

# Practice-Based Teacher Education With ELK: A Role-Playing Simulation for Eliciting Learner Knowledge

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**Abstract:** Compared to other helping professions, teacher training typically lacks sufficient opportunities for novices to practice new skills. When teachers learn, they listen to people talk about teaching, or talk about teaching themselves, but they very rarely do the work of teaching. Games and simulations offer a promising framework to advance practice-based professional training for complex skills such as teaching. In this work, we built a role-playing simulation ELK to help teachers develop effective questioning strategies to elicit learner prior knowledge. We evaluate ELK with 76 pre-service teachers in two modes, “Chat” and “Code”. We find that in both modes ELK raises teachers’ awareness about student misconceptions and the importance of student thinking, and teachers demonstrate a modest increase in effective questioning strategies after three rounds of playing.

## Introduction

In this work, we develop and evaluate a role-playing simulation that helps teachers learn and practice one important classroom discourse strategy: eliciting learner knowledge. ELK is a two-person, chat-based simulation where pre-service teachers can practice question asking strategies and role-play as students with developing understanding of STEM concepts. We demonstrate that the early prototype of our system can help teachers cultivate empathy with students and lead to improvements in their questioning strategies.

The system offers a scalable and practice-based solution for teacher professional training around classroom discourse. ELK provides two modes of play. In the “Chat” mode, two players each assume the role of a “teacher” or a “student” with pre-written profiles. The “student” profile presents a realistic set of conceptions and misconceptions about a topic (such as the causes of seasons in the northern hemisphere). The “teacher” profile sets out questioning goals for the teacher player (“does the student understand the role of the Earth’s tilt in seasonality?”) The goal of the “teacher” player is to elicit prior knowledge of the “student” player as scripted. The two players type to chat. Each session lasts 7 minutes. In the “Code” mode, players can play individually. Players come in and evaluate past users’ conversation transcripts collected on ELK. Players need to assign a qualitative code for to each line of the transcript, indicating which questioning move was employed – such as “Telling”, “Evaluating”, or “Probing.”

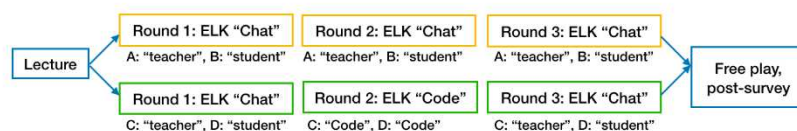
We evaluate ELK with 76 pre-service teachers. We find that ELK raises teachers’ awareness about student misconceptions and the importance of student thinking, and teachers demonstrate a modest increase in effective questioning moves in eliciting learner knowledge after three rounds of playing. Additionally, we find that a combination of “Chat” and “Code” modes may be more desirable to provide both targeted training and simulated experience to teachers. We discuss implications for future design of teacher training programs.

## Evaluation of ELK

We evaluate ELK in an authentic teacher training context. The experiment was conducted at a small liberal arts college in the Mid-Atlantic region. 80 undergraduate students (PSTs) from a teacher training program participated in the experiment. We ask two research questions in this experiment. First, is ELK helping pre-service teachers learn effective questioning moves? Second, is the combination of “Chat” and “Code” play more helpful for learning than “Chat” only? An alternative way of framing the second question is, with learning effective questioning moves as the goal, is practice through “solution generation plus evaluation” more helpful for learning than practice through “solution generation” only?

The experiment was incorporated into the curriculum of four classes on teacher education. The experiment happened during two 90-minute class meetings. Three instructors were involved and they followed the same procedure as shown in Figure 1. In the first class meeting, the instructor first gave a 15-min lecture on

effective questioning moves, with definitions and examples of each of the five questioning moves we introduced earlier. All participants were randomly divided into two conditions. In each condition, participants were randomly assigned into pairs. Each pair played ELK together. Between the pair, the instructor randomly assigned one to play the “teacher” role, and the other to play the “student” role. All participants played either the “teacher” or the “student” role across three rounds. The only difference between conditions is in Round 2, where one group did the “Chat” mode, and the other did the “Code” mode. This design allows us to see whether PSTs’ performance in the chats become better from Round 1 to Round 3 if they received different treatments in Round 2. In the second class meeting, all participants get to switch roles and experience both modes. We then sent a post-survey to ask about participants' experience and feedback in the game.



**Figure 1.** Experiment procedure across two 90-minute class meetings. In the first class meeting, participants play three rounds of ELK. All students play one Chat round, and then students are randomly assigned to play either “Code” or “Chat” mode in Round 2. In the second class meeting, all participants get to play both roles and try both modes. They then ask a user experience survey in the end.

## Data analysis and results

Prior work has studied effective “talk moves” for teachers to elicit learner knowledge, such as asking follow-up questions (Furtak & Glasser, 2016; Duckor & Holmberg, 2017). We reviewed prior work and then developed a framework for training pre-service teachers on effective questioning moves. The framework contains five categories of questioning moves, *Priming*, *Eliciting*, *Probing*, *Evaluating* and *Telling*. To evaluate how PSTs performed in ELK, we coded the transcripts PSTs generated in ELK. We then summed up the number of effective moves (“Priming”, “Eliciting”, “Probing”) and the number of ineffective moves (“Telling”, “Evaluating”) in a chat for each PST as the performance measure. More specifically, we used the score for Round 1 as the pre-test measure and the score for Round 2 as the post-test measure. Here we summarize the two major findings from this experiment.

### Teachers displayed more effective questioning moves

We found PSTs displayed significantly more positive moves in post-test than in pre-test ( $p = 0.014$ ). The average number of positive moves per chat was 4.5 for pre-test, and 5.1 for post-test. This suggests that as users engage more in the game, there is a modest increase in the positive behaviors that they display.

### A combination of solution generation and evaluation is better

In Round 2, half of PSTs practiced through generating questions, while the other half practiced through evaluating questions using the “Code” mode. We investigated how the different Round 2 treatment affects PSTs’ performance from Round 1 to 3, using the counts of positive and negative questions moves as a measure. We found that PSTs in the “Code” condition gained more positive behaviors from Round 1 to Round 3 compared to PSTs in the “Chat” condition. The result suggests that having PSTs evaluate past transcripts can be an effective instructional activity to prepare them for applying good strategies in eliciting learner knowledge.

## Design recommendations

We offer two design recommendations for professional training programs. First, from the experiment, we see a modest increase in effective questioning moves for both conditions from Round 1 to Round 3, and the increase for the condition who did a combination of “Code” and “Chat” practice is slightly higher. This addresses our research question that in terms of learning to ask good questions, getting practice through evaluating solutions can be beneficial. Future training programs could consider offering focused practice through evaluation activities. Second, our study suggests that teachers developed sympathy with students through role-playing. This points to the potential of role-playing simulations for professional training for teachers or other helping professions to enable trainees to take a different perspective and develop sympathy with other stakeholders.

## References

- Duckor, B., & Holmberg, C. (2017). *Mastering formative assessment moves: 7 high-leverage practices to advance student learning*. ASCD.
- Furtak, E. M., & Glasser, H. M. (2016). *Using Formative Assessment Data for Science Teaching and Learning*.