Genre-based automated writing evaluation

Elena Cotos, Iowa State University, USA

Genre-based automated writing evaluation (GBAWE) is an emergent domain of inquiry and praxis motivated by the need to assist students in advanced writing contexts to acquire the specialized discourses of their target disciplinary communities. It involves the design and pedagogical use of digital writing tools that analyze and generate automated feedback on texts based on the communicative conventions of the genre they pertain to. Unlike traditional AWE (See Cotos, 2018), GBAWE feedback is generally operationalized to reflect the formal characteristics of genres as theorized in the field of English for Specific Purposes (ESP) (Swales, 1990; Bhatia, 2004). In other words, the feedback focuses on communicative goals called 'moves' and functional strategies called 'steps,' which are conventionalized rhetorical forms that both constitute and reproduce genres.

Pioneering examples of GBAWE were developed for the abstracts (Anthony & Lashkia, 2003) and introductions (Cotos, 2011) of the research article genre. Automated analysis of these part-genres was based on the create-a-research-space (CARS) moves – establishing a territory, establishing a niche, and occupying the niche (Swales, 1981, 1990, 2004). The CARS moves, validated in ESP genre studies and widely adopted by teachers, continued to serve as the foundation for new developments. For example, a cross-disciplinary framework for Introduction, Methods, Results, and Discussion/Conclusions was applied to generate automated move and step-level feedback on individual sentences as well as discipline-specific, goal-orienting feedback on a student's entire draft (Cotos, 2016; Cotos, Huffman, & Link, 2015). In a similar vein, rhetorically salient sentences are highlighted for feedback on analytical, argumentative, reflective essay genres (Gibson et al., 2017; Knight, Buckingham Shum, Ryan, Sándor, & Wang, 2018).

While essentially grounded in ESP, GBAWE crosses disciplinary boundaries within applied linguistics and beyond. Theoretically, it intersects with perspectives on genre in systemic functional linguistics and rhetoric. When designed for use by language learners, it accounts for theoretical tenets in second language acquisition. Operationally, the feedback affordances are possible due to methods in computational linguistics, natural language processing, and machine learning. In terms of practical uses, connections extend to writing pedagogy, computer-assisted language learning, and more broadly to writing and learning analytics.

Considering that it builds on scholarship and praxis in different fields, the advancement of GBAWE thus calls for an interdisciplinary research agenda. Studies providing comprehensive descriptions of the rhetorical, functional, linguistic, and content realizations of a wider range of genres and discourse communities (e.g., Cotos, 2019) still need to feed into the design of new systems. Computational models for automated analysis and feedback need to be trained, evaluated, and augmented for improved accuracy (e.g., Cotos, forthcoming; Fiacco, Cotos, & Rose, 2019). Most importantly, practical uses of GBAWE (e.g., Cotos, Link, & Huffman, 2017; Shibani, Knight, & Shum, 2019) need to be investigated to understand the factors that may enhance or inhibit the development of genre writing competence, and to generate guidelines for effective pedagogical implementation. Few GBAWE exemplars are available to date; therefore,

this is an area ripe for investigation and scalability. The general directions that need to be pursued as points of departure include principled design, feedback generation and optimization, usefulness for genre-based writing pedagogy, and impact on genre knowledge and writing competence.

References

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The Research Questions

1. To what extent can GBAWE feedback accurately reflect students' genre writing competence?
2. How helpful is GBAWE for revision practice and genre writing improvement?
3. How do students use GBAWE, and what strategies are most effective?
4. What kind of and how much training do students and teachers need to use GBAWE effectively?
5. How can teachers assess the effectiveness of GBAWE implementations in their classrooms?
6. What are the strengths and limitations of GBAWE compared to other digital writing technologies, and how can different strands of research on feedback, usefulness, and impact address limitations and further inform the advancement of *GBAWE?*
7. How can we most appropriately operationalize genre constructs to design 'actionable' GBAWE feedback; i.e., feedback that provides the guidance needed to improve?
8. How can the functionality and output of GBAWE engines be evaluated and interpreted in meaningful ways for teachers and students?
9. How can different theories, research results, and practical needs be best integrated in the design of GBAWE for a range of target contexts?
10. What principles should be developed to scale GBAWE from individual genres to genre systems spanning different contexts and discourse communities?

Suggested Resources

Anthony, L., & Lashkia, G. (2003). Mover: A machine learning tool to assist in the reading and writing of technical papers. *IEEE Transactions on Professional Communication*, 46(3), 185-193.

This paper describes the approach to developing the first genre-based automated analysis tool called the Mover. While not conceptualized as a feedback tool, it was intended to assist novices with their reading and writing in science and engineering related fields by presenting the move structure of texts based on a modified *create-a-research-space (CARS)* model. Explicitly linking to the interdisciplinary field of machine learning, Anthony and Lashkia comprehensibly and accessibly describe the process of designing the Mover as a learning system. In short, the Mover was trained to 'learn' the moves from a collection of abstracts, to apply the information learned to the automatic identification of moves in a new text, and then to display the moves associated with each sentence to the user. To determine the degree to which the Mover could be confidently used in the classroom, it was evaluated in terms of accuracy of automated analysis and usefulness for reading and writing tasks in a classroom context. This work served as proof-of-concept for automated genre analysis and laid the foundation for GBAWE.

