Analysis of strategies in expert tutoring dialog for use in Intelligent Tutoring System development

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One-on-one tutoring that encourages students to explain their answers has long been known to be an effective means of increasing student performance, even when the tutors are far from experts in the field concerned (e.g., Chi, de Leeuw, Chiu, and LaVancher, 1994; Bloom, 1984). The design of effective Intelligent Tutoring Systems (ITS) is an area of active research that attempts to take advantage of the benefits of this type of tutoring with the added convenience of automated, just-in-time teaching interventions. Validating ITS dialogues requires comparison with human tutors constrained to conditions similar to those found in ITS interfaces. A basic assumption in the design of ITS is that student productions (questions, statements, and side comments) can be categorized in a way that permits selection of an appropriate tutor response. Advanced ITSs attempt to use Natural Language Processing (NLP) components to give the student an intervention tailored to their specific needs. For these systems to work, a detailed modeling of the conversations that occur during a domain specific tutoring session is desirable.

This study addresses two questions posed by the comparison of ITSs to human tutors. The first is the degree of variance that can be expected between expert tutors in a given discipline, in this instance physics. The second is the extent to which the productions of expert tutors vary from one tutor to another and if experience has any impact on the set of dialog moves employed by domain expert tutors. Answers to these questions could be key to the development of a robust ITS.

AutoTutor is an ITS that teaches physics by using NLP components to conduct a dialog with the student (Graesser et al., 2000). Students are asked questions in conceptual physics and AutoTutor responds based on the quality of the student response. The overall selection of tutor responses is based on an extensive analysis of the moves employed by nonexpert human tutors across a broad range of subjects (Graesser & Person, 1994).

In the process of developing and validating a version of Auto Tutor for conceptual physics, a set of 17 verbatim transcripts of tutoring sessions between students and expert physics tutors were collected. These transcripts represent well over 100 hours of human physics tutoring in a chat room environment. A turn by turn analysis of the transcripts was conducted by an experienced physics professor and a graduate student in educational technology using a modified form of the classification scheme introduced by Graesser and Person (1994). This analysis sheds light on how expert tutors use dialog to elicit deep processing of conceptual physics problems for use in improving intelligent tutoring of physics.

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