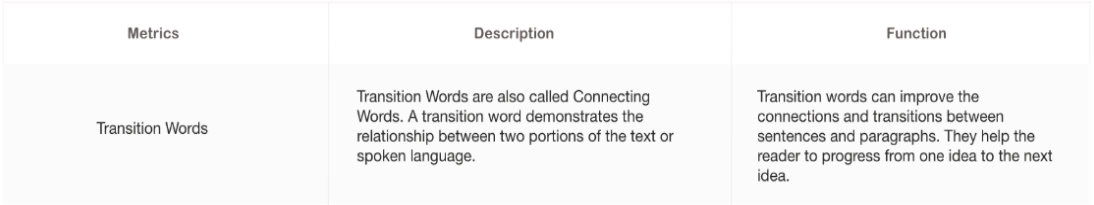


**Figure 2: Metric library interface**

### 3.3 Need 3: Supporting teacher-student communication

TAB members agreed that an important element of their instruction was the ability to engage students in dialog about writing. In these interactions, teachers use their wealth of information about students to provide personalized feedback. Thus, teachers wanted AWEs to help them further understand students' writing perceptions, struggles, or intentions, which are not always visible or explicit. We thus developed a "tag and flag" function that enables students to communicate about their writing by annotating segments of their essays. "Tags" allow students to label specific writing elements (e.g., arguments and topic sentences) and "flags" allow students to metacognitively indicate their status (e.g., "I am still working on this"), intent (e.g., "I'm trying to be funny here"), or ask for help (e.g., "Does this sound right?").

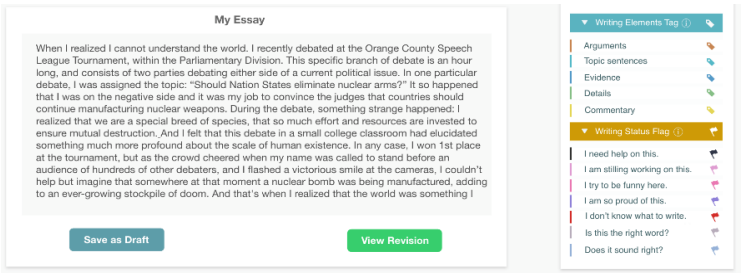


**Figure 3: Teacher-student communication interface**

## 4 CONCLUSION AND NEXT STEPS

Participatory and collaborative design with teachers revealed that teachers crave AWE systems that will (a) support and not replace their central roles as writing instructors and mentors, (b) provide them with actionable information about students' writing, and (c) facilitate students' writing agency. Our next steps are to complete and test prototypes for emerging solutions, including seeking TAB expertise on whether proposed solutions actually satisfy their needs and expectations. Upcoming focus group sessions with the TAB (Phase 2) are expected to uncover further needs and functionalities for WAT design. In essence, participatory design is a continuous improvement process that never ends.

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