

# AutoTutor: A Conversational Tutoring Environment

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## Abstract

AutoTutor is a conversational tutoring environment applicable to any content domain. AutoTutor simulates the dialog patterns and pedagogical strategies of human tutors in a conversational interface that supports mixed-initiative dialog. As the student and AutoTutor progress through the tutoring session, they engage in a conversation to collaboratively improve the quality of the student's contributions.

## 1 Introduction

AutoTutor is a conversational tutoring environment applicable to any content domain. We will focus our demonstration on two distinct domain applications of AutoTutor available on the Internet, computer literacy and conceptual physics. The computer literacy AutoTutor, which has now been used in experimental evaluations by over 200 students, tutors students on core computer literacy topics covered in an introductory course, such as operating systems, the Internet, and hardware. The recent conceptual physics AutoTutor is currently being evaluated in a collaborative experiment with the LDRC at the University of Pittsburgh. The topics covered by the physics AutoTutor are grounded in basic Newtonian mechanics and are of a similar introductory nature. It has been well documented that AutoTutor promotes learning gains in both versions (Person, Graesser, Bautista, Mathews, & TRG, 2001).

AutoTutor simulates the dialog patterns and pedagogical strategies of human tutors in a conversational interface that supports mixed-initiative dialog. AutoTutor's architecture is comprised of

seven highly modular components: (1) an animated agent, (2) a curriculum script, (3) a parser/speech act classifier, (4) latent semantic analysis (LSA), (5) a dialog move generator, (6) a Dialog Advancer Network, and (7) a question-answering tool (Graesser, Franklin, Wiemer-Hastings, & the TRG, 1998; Graesser, VanLehn, Rose, Jordan, & Harter 2001; Graesser, Wiemer-Hastings, Wiemer-Hastings, Harter, Person, & the TRG, 2001; Louwerse, Olney, et. al. submitted; Person, Graesser, Harter, Mathews, & the TRG, 2000; Person, Graesser, & TRG, 2000; Wiemer-Hastings, Graesser, Harter, & the TRG, 1998).

## 2 AutoTutor in Action

A tutoring session begins with a brief introduction from AutoTutor's three-dimensional animated agent. AutoTutor then asks the student a question from one of topics in the curriculum script. The curriculum script contains lesson-specific tutor-initiated dialog, including important concepts, questions, cases, and problems (Graesser & Person, 1994; Graesser, Person, & Magliano, 1995; McArthur, Stasz, & Zmuidzinas, 1990; Putnam, 1987). The student submits a response to the question by typing and pressing the "Submit" button. The student's contribution is then segmented, parsed with ApplePie (Sekine & Grishman, 1995), and sent through a rule-based speech act classifier. The speech act classifier assigns the student's input into one of three basic speech act categories, Assertion, Question, and Directive, each of which are parameterized by 18 other categories including metacognitive, metacommunicative, and sixteen types of question category (Louwerse, Olney, et al. submitted; Olney, Louwerse, et al. submitted).

Mixed-initiative dialog starts with speech act classification and ends with dialog move generation, which can include question answering, repeating the question for the student, or just encouraging the student. Concurrently, the LSA module evaluates the quality of the student Assertions, and in the tutor-initiative mode, the dialog move generator selects one or a combination of specific dialog moves that is both conversationally and pedagogically appropriate (Person, Bautista, Kreuz, Graesser, & the TRG, 2000; Person, Graesser, & the TRG, 2000). The Dialog Advancer Network (DAN) is the intermediary of dialog move generation in all instances, using information from the speech act classifier and LSA to select the next dialog move type and appropriate discourse markers. The dialog move generator selects the actual move. There are twelve types of dialog move: Pump, Hint, Splice, Prompt, Prompt Response, Elaboration, Summary, and five forms of immediate short-feedback (Graesser & Person, 1994; Graesser, Person, & Magliano, 1995; Person & Graesser, 1999).

### 3 Conclusion

As the student and AutoTutor progress through the tutoring session, they engage in a conversation to collaboratively improve the quality of the student's contributions. In this respect AutoTutor is foremost a conversational tutoring environment, rather than an information delivery system. Conversation evolves naturally as AutoTutor selects topics from the curriculum script based on student ability.

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