ReaderBench: The Learning Companion

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Abstract. Continuous progress tracking in terms of automated essay scoring, assessment of reading strategies, and evaluation of learners' involvement in collaboration groups represents a key component in technology-scaffolded learning. Our educational software, *ReaderBench* [1, 2], is based on current research in the automated essay scoring field (*E-rater*, *iSTART*, *Coh-Metrix*), but provides an integrated approach centered on cohesion. *ReaderBench* supports both tutors and students, affording automated evaluations of reading strategies, course materials selection, and CSCL collaboration. *ReaderBench* has been designed to flexibly allow multiple configurations for various educational scenarios and languages (English, French, and Italian).

1 *ReaderBench*'s Purpose

ReaderBench targets both tutors and students by providing a fully functional learning model approach including invidual and collaborative learning methods, cohesion-based discourse analysis [2], dialogical discourse model [3], textual complexity evaluation [1], reading strategies identification [4], and participation and collaboration assessment [5]. By using natural language processing techniques, the main purpose of this framework is to bind traditional learning methods with new trends and technologies to support computer supported collaborative learning (CSCL). *ReaderBench*, by design, is not meant to replace the tutor, but to scaffold both tutors and learners by enabling continuous assessment, self-assessment, collaborative evaluation of individuals' contributions, as well as the analysis of reading materials to match readers to their appropriate class level text.

Overall, *ReaderBench* is a fully functional automated software framework, designed to be an educational helper for students and tutors. The system makes uses of text-mining techniques based on advanced natural language processing and machine learning algorithms to design and deliver summative and formative assessments using multiple data sets (e.g., textual materials, behavior tracks, self-explanations).

2 Outline and Experiments

From a learner's perspective, *ReaderBench* can act as a Personal Learning Environment (PLE) that incorporates: a) *individual assessment* of textual materials making use of the textual complexity metrics (semantics, morphology, surface factors integrated by support vector machines) that reflect the textual organization and structure of reading materials [1]; b) *comprehension prediction* by identifying reading strategies employed by students in their self-explanations or by automatically evaluating student summaries [4]; c) *collaboration* and *participation evaluation* in CSCL conversations based on cohesion graphs and on Bakhtin's dialogism [5].

In the first representative experiment, French students aged between 8 and 11 years old (3^{rd}–5^{th} grade) explained what they understood from two French stories comprised of about 450 words, resulting in 149 summaries and post-test examinations used to assess their comprehension of the reading materials [4]. As expected, paraphrasing, control and causality strategies were more reliably identified than information stemming from students' experience, whereas comprehension was reliably predicted by using the identified reading strategies from learner's self-explanations or from the textual complexity factors extracted from their summaries [4].

A second experiment included 110 4th year undergraduate 1st year master students asked to manually annotate 3 chat conversations [5]. We opted to distribute the evaluation of each conversation due to the amount of time required to manually assess a single discussion. In the end, based on an average of 33 annotations per conversation, the overall results indicated a reliable automated evaluation of both participation (ICC = .97 Rho = .84) and collaboration (ICC = .90; Rho = .74) [5].

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