Using Learning Analytics to Support Engagement in Collaborative Writing

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ABSTRACT

Online collaborative writing tools provide an efficient way to complete a writing task. However, existing tools only focus on technological affordances and ignore the importance of social affordances in a collaborative learning environment. This article describes a learning analytic system that analyzes writing behaviors, and creates visualizations incorporating individual engagement awareness and group ranking awareness (social affordance), and review writing behaviour history (technological affordance), to support student engagement. Studies examined the performance of the system used by university students in two collaborative writing activities: collaboratively writing a project proposal (N = 41) and writing tutorial discussion answers (N = 25). Results show that students agreed with what the visualization conveys and visualizations enhance their engagement in a collaborative writing activity. In addition, students stated that the visualizations were useful to help them reflect on the writing process and support the assessment of individual contributions.

KEYWORDS
Collaborative Writing, Group Awareness, Learning Analytics, Online Collaborative Writing Tools, Student Engagement, Visualization

1. INTRODUCTION

Writing is an important factor of teaching and learning in university settings, which cultivates students’ self-expression, construction of identity, understanding and knowledge building (Galbraith, 1999). Writing has been mostly considered an individual learning activity. In recent years, collaborative writing has attracted many educational researchers’ interests due to the discovery of new pedagogical benefits. As recent research initiatives illustrate, collaborative writing (CW) can encourage students’ initiative, creativity and critical thinking (Hodges, 2002); and help students to work jointly on shared objectives (Caspi and Blau, 2011). Some researchers also argue that participation in CW activities including online text-based discussions can assist students in becoming more competent knowledge workers (Ellis and Goodyear, 2010).

Research in the field of online collaborative writing (OCW) has largely emphasized on the efficiency of specific affordances, processes and conception. For example, how students use Google docs, Wikis and other OCW tools (Wheeler et al., 2008); how scripts and other process scaffolds improve the efficiency of group writing (Daemmrich, 2000); how synchronous communication and other additional technological tools enhance coordination or group awareness in OCW environments (Elola and Oskoz, 2010); and what are university students’ conception of OCW (Limbu and Markauskaite, 2015). However, academics who attempt to embrace Online Collaborative Writing

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(OCW) in their teaching often report challenges that result in less positive student engagement or learning outcomes (Caspi and Blau, 2011; Cole, 2009). In addition, these challenges include the accurate assessment of the individual contributions of the members within the student groups toward the final output (Roberts and McInerney, 2007). In this study, we attempt to use learning analytics to generate useful visualizations to address these issues.

As research shows, a student who is engaged and intrinsically motivated in a task is more likely to learn from an activity. Fredricks et al (2004) defined engagement in three dimensions: behavioral, cognitive and emotional engagement. ‘Behavioral engagement’, which is the focus of the present study, refers to participation in school related activities and involvement in academic and learning tasks such as those being done online. It can be measured by observation and self-report. ‘Cognitive engagement’ refers to motivation, thoughtfulness and willingness to make an effort to comprehend ideas and master new skills. ‘Emotional engagement’ includes emotions and interest, such as affective reactions in the classroom towards teachers. These three aspects are interrelated and helpful to understand engagement as a whole. The term ‘engagement’ used throughout the paper, unless otherwise specified, refers to ‘behavioral engagement’.

Compared with emotional and cognitive engagement, the measurement of behavioral engagement is more straightforward because behavioral patterns can be defined, observed and interpreted. For instance, when a student participates in an activity that is mediated by technology, a detailed collection of behavioral events can be recorded. Computer keystroke-logging (Bixler and D’Mello, 2013; Stromqvist and Malmsten, 1998) or screen capturing (Latif, 2008) allow a detailed account of the behavior of a writer including actions such as starting a new paragraph or deleting a text portion and these are all considered indicators of behavioral engagement. Thus, new computer technology permits the observation and identification of learning events, which can then be examined in relation to other indices of engagement. However, in order to collect the learning events, these computer technologies required some special software applications or hardware, such as ScriptLog (Stromqvist and Malmsten, 1998), installed in the student computer. These factors present a barrier to the use of this technology in the education sector.

New cloud-based technologies, such as Google Docs not only record the revision history (each revision contains the document content and timestamp) they also provide application programming interfaces (API) to access this information programmatically. In addition, Google Docs has the advantage of supporting easy system integration and synchronous collaborative writing and it has been successfully applied in student assignment management (Calvo et al., 2011), collaborative writing practices (Southavilay et al., 2013) and engagement visualization and measurement (Liu et al., 2013). Similar to Google Docs, Etherpad (www.etherpad.org) is a web-based collaborative real-time editor, which was acquired by Google in December 2009 and released as open source. It has many advantages, such as lightweight, quick to start up and easy to differentiate between different authors. We use the Etherpad to implement the collaborative writing environment.

This paper describes the development and evaluation of a new method to measure and visualize student behavioral engagement and patterns in a collaborative writing environment that was trialed with university students. In these studies participants were required to collaboratively complete writing tasks, a project proposal and tutorial discussion questions, while their writing activities were recorded using Etherpad. Computer-generated observations were processed and visualizations generated to yield estimations of the individual writer and group’s level of engagement and illustrate the writing behavior patterns of individual writers. The visualizations for formative feedback are used to support student engagement during the writing activity while the visualization for summative feedback to support student reflection on the overall writing process after the writing activity.

The major contributions described in this paper are: 1) a novel learning analytic system that collects behavioral data of users’ collaborative writing, estimates the level of engagement, and generates two types of visualizations, visualization for formative feedback and visualization for
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