

Are You Asking the Right Questions: The Use of Animated Agents to Teach Learners to Become Better Question Askers

Jeremiah Sullins¹, Danielle McNamara², Samuel Acuff¹,
Daniel Neely¹, Eric Hildebrand¹, Grant Stewart¹, & Xiangen Hu³

¹Harding University, ²Arizona State University,
³University of Memphis

Corresponding author: jsullins@harding.edu

Abstract

Is it possible to teach a learner to become a better question asker in as little as 25 minutes? It is well documented that the ideal scenario of a curious question asker does not match reality. Students are unspectacular at monitoring their own knowledge deficits and their question generation is both infrequent and unsophisticated. Given that many teachers and school districts do not have the resources to provide individualized question training to students, the current study seeks to explore the benefits of using animated pedagogical agents to teach question asking skills in a relatively short amount of time (approximately 25 minutes). Results revealed a significant difference in the quality of questions generated on the posttest as a function of condition. Results also revealed a significant difference between the two conditions on the posttest scores. Furthermore, results revealed that question training was most beneficial for participants who entered with low prior knowledge. Lastly, certain individual differences were found to be related to question asking and learning.

Introduction

Is it possible to teach a learner to become a better question asker in as little as 25 minutes? Question generation is believed to play a crucial role in a variety of cognitive faculties, including comprehension (Graesser, Singer, & Trabasso, 1994) and reasoning (Graesser, Baggett, & Williams, 1996). Asking good questions has been shown to lead to improved memory and comprehension of material in school children and adult populations (Rosenshine, Meister, & Chapman, 1996). Available research suggests that learning how to ask good questions should be taught at an early age but all ages benefit from question generation training (Wisher & Graesser, 2007).

Sadly, consistent with the research coming out of self-regulation, it is well documented that the ideal scenario of a curious question asker does not match reality. Students are unspectacular at monitoring their own knowledge deficits and their question generation is both infrequent and unsophisticated. For example, Graesser and Person (1994) reported that an individual student asks approximately one question in seven hours of class time (around one question per day). Most of these questions are not good questions, so the quality is also disappointing.

Of the questions that are generated, the majority are shallow questions rather than questions that require deep reasoning. A deep reasoning question is one which integrates content and that fosters understanding of the components and mechanisms being covered (Craig, Vanlehn, & Chi, in press). Deep reasoning questions are questions that typically invite lengthier answers (usually around a paragraph in length) and often start with words such as *why*, *how*, or *what-if*. These questions are aligned with the higher levels of Bloom's taxonomy (1956) and the long-answer question categories in the question taxonomy proposed by Graesser and Person (1994).

In order to illustrate the difference between shallow reasoning questions and deep reasoning questions, consider an example of each. An example of a shallow reasoning question, according to Graesser and Person (1994), would be "Does the CPU use RAM when running an application?". The reason for categorizing this type of question as "shallow" is because it does not require substantial thought on the student's part; indeed, the student could answer it by simply guessing yes or no. In contrast, a deep reasoning question would be "How does the CPU use RAM when running an application?". The reason for categorizing this question as "deep" is because the student must use the knowledge known about computers to articulate the causal mechanisms that relate two components in the operating system. They not only need to generate a

nontrivial amount of content, but must be able to reason about complex causal mechanisms.

There are several possible explanations as to why students do not ask many questions. These include the lack of prior domain knowledge, high social editing, and insufficient training/modeling. The first explanation for the lack of student questions might be due to insufficient prior knowledge so they are incapable of monitoring the fidelity of knowledge. For example, Miyaki and Norman (1979) posit that students need a large amount of knowledge to detect when they do not understand something. Because of this, students simply do not know that they do not understand and therefore do not ask questions. The second possible explanation for a low amount of student questioning is due to social editing. Students may not ask questions because they are afraid of looking ignorant in front of their peers and losing social status. The third reason for a low number of student questions has to do with the training they receive. Graesser and Person (1994) point out that 96% of questions that occur in the classroom come from the teacher and most of the questions are shallow. Therefore, students in a typical classroom are not provided with examples of good deep-reasoning questions from the teachers. And of course, given the above statistics on student question asking, students rarely observe other students asking questions. Good student role models are essentially absent.

Given that many teachers and school districts do not have the resources to provide individualized question training to students, the current study seeks to explore the benefits of using animated pedagogical agents to teach question asking skills in a relatively short amount of time (approximately 25 minutes).

Current Study

The purpose of this study was to teach learners effective question asking skills through the use of animated pedagogical agents. Participants were first given a demographics questionnaire asking them basic information about age, year in school and major. Following the demographics questionnaire, participants completed the Gates MacGinitie Reading Comprehension test. After the reading comprehension test, participants were given a 30 question prior knowledge test assessing general science knowledge questions in addition to history and literature (e.g., “Blood is supplied to the heart wall by the...”). Participants then completed the pretest (Earthquakes and Heart Disease counterbalanced between pretest and posttest) which consisted of two parts: 1) A paragraph broken into sentences in which learners had the opportunity to type any questions they may have about the sentence they just finished reading

and 2) multiple choice test in which they were required to answer questions about the previously read paragraph.

