

The use of text and process mining techniques to study the impact of feedback on students' writing processes

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Abstract: Understanding the impact of feedback in complex learning activities, such as writing, is challenging. We contribute a combination of writing environments and data and process mining tools that can provide new ways of measuring this impact. We use the tools in a field experiment in an engineering course (N=45). Responses (timing, amount and types of text changes) were examined using log data and process mining techniques. Two experimental conditions were used: reflective followed by directive feedback (A) and vice-versa (B). We found that both forms of feedback were read multiple times. Students required longer times to respond to reflective, compared to directive, feedback. The type of feedback, however, made little difference to the types of revisions that students performed. Overall, our findings point to the difficulty of encouraging students to reconsider and revise what they have already written.

Introduction

Writing is considered to be a critical form of learning activity at all educational levels. Writing is also a particularly complex activity, and it is generally believed that both novice and experienced writers benefit from feedback provided by others in order to improve their writing. This paper presents a new approach to study the impact of feedback and findings from a field trial in engineering education. This paper examines the impact of different types of writing feedback (directive vs. reflective) on students' writing process, including the types of revisions students make to their document.

Feedback can be defined as information provided to a person about his/her performance in a task. In educational contexts, the provision of feedback is intended to increase not only a student's performance, but also the likelihood of learning from the task. Intuitively, feedback should almost always improve learning and performance. Research has shown that the relationship between feedback, performance and learning is nothing but simple (Hattie & Timperley, 2007; Shute, 2008). A meta-analysis found that while feedback improved performance on average, there was a large variation in the effect sizes, and in a third of the studies feedback had a negative impact (Kluger & DeNisi, 1996). To explore possible moderators, Kluger and DeNisi formulated a theory called Feedback Intervention Theory (FIT). FIT draws from control theory and cybernetics to state that feedback interventions cause a person to compare the feedback with a standard or goal. Perceived discrepancies between the feedback and the standard will motivate the person to reduce the discrepancy.

FIT provides a framework to predict the influence of different types of feedback on learning. For instance, feedback with criticism (or praise) towards the learner would divert attention from task relevant processes and can impede learning. Similarly, feedback that highlights one's performance compared to others (normative feedback, such as grades) would also impede learning. In contrast, feedback that directs attention to the task should facilitate learning, especially if it contains information needed to address the problem highlighted in the feedback (Kluger & DeNisi, 1996, pp. 267-268). Feedback that includes cues about the goal or standard of the task outcome ("goal-setting interventions") should also increase performance and learning.

Writing, the particular task that we are concerned with here, is much more complex than the typical tasks used in feedback research. Nonetheless, there are some findings consistent with FIT. For instance, FIT would predict that without distinguishing different types of feedback, the effect of writing feedback might be negligible. In line with this prediction, a meta-analysis which lumped together feedback of various kinds found that feedback did not significantly increase the effectiveness of writing interventions on learning (Bangert-Drowns, Hurley, & Wilkinson, 2004, p. 47). But when types of feedback are distinguished, FIT would predict that their impact would differ. Not many studies have examined this issue, but there is some supporting empirical evidence. One study by Nelson and Schunn (2009) examined correlations between features of peer feedback and the likelihood of the feedback being implemented. The writing task was an essay in an undergraduate, introductory course on history. This study found that task-focused feedback (such as those that included specific solutions or specific location of problems) predicted implementation, whereas feedback that focused on the writer (those with affective language such as praise and criticism) did not.