Explanatory Content and Multi-Turn Dialogues in Tutoring

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We aim to systematically investigate the effects of explanatory content and multi-turn dialogues on learning during tutoring by implementing alternative tutoring regimens in an intelligent tutoring system for a letter sequence extrapolation task.

It is plausible that the power of tutoring resides, in part, in the fact that a tutor can extend right/wrong discourse moves like "OK" and "are you sure" with *explanatory content* ("this is right/wrong, because ..."). In past work, we have proposed a computational theory of learning from information about wrong answers (Ohlsson, 1996). However, some empirical tutoring studies have found an effect of explanatory content, others have not.

The effects of explanatory content might depend on the linguistic devices used to communicate it. For example, backward references in multi-turn dialogues ("remember what we said before about ....") are part of normal discourse, and evidence suggest that they add pedagogical power. However, resolving such references requires working memory capacity, so they might interfere with learning. A deeper understanding of the interaction of explanatory content and linguistic form is important for determining the optimal design of natural language interfaces for intelligent tutoring systems (DiEugenio, 2001).

We investigate this issue by systematically varying the content and the linguistic form of tutoring explanations, and assessing the effects in controlled experiments. The relevant dimensions of variation are identified via the analysis of tutoring dialogues generated by novice and expert tutors.

Empirical Study

We tutored students in sequence extrapolation, a laboratory task for which significant learning can be achieved within an hour. There were three tutors: a senior professor with lecturing experience but little tutoring experience; a professional tutor; and a student with no prior teaching or tutoring experience. Each tutor tutored 10 students in any manner he or she thought most effective. Each tutoring session ended with a posttest consisting of two problems presented via a computer controlled by the PsyScope software. Thirty control participants took the posttest with only minimal task instructions. The posttest data confirmed that the professional tutor elicited better performance on the part of the students than the other two tutors.

The transcripts from the tutoring sessions are analyzed to identify differences between the expert and the novice tutors with respect to explanatory content and the occurrence of multi-turn dialogue exchanges. It is expected that the three tutors will exhibit systematic differences along those dimensions.

We have implemented a tutoring system for letter s e-quence extrapolation, using the TDK authoring tools developed at Carnegie-Mellon University. The system will be extended with a natural language capability. Due to the simplicity of the letter sequence extrapolation task, we can implement tutoring regimens that differ systematically with respect to both the content and the form of the tutoring discourse, and then evaluate the effects in controlled experiments. This approach will allow us to address questions that are difficult to investigate by analyzing naturalistic tutoring dialogues.

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References

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