Participants were then randomly assigned to one of two different conditions. In the *Question Training* condition participants watch a dialogue between three animated pedagogical agents (a teacher agent and two student agents). The training begins with a brief introduction where the teacher agent discusses the importance of question asking and describes the difference between a deep and shallow question. Following the introduction, a series of science passages appear on the screen and the two student agents take turns asking questions (deep and shallow) and received feedback from the teacher agent. At predetermined points during the presentation, the participants were asked to generate their own questions based on the science passages on the computer monitor and received real time feedback on their question from the experimenter. In the *Artigo* condition (control), participants were paired with an anonymous online partner and viewed various pictures on the monitor. Their job was to try to match as many words as they could with their online partner and would receive points for every matching word. The participants worked on this task for 25 minutes.

Following the completion of the intervention, participants completed the posttest (counterbalanced with the pretest). Finally, participants completed two tests of individual differences (i.e., the Big Five Personality Test and the Motivated Strategies for Learning Questionnaire).

Results

The current study explored the possibility of teaching learners to become better question askers in a relatively short amount of time. Results revealed a significant difference in the quality of questions generated on the posttest as a function of condition. Participants in the *Question Training* condition asked significantly more “deep” questions on the posttest than did the participants in the control condition $F(1,45) = 73.28, p = .000$. Additionally, it was discovered that participants in the control condition asked significantly more “shallow” questions on the posttest than did the participants in the *Question Training* condition, $F(1,45) = 79.31, p = .000$. A full list of question asking means and standard deviations for the pretest and posttest can be seen in Figure 1.

Because previous research has suggested that the quality of questions asked can influence learning, an analysis was performed to see if any differences existed between conditions on learning gains. Results revealed a significant difference between the two conditions on the posttest

scores. More specifically, participants in the *Question Training* condition scored significantly higher than the participants in the *Artigo* condition on the posttest, $F(1.45) = 10.042$, $p = .003$. A full list of means can be seen in Figure 2.

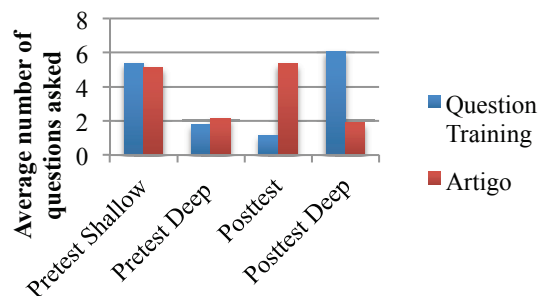


Figure 1. Pretest and posttest question asking means between the two different conditions.

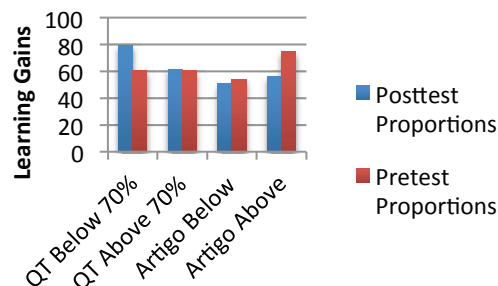


Figure 2. Average learning gains between conditions split by prior knowledge level.

A correlational analysis was conducted in order to determine if any relationships existed between the posttest proportion scores and personality. A marginally significant correlation was discovered between performance on the posttest and the Big Five personality trait Neuroticism, $r = .258$, $p = .08$.

A correlational analysis was conducted to determine if any relationship existed between the posttest proportion scores and the Motivated Strategies for Learning Questionnaire. A significant correlation was discovered between posttest scores and the variable Rehearsal, $r = .347$, $p = .017$. Additionally, a significant negative correlation was discovered between posttest scores and the variable Help Seeking, $r = -.319$, $p = .029$.

A correlational analysis also revealed a marginally significant negative correlation between the amount of “deep” questions asked on the posttest and the MSLQ variable Peer Learning, $r = .273$, $p = .06$. Lastly, a signifi-

cant negative correlation existed between the amount of “deep” questions asked on the posttest and the MSLQ variable Help Seeking, $r = -.413$, $p = .004$.

Discussion

The results from the current study suggest that learners can be taught to become better question askers in a short period of time. Overall, it was discovered that learners who received the question training did ask more deep question along with performing significantly better on the posttest than those in the control condition. The unexpected finding was revealed once the data was split based on prior knowledge. These data suggest that question training is more beneficial for those students who enter the training with a lower level of knowledge. The participants who entered the learning session with high knowledge gained one percentage point from pretest to posttest. However, the low knowledge learners gained almost 20 percentage points from pretest to posttest. Furthermore, it was discovered that low knowledge students who received the question training improved 30 percentage points (3 letter grades) above the low knowledge students who did not receive the question training. This can be potentially be explained by the increase in the amount of deep questions that low knowledge learners asked from pretest ($M = 1.62$) to posttest ($M = 5.50$).

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