Chapter III

The Use and Evolution of an Audience Response System

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Abstract

This chapter reports the authors' use and refinement of a wireless audience response system (ARS) over a 10-year period. The motivation for this effort was to replace the traditional passive lecture with a more interactive classroom. Our classroom procedures and the evolution of these procedures are detailed. The authors also illustrate how ARS systems can be applied in a variety of ways, including the use of modified multiple-choice questions. ARS systems allow for both formative and summative assessment in real time, which is a unique and desirable property. The use of ARS systems similar to the ones described has increased rapidly in the past few years. A brief survey of current and proposed commercial wireless keypad systems is included.
Introduction

The study of audience response systems is closely related to the process of teaching itself, and as such, it has had a long history. In this article, we discuss the subject, starting from the time when electronic teaching tools just became available, about 30-40 years ago. However, most of the activity with these audience response systems has been within the last 10 years. In these recent years, interest has been focused upon keypad systems (Burnstein & Lederman, 1996, 2001, 2003; Dufresne, Gerace, Leonard, Mestre, & Wenk, 1996). Such systems can be used to quiz students in real time during class, thus engaging students more directly in the lecture. Nonetheless, until recently, widespread use of such keypad systems has been limited. The reason for this is that the original keypad systems were relatively expensive, and perhaps additionally, there was reluctance on the part of faculty to change from the existing passive lecture format. For a number of reasons, there has been a significant change in opinion in the last few years, and consequently, there has been a very large increase in the use of wireless keypads. At the same time, there have been rapid changes in the number and type of commercial wireless products available. In this chapter, we discuss a wide range of these related topics.

Background for Change from Passive Learning

The proposals for the revitalization of the physics lecture by involving the students more in the lecture itself started over 10 years ago (Fuller, 1994; Hudson, 1984; Mazur, 1997). It was our belief in the early 1990’s that the introductory lectures in physics to engineering, science and nonscience students were ineffective. This was largely due to the size of the lecture, which was rarely less than 40 students, and in some cases, as many as several hundred students. The financial problems in both private and public universities made it safe to predict that the class size problem would only get worse in the future. Further, it was known that large-scale dropouts would usually impact aspiring minority students most seriously. Hewitt and Seymour (1991) had studied the attrition rate among first-year science and engineering students, and they noted that this was about 50%. Blame for this unfortunate loss of students was most often attributed to teaching associated with the large, impersonal lecture format, rather than with the subject being taught.

The reasons for the lack of success of students in a large lecture were understandable, but we felt the problem could be overcome by changing the lecture format. Our approach was later supported by the research articles of Hake (1998) and Poulis, Massen, and Gilbert (1998) that established the value of modifying the passive lecture with “interactive engagement.” Although many suggestions and innovations have been proposed and tried, for example, Van Heuvelen, 1991; Beichner, 2000; and Sokoloff and Thornton, 1997, judging by numbers alone, wireless keypad systems are currently the most widely used option, and therefore the main focus of this chapter.
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