

# A Collaborative Writing Tool on Cloud Environment

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**Abstract:** *Collaborative writing describes a full length writing assignment completed in pairs or small groups. Collaborative writing (CW) transforms the usually solitary work of writing and editing college papers into a group endeavor. Instructors value such assignments because of their real world relevance. After all, in most workplaces writing is typically produced by a team or goes through multiple hands for revising purpose. Even in academia we often collaborate on research and co-author journal articles with the colleagues. Giving students the opportunities to practice writing and editing with others is a prudent step in preparing them for the world after their graduation. This paper reports on architecture for supporting collaborative writing that was designed with both pedagogical and software engineering principles in mind, and a first evaluation. The overall aim of this paper is to demonstrate how our system, called iWrite, effectively allows researchers and instructors to learn more about the students' writing activities, particularly about features of individual and group writing activities that correlate with quality outcomes.*

**Keywords:** AQG, Cloud, Collaborative writing, Glosser.

## 1. Introduction

Writing can be an important form of learning, both of writing itself and of the subject matter [1][2]. We are particularly interested in collaborative forms of writing, for the purpose of learning, which fall into two main categories: First one is peer reviewing where the outcome is an individual document that has been composed by one student and has been reviewed by at least one other student (once or repeatedly), and second one is collaborative writing, where the outcome is a collaboratively composed and revised document. Collaborative writing, defined as "An iterative and social process that involves a team focused on a common objective that negotiates, coordinates, and communicates during the creation of a common document" [3] is a cognitively and organizationally demanding process. As a specialized form of group work, CW involves a broad range of group activities, multiple roles, and subtasks. When performed by groups that communicate (partially or only) through communication media, the process typically involves, in addition, multiple tools like phone, mail, instant messaging, document management systems, with different use characteristics.

Writing to communicate is an essential academic and professional, and an engineering education should help prepare students for the kinds of writing common to their professional life. Our system, called iWrite, effectively allows both researchers and instructors to learn more about the students' writing activities, particularly about features of individual and

group writing activities that correlate with quality outcomes. Using this system can produce an efficient writing result. The evaluation of the system provides data collected in general classroom activities and writing assignments (individual and collaborative), using mainstream tools yet allowing for new intelligent support tools to be integrated. These tools include automated feedback, document visualizations, and automatically generated questions (AGQ) to trigger reflection. A combination of synchronous and asynchronous modes of collaborative writing is used. The use of computer-based text analysis methods to provide an additional information on text surface level and concept level for writing groups is also provided.

## 2. Related Work

Research that analyses collaborative writing in terms of group work processes, focusing on issues such as process loss, productivity, and quality of the outcomes [4] and research that studies collaborative writing in terms of group learning processes, focusing on topics such as establishing common ground, knowledge building, and learning outcomes [5]. Writing for Learning (WFL), with variations such as Writing Across the Curriculum and Knowledge Building pedagogy [6], has attracted the interest of both teachers and of researchers for more than thirty years. A number of reasons have been identified to explain why collaborative writing is an important tool for learning. Cognitive psychologists make the general argument that collaborative writing requires the coordination of

multiple perspectives (content and audience) and the linearization thought, which might not be linear [7].

Automated feedback systems have been studied for over a decade and most of these systems focus on only individual writing, not on collaborative activities. The increasing use of automatic essay scoring (AES) in particular by many institutions has created robust debates about pedagogical value and accuracy. Two recent books discuss advances in AES, one taking a very supportive approach [8] and the other one providing a more critical debate [9]. Glosser [10] is an automatic feedback tool used in our proposed work for selected subjects. Other researchers have used techniques similar to those used in Glosser system for Automatic Essay Assessment for building writing support tools. MyAccess (by Vantage Learning), Criterion (by ETS Technologies) and WriteToLearn by Pearson Knowledge Technologies are all commercial products increasingly used in classrooms[11].

### 3. Proposed Work

The collaborative writing environment framework integrates a front-end writing tool that supports collaborative writing activities (manages access writes etc.) and stores all revisions of the documents created, shared and edited by groups of writers, with tools for document and process analysis. Figure 1 shows the architecture of iWrite.

#### 3.1 Documents and API

The front end writing tool in collaborative writing environment is Google Docs, a web-based utility with most functionality for word processing that allows users to share their documents with other team members and to write (almost) synchronously. The API allows writing environment to retrieve and track all versions of documents created, shared and edited among group members. Every time a writer makes changes and edits a particular document, the identification of the writer, the timestamp of committing changes, the edited content of the document and the version number of the edited document are retrieved and stored in writing environment's central relational database by using the API. This information extraction is executed seamlessly in the background so that the writers are not interrupted regularly. Using these records, writing environment performs document analysis in order to provide feedback on certain aspects of a document (Glosser) and performs process analysis to provide information on the collaboration process (WriteProc).

