Chapter 25
Advances in Automated Scoring of Writing for Performance Assessment

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ABSTRACT

The ability to convey information through writing is a central component of real-world skills. However, assessing writing can be time consuming, limiting the timeliness of feedback. Automated scoring of writing has been shown to be effective across a number of applications. This chapter focuses on how automated scoring of writing has been extended to assessing and training of real-world skills in a range of content domains. It illustrates examples of how the technology is used and considerations for its implementation. The examples include 1) Formative feedback on writing quality, 2) scoring of content in student writing. 3) improving reading comprehension through summary writing, and 4) assessment of writing integrated in higher-level performance tasks in professional domains.

WRITING FOR PERFORMANCE ASSESSMENTS

Writing is the ability to create meaning through symbols (e.g., Kellogg, 1999) and to communicate that meaning to others. Communicating information through writing is considered one of the key 21st Century skills and has been incorporated as a critical component in many national standards (e.g., Ananiadou & Claro, 2009; OECD, 2013). For example, the U.S. Common Core State Standards require students to develop more rigorous writing skills with a stronger emphasis on the ability to synthesize and summarize informational text, formulate arguments, as well as respond appropriately to source documents. This puts greater emphasis on writing for a purpose, with students linking ideas to texts and argumentation and writing across the curriculum. With the advent of information technologies, writing also plays a more central role in everyday communication. Information can be readily published on the web and communication via writing has become more ubiquitous through email, chat, and other collaborative tools. Thus, within an information economy, writing is not just an academic pursuit, it is the primary conduit for

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effective transmission of the vital information. As such, writing is a crucial skill across almost all career paths.

Educational practice has also recognized that writing is not just a matter of teaching compositional writing skills. Training of writing typically occurs both through more domain general means, such as in language arts classes and as integrated components within particular curricula to train domain specific writing skills. Over the past few decades, greater emphasis has been placed in training writing across the curriculum (e.g., McCleod, 1992), by emphasizing that students are not just learning to write, but by embedding writing in curricula, they are writing to learn. Indeed, over half of U.S. higher education institutions have formal programs where writing is integrated across the curriculum (Thaiss & Porter, 2010). Thus, writing activities must occur within natural performance tasks in order to promote the abilities that will be needed and used in and out of the classroom.

Learning to write well is a multi-faceted ability. It requires language, organization and expression skills as well as domain knowledge, and it develops slowly over a person's educational career. It is a well-known adage that in order to become a good writer, one needs to do a lot of writing. However, while time on task is typically a strong predictor of performance gains in reading and writing, receiving timely feedback is critical (e.g., Black & William, 1998; Hattie & Timperley, 2007; Shute, 2008). Meta-analyses of studies of formative writing (e.g., Graham, Harris, & Hebert, 2011; Graham & Hebert, 2010; Graham & Perin, 2007) have shown that instructional practices can have strong effects on helping students with learning to write. For example, supporting students with feedback had an effect size of 0.77, and providing students with instruction in strategies for planning, revising and editing their compositions had an effect size of 0.82 (Graham & Perin, 2007), indicating that each instructional practice can be highly valuable. Other findings from these studies indicate that having teachers actively monitor a student's writing progress and teaching students to monitor their own writing also significantly improve student performance. Thus, it is not good enough to just tell students to write more or write more often. The writing must be monitored and the students need to receive timely feedback and instruction for it to be most effective.

However, a key limitation of implementing increased writing instruction is the amount of time that instructors need to review, edit, and comment on student writing. Typically a teacher can only review student essays after a class period and even then, students may not receive the feedback on their writing a day or a week later. This limits learning since students learn best when receiving timely feedback (e.g., Anderson et al., 1990). Automated scoring of student writing provides the potential to give students specific, immediate, feedback that addresses both the content of their writing, as well as the quality of the written expression. As such, it can give students increased opportunities to practice writing skills and use the feedback to improve writing. Given the need for greater performance assessments for real-world skills, it is critical to have computer-based tools that can support formative processes in writing and be general enough to support types of writing that people perform in real-world tasks. These tools can do more than just *automate* existing educational processes for formative writing. They can also *enhance* and *change* these processes to be more effective for students and teachers. This chapter provides some illustrations of how the technology supports this change.

Automated Scoring of Writing

Automated scoring of writing, or Automated Essay Scoring (AES), provides the ability to analyze student writing and score writing instantly. AES has become increasingly accepted with multiple systems available for implementing the scoring of writing (e.g., Shermis & Burstein, 2013; see also Bunch et al., this volume; Wilson & Andrada, this