Using Log Data to Predict Response Behaviors in Classroom Discussions

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Abstract. The Comprehension SEEDING system allows students to respond to an open-ended question using tablet computers; the system provides formative feedback to teachers to facilitate discussion and encourage students to engage in reflective behaviors. Data from a semester-long intervention suggested that few students engaged in this reflective process, leading us to question under what conditions the reflection process does or will occur. Using logistic regression, we investigated different ways the system was used, and what types of usage lead to desired, reflective behavior.

Keywords: data mining, classroom response technology, classroom discussion.

1 Introduction

Comprehension SEEDING is a new type of classroom response technology in which a teacher poses a discussion question and students reply by typing an answer on a tablet computer. After a sufficient number of responses have been received, the system automatically clusters the responses (for a description of the system and clustering algorithm and other system components, see [1]). Clustering allows teachers to quickly evaluate the class's understanding and use that information to lead a productive discussion, which, in turn, should encourage students to reflect on and revise their original answer. To facilitate the discussion process, the system includes a number of features (e.g., teachers can "pause" students from entering or editing responses, teachers can display individual or cluster representatives, etc.)

Preliminary data from a semester-long pilot study showed that students only revised or changed their answers 32% of the time. To raise this rate, we examined the log data associated with how students used the system, identifying types of system use that lead to the revisions/reflective behavior. We used the Comprehension SEEDING system log data to ask: What student and teacher behaviors predicted a statistically significant change in likelihood that a student would revise his/her original response?

Data were collected from 8 sixth grade science teachers (416 students) who used the system to ask 414 questions, which generated 8,751 question-response pairs. We

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first coded answers to determine the type of revision students made to their initial response (no change, substantive change, or non-substantive change.) Two raters coded 20% of the data and achieved Kappa = 0.81 ($p<0.01$), 95% CI (0.75, 0.86) (characterized as almost perfect agreement [2]). The remainder of the data was coded by a single coder. In order to predict whether or not students would revise their answer, the following predictors were used:

- Student variables: teacher, class, pretest score,
- Experience variables: # of days into the school year, # of times class period had previously used SEEDING, # of times teacher had previously used SEEDING with sixth grade science classes
- Question variables: seconds to first response, whether or not the teacher displayed a response, and whether or not the teacher paused the question.

2 Results

The outcome (dependent variable) focused on three types of revisions: no change (68.1% of the responses), non-substantive change (e.g., grammar and spelling changes) (5.3% of the responses) and substantive change (26.6% of the responses). Because our outcome was categorical, we examined potential predictors using multinomial logistic regression. Teacher, number of days into school year, and the pretest score, did not predict the likelihood of a student changing his or her answer with statistical significance. On the other hand, class, seconds to first response, number of times teachers used SEEDING, number of times a class used SEEDING, and whether or not the teacher displayed student responses did change the likelihood of a student changing his/her response. Among those predictors, seconds to first response mattered statistically, but did not correspond with a meaningful change in student behavior. Whether or not a teacher displayed student responses increased the odds of a non-substantive (grammar/spelling) change by 61%; however, displaying student answers did not predict a change in the likelihood of a substantive revision. The number of times the class used SEEDING positively predicted likelihoods to substantially change answers; using SEEDING more increased the odds of changing a response 13%. Surprisingly, the data show that the number of times teachers used SEEDING with their sixth grade science classes actually decreased the likelihood that a student would substantially change his/her answer by 9%. This result is complicated by the fact that teachers may have used the system for classes that were not part of the study (i.e., non-sixth grade classes) and is an interesting area for future research.

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