Chapter IX
Grounding Collaborative Learning in Semantics-Based Critiquing

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ABSTRACT

In this article we investigate the use of latent semantic analysis (LSA), critiquing systems, and knowledge building to support computer-based teaching of English composition. We have built and tested an English composition critiquing system that makes use of LSA to analyze student essays and compute feedback by comparing their essays with teacher’s model essays. LSA values are input to a critiquing component to provide a user interface for the students. A software agent can also use the critic feedback to coordinate a collaborative knowledge-building session with multiple users (students and teachers). Shared feedback provides seed questions that can trigger discussion and extended reflection about the next phase of writing. We present the first version of a prototype we have built and report the results from three experiments. We end the paper by describing our plans for future work.
INTRODUCTION

English is the preferred second language for many people and learning it occurs in many ways. For example, young people are quite apt to learn spoken English phrases while watching TV, browsing the Internet, and communicating with peers on mobile phones (e.g., SMS). However, previous studies have shown these influences may have a negative effect on vocabulary development (Rice, Huston, Truglio, & Wright, 1990; Weizman & Snow, 2001). As a consequence, students’ reading and writing skills do not keep pace with listening, viewing, and speaking. Furthermore, English composition is primarily taught in the classroom and practiced in homework assignments, supported by qualified teachers and parents. These are important but scarce resources, creating an imbalance of textual and oral language exposure. We address this dilemma by augmenting classroom-based composition training integrated with computer support.

The article is organized as follows. We start by characterizing English composition as a design activity and identify the components of a computer-based design environment to support it. Next, we explain how LSA can be used to provide feedback on student compositions within this context, and how we have incorporated LSA as part of system architecture. We show a prototype of a critiquing system we have built, discuss our efforts in integrating it with a knowledge-building environment (FLE) and report the results from three experiments, including comparing LSA with manual teacher feedback on a set of essays.

RELATED WORK

Essay writing can be viewed as a design activity, producing a textual artifact—a document. A document consists of words and sentences. It has structuring (abstraction) and content production (composition) elements (Yamamoto, Takada, Gross, & Nakakoji, 1998). These are key aspects of any design process. More specifically, structuring defines the organization of the document in terms of sentences, paragraphs, and sections (i.e., levels of abstraction); whereas content production is about finding words and phrases and sequencing them into readable sentences, which again become part of paragraphs, and so on. A well-composed essay will communicate certain ideas, topics, or themes about some area of shared concern. Intermediate level abstractions, such as paragraphs and sections, serve as placeholders for complex ideas extended over multiple paragraphs so that the writers and readers can focus on one idea at a time while suppressing unimportant details.

The two basic activities of design are action and reflection (Schön, 1983), supporting composition and abstraction, respectively. Action means to create an artifact by selecting building blocks and combining them into functional arrangements, and reflection means to evaluate the artifact from multiple viewpoints (McCall, Fischer, & Mørch, 1990). When this occurs without external disruption other than situation-specific feedback, it is referred to as reflection-in-action (Schön, 1983). In a good process of design, the designer will rapidly cycle between action and reflection until the design is completed. During this process, the “back talk” of the situation signals to the designer when there is a need to switch to the other mode. This is communicated by means of an incomplete design (e.g., missing parts), inconsistency in arrangement of parts, or a need for restructuring the overall activity.

Design Critiquing

Computational support for reflection-in-action is provided with the critiquing approach (Fischer, Lemke, Mastaglio, & Mørch, 1991; Qiu & Riesbeck, 2004; Robbins & Redmiles, 1998). Critiquing is defined as “presentation of a reasoned opinion about a product or action” created by a user with a computer (Fischer et al., 1991). A critiqu-
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