#### 3.2 Glosser

Glosser is a web-based tool that uses some grammatical but mainly statistical techniques to analyze a document (each version) with respect to parameters such as topics included, relationship between the topics and coherence between paragraphs. The feedback provided by Glosser helps the students to review a document by highlighting the features a document communicates, such as the keywords and topics it includes, and the flow of paragraphs. For the case of CW, by analyzing the content and author of each document revision, it is possible to determine which author contributed which sentence or paragraph and how these contribute to the overall topics of the document. These collaborative features of Glosser can help a team to understand how each member is participating in the writing process.

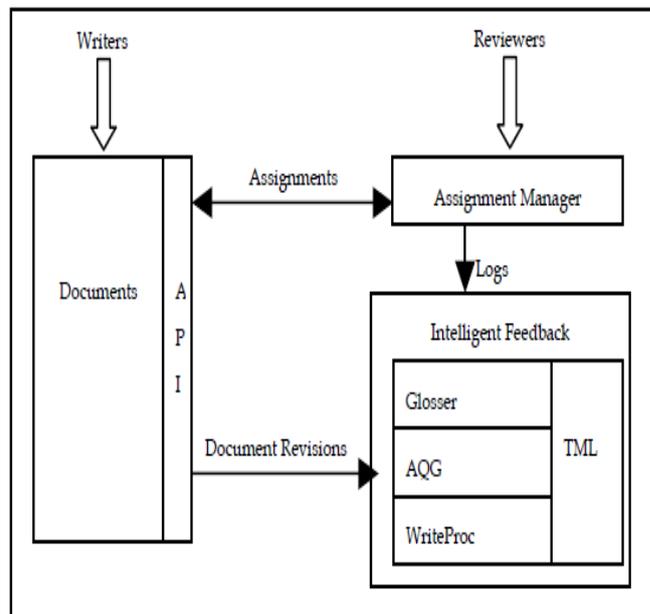


Figure 1: The iWrite architecture diagram

#### 3.3 WriteProc

WriteProc uses a combination of process mining techniques and text statistical techniques to extract information about the mining process from document changes as well as event logs capturing user behavior. WriteProc is currently under development and will eventually comprise a process mining component and a module that will provide process visualizations for students. Both WriteProc and Glosser use TML, a multipurpose text mining library that implements the natural language processing (NLP) and machine learning techniques that analyse the actual content of the document revisions. TML provides a comprehensive set of text mining algorithms plus scaffolds at every stage of the text mining process. TML integrates the open source Apache Lucene search engine, the Weka machine learning libraries and the Stanford NLP parser, and is itself open source.

#### 3.4 Automatic Question Generation(AQG)

Automatic Question Generation (AQG) tool [12] that extracts citations from students' compositions, together with the key content elements. For example, if a student uses the APA citation style, author and year are extracted. Then the citations are classified with the help of a rule-based approach. For example, based on the grammatical structure and other linguistic properties, the citations are identified as an opinion, or describing as an aim, or a result, or a method, or a system.

#### 3.5 Assignment Manager

The Assignment Manager is designed to use cloud computing applications plus their APIs. This means that the collaborative writing tool and the documents themselves are managed by a third party. This significantly reduces the cost of managing a writing system with large number of students, and a Service Level Agreement (SLA) ensures that assignment documents are always available. Assignment Manager handles all aspects of the assignment submission, peer review process and assessment. It uses the API provided to a Google Apps for

education account to administer user accounts and to create, share and export the documents.

#### 4. Conclusions

In this paper, we describe the architecture for a new collaborative writing support environment used to embed such collaborative learning activities in engineering courses. iWrite provides tools for managing collaborative and individual writing assignments in large legions. The front end writing tool in collaborative writing environment is Google Docs, a web-based utility with most functionality for word processing that allows users to share their documents with other team members and to write (almost) synchronously. The API provides programmatic access to the documents created. Assignment Manager deals with the administration and scheduling of courses plus writing activities. Automatic Question Generation (AQG) generates questions from templates based on the references used in the documents. Glosser is an automatic feedback tool used in iWrite for selected subjects only. It was designed to help a student review a document and reflect on their writing. WriteProc is a tool for analyzing students' usage of iWrite system in combination with the methodological process of their writing.

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