Chapter 33
Using Mobile Devices to Facilitate Student Questioning in a Large Undergraduate Science Class

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ABSTRACT

Asking scientific questions is the first practice of science and engineering listed in the Next Generation Science Standards. However, getting students to ask unsolicited questions in a large class can be difficult. In this qualitative study, undergraduate students sent SMS text messages to the instructor who received them on his mobile phone and via Google Glass. Using observations, coding of texts, and interviews, the researchers investigated the types and level of questions students asked and the perceptions of the instructor and TAs on how the messages were received. From the findings of this study, it is evident that students asked a wide variety of question types and levels. It would appear that important distinctions between voice and text questions are that: (a) a shy or insecure questioner can remain anonymous; (b) questions can be asked in an interactive, but not interruptive manner; (c) there is no time limit to answering questions; and (d) the record of questions on the instructor's phone can be used to guide revision of lecture notes for future semesters.

INTRODUCTION

Student questioning is crucial to the learning process. When students pose questions in class, they are more engaged and experience more autonomy (Etkina, 2000; Marbach-Ad & Sokolove, 2000). Asking scientific questions and defining problems are the first practices of science and engineering listed in the Next Generation Science Standards (NGSS, 2013) and the framework that guided their development (NRC, 2012). If asking questions is a core scientific practice, then it stands to reason that encouraging students to engage in questioning within a traditional classroom learning environment is a desirable action on the part of any instructor. Science learning at the early undergraduate level offers a uniquely challenging context for promoting student questioning. In this context, where enrollment in a single course can often be in the hundreds, student-to-student and student-to-teacher communication is uncommon (Cotner, Fall, Wick, Walker & Baepler, 2008). Therefore, the instructor must be skilled in developing techniques to enable students to ask questions in large classes (Cotner et al., 2008; Harper, Etkina & Lin, 2003; Etkina, 2000).

Mobile devices can be used by students to interact with instructors in courses with large enrollments (Caldwell, 2007; Draper & Brown, 2004; Elliot, 2003; Pradhan, Sparano, & Ananth, 2005). The affordances of these communication devices can facilitate various types of interactions, including instructor-to-students, students-to-instructor, and students-to-peers. The purpose of this study is to explore how science students in a large university class used Short Message Service (SMS; which is commonly referred to as text messaging) to ask student generated questions. These questions are explored to determine the topics of questions students ask, such as questions about the organization of the class or questions about science concepts, and the level of those questions (higher or lower level questions). In addition, the researchers examined instructor perceptions of the way questions were received through two different mobile devices; mobile phone and smart glasses. There are various types of smart glasses offered by Sony, Apple, Amazon and Microsoft; however, for this study, Google Glass was used.

The two questions guiding this study are:

1. When students ask questions via text messages in a large classroom, why kind of SMS messages are received?
2. When students ask questions via SMS messaging what sort of questions are asked in terms of higher and lower order thought processes?
3. What are the perceptions of the instructors regarding perceived benefits when receiving student initiated questions using a mobile phone and smart glasses?

LITERATURE REVIEW

The two questions guiding this study focus on four main topics; 1) how student questioning can support learning, 2) higher/lower order questioning, 3) limitations and difficulties in soliciting questions in large classes, and finally 4) how mobile learning can offer an alternative questioning method.

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