

Title	アカデミックライティングにおける修正スキル向上のためのコーパスを利用した適応的ツール：TRONAの場合
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Abstract

Academic writing occurs in the final phase of a research activity cycle, where students present the results of their research. Students and researchers in higher education measure their achievements through the number of quality research articles that they publish. Therefore, studying how to improve the quality of writing is an important area of research. Quality writing is required in research in order to convey ideas clearly, especially when students write research articles or dissertations.

Writing is a cognitive activity consisting of generating, translating and revising. Much of the research in the area of academic writing tools is focused on equipping students with grammatical skills (especially in the case of English as a second language) and technical writing skills. Some of the tools also assist students with the generating stage (idea generation, planning etc.). However, there is not much research on the use of software tools to assist students during the revision process of academic articles. This is the motivation for this dissertation to focus on the revision aspect of the writing process.

This research designed and implemented a corpus-based adaptive tool, TRONA (**T**opic **R**elated **r**evisi**ON** **A**ssistant), to support the improvement of revision skill in academic writing. The revision corpus consisted of articles written by former students in one laboratory and it included the raw drafts as well as the final articles, and the feedback from the laboratory supervisor in the form of comments that helped those students improve their drafts. Natural language processing and machine learning techniques were applied to reliably predict the most important comments. These comments were used to provide adaptive support in the form of hints to help students resolve reviewer comments in their own article drafts.

The type of hints provided depend on the student's skill level. The type of adaptive support given is based on the teaching methods of the cognitive apprenticeship theory: specifically, modeling, coaching, scaffolding and fading. The cognitive apprenticeship theory is a widely accepted pedagogical theory of teaching cognitive skills in an explicit way. Through the adaptive interface, novices are provided with modeling support, intermediate students with coaching, while the support for advanced students fades so that they can become more independent.

The Item Response Theory (IRT) was applied to estimate the student's revision skill and the comment difficulty. The estimated student revision skill score for 7 students and the comment difficulty measure for 20 comments by IRT was compared with a manual evaluation by a supervisor of the laboratory. The Pearson's correlation analysis results showed a significant correlation between the student scores by IRT and supervisor estimations.

Furthermore, a machine learning algorithm (SVM) was applied to classify the comments in the article drafts in the corpus as *content-related* (comments that encourage global revision) or *not content-related* (comments on simple spelling and grammatical errors). With performance measures of 89% that were achieved for both recall and precision, it was demonstrated that machine learning can be applied to automatically and reliably predict whether a reviewer comment in an academic article is content-related or not. Once a student uploads their document to TRONA, about 90% of the *non content-related* comments can be filtered out. The student can therefore first focus on revising the comments that encourage global revision. The classification method was also incorporated into TRONA to select the content-related comments that were applied in the Item Response Theory to estimate the students' revision skill level.

The contribution of this research is in the area of writing tools that use artificial intelligence to support the revision process of students in higher education. This study presented a way to construct a revision corpus of raw article drafts from previous students in one laboratory, as well as a way of using machine learning, to make the reviewer comments in the drafts more meaningful to the students' revision process. The Item Response Theory was proposed as a suitable method to estimate students' revision skill. In addition, this study demonstrated how to achieve adaptation in a revision support tool through the cognitive apprenticeship methods of modeling, coaching and fading. Acquisition of revision skill is highly dependent on the laboratory style of writing; therefore this research could have an impact on laboratory education.

Keywords: revision support system, academic writing skill, revision skill, comments classification, laboratory education