Cotos, E. (2014). *Genre-based automated writing evaluation for L2 research writing: From design to evaluation and enhancement*. Basingstoke, UK: Palgrave Macmillan.

This book launches the notion of GBAWE, proposing it as a novel approach to enhancing academic writing pedagogy for second language (L2) writers. Cotos argues for the importance of connecting teaching and learning needs with theoretical premises and research findings and introduces a new conceptual model for GBAWE design grounded in *theoretical and operational frameworks*. The theoretical framework includes genre theory, systemic functional linguistics, second language acquisition and skill acquisition theories. The operational framework allows for the integration and actualization of the different theoretical tenets drawing on research in formative assessment, intelligent computer-assisted learning, and evidence-centered design. Showcasing how this model guided the development, implementation, and evaluation of a prototype tool, Cotos further explains how empirical evidence derived from a study with mixed and triangulated methods informed scaling up from the prototype to a full-fledged system – the Research Writing Tutor (RWT). Apart from demonstrating how specific needs can be attended to through GBAWE, this book offers critical reviews of genre-based pedagogies, cognitive and socio-disciplinary dimensions of research writing competence, and state-of-the art of automated writing evaluation technology.

Cotos, E. (2016). Computer-assisted research writing in the disciplines. In S. A. Crossley & D. S. McNamara (Eds.), ***Adaptive educational technologies for literacy instruction*** **(pp. 225-242). NY: Taylor & Francis, Routledge.**

The chapter in this volume has three main foci: theoretical, descriptive, and evaluative. In the first part, GBAWE is situated within a theoretical landscape where ESP genre theory and cognitive writing theories are presented in a symbiotic relationship with regard to *research writing competence*. From the perspective of cognitive writing models, novice writers need to practice and improve their revision skills in order to move from *knowledge-telling to* expert-like *knowledge-transformation* in their writing. Considering that, the second part of the chapter elaborates on how GBAWE can create conditions for revision practice through the example of RWT. Here, this system is described as integrating genre and disciplinary conventions in a platform for independent writing and revision practice enabled by its interactive modules with feedback and corpus-based scaffolding affordances. The third part shifts to a review of studies investigating implementations of RWT in English for academic purposes contexts. Research results indicate the potential of the feedback to activate novice researchers' higher-order thinking processes and strategies during revision, foster their knowledge of rhetorical conventions, improve genre writing quality, and have a positive impact on their motivation.

Cotos, E., & Pendar, N. (2016). Discourse classification into rhetorical functions for AWE feedback. ***CALICO Journal,*** **33(1), 92-116.**

This article will be useful to those interested in knowing how GBAWE feedback is generated by combining genre analysis and machine learning. The authors present an accessible description of the approach adopted in the development of the automated analysis engine of RWT. The readers are first acquainted with natural language processing and machine learning approaches to automated discourse categorization as well as with implementations in computer-assisted writing tools. Following this overview, the method by which RWT categorizes sentences in student texts into rhetorical moves is described. First, a corpus was manually annotated with moves and steps. Then, linguistic features indicative of rhetorical functions were extracted. Sentences were

represented as vectors in two-dimensional planes, and supervised vector machine models were trained to classify sentences into moves and steps. The authors report measures of accuracy for all the moves and steps, discussing the challenges of the genre classification task and proposing techniques for improving the performance of the analytic models that generate feedback.

Knight, S., Buckingham Shum, S., Ryan, P., Sándor, Á., & Wang, X. (2018). Designing academic writing analytics for civil law student self-assessment. ***International Journal of Artificial Intelligence in Education*****, 28(1), 1-28.**

This is a classic example of interdisciplinary work by collaborators in learning analytics, linguistics, natural language processing, software development, and the target discipline. The team describes the process of designing and evaluating the Academic Writing Analytics (AWA) tool intended to provide formative feedback to undergraduate students. While not explicitly positioned in relation to GBAWE, AWA was developed to assist students in an English for specific purposes context who need to master a civil law genre. Also, its feedback is generated based on parsing students' drafts into rhetorically-salient sentences, which are closely associated with Swales' (1990) rhetorical moves. After a comprehensive description of the participatory design process through which the parsing engine was tested and refined, the authors report student data that substantiates the usefulness of AWA and also reveals limitations to be addressed in future work. Importantly, they emphasize the need to make writing analytics transparent to different stakeholders.

About the Contributor

Elena Cotos is an Associate Professor of Applied Linguistics and the Director of the Center for Communication Excellence at Iowa State University, USA. Her scholarship focuses on genre-based automated writing evaluation, corpus-based genre analysis and pedagogy, and computer-assisted language learning and assessment. She authored *Genre-based automated writing evaluation for L2 research writing* (2014). Her contributions appeared in different journals (e.g., *ESPJ, JEAP, LLT, ReCALL, CALICO, Journal of Writing Research, Writing&Pedagogy, IJCALLT*) and edited volumes (e.g., C. A. Chapelle (Ed.), *The Encyclopedia of Applied Linguistics* (2018); J. I. Liontas (Ed.), *The TESOL Encyclopedia of English Language Teaching* (2018); C. Chapelle & S. Sauro (Eds.), *The Handbook of Technology in Second Language Teaching* (2017, Wiley Blackwell); S. A. Crossley & D. S. McNamara (Eds.), *Adaptive educational technologies for literacy instruction* (2016)).