Chapter 16
Best Practices for Teaching and Designing a Pure Online Science Classroom

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ABSTRACT
With the modification of the 50/50 rule by the Higher Education Reconciliation Act of 2005, the purely online university has become increasingly popular and thus so has the purely online science class. In this chapter, the author will use over a decade of teaching physics and math at traditional offline and pure online universities to compare the two. In the process, the author will uncover what techniques have successfully carried over from the traditional to the online environment and how physics education research and technology are changing the physics classroom. The main purpose of this chapter is to identify best practices in designing and teaching online science courses and to provide recommendations on improving existing online science classrooms. Throughout the chapter, Moodle™, an open source LMS, will be used to showcase and implement the ideas being presented.

INTRODUCTION
In 2005, the Higher Education Reconciliation Act (2005) modified the 50/50 rule which mandated that distance education classes could only constitute 50% of a student’s total class load in order for a university to qualify as a Title IV institution. Through the relaxation of this constraint, the purely online university has gained popularity and with it the purely online science class. In creating science classes for this new pure online environment, an old paradigm has been squeezed into a new medium. This has worked in some areas, but failed in most. As well, there is little in the way of experienced online science course designers and teachers. While these design problems may be endemic to the online environment, creating a science class brings with it unique problems such as lab requirements and math prerequisites. These problems trickle down to the individual charged with teaching these courses for they are required to not only adapt to this new pure online environment but also work within the
limitations of the technology and curricula itself.

In this chapter, the author will use over a decade of experience teaching physics at traditional offline and pure online universities to compare these two modes of instruction and derive best practices in designing and teaching a science class purely online. While the focus will be exclusively on physics, the methods and ideas should be applicable to any online science class. In Section one, the different types of physics classrooms currently encountered are presented. This will serve as a review of the current educational space as it regards to physics. Several of the terms and concepts used later will be presented here. In Section two, a traditional offline physics class is compared to a pure online physics class. As the online class is derived from the offline class, one might expect to see more similarities than differences; yet this is not the case. Sections three and four are the bulk of the chapter, where the focus is exclusively on the pure online physics classes and how to best design and teach them. These sections have been subdivided by the types of assignments one will likely encounter in an online class. In the process of reviewing these classrooms, the techniques that have been successfully carried over from the traditional to the online environment will be uncovered as well as how to improve the content of existing pure online science classes.

Throughout the chapter, Moodle™ (http://www.moodle.org) will be used to present examples of a pure online classroom. Moodle™ is an open-source Learning Management System (LMS) which allows the user to deploy an online class easily and inexpensively. With a wealth of add on modules and a strong support network, Moodle™ is gaining popularity as the LMS of choice with over 36,000 active sites in over 200 countries (Registered Moodle sites, 2009).

Section 1: Physics Classroom Review

Less than twenty years ago, the only physics classroom was the traditional offline classroom as encountered in any brick and mortar high school or university. Only recently with the advent of the Internet and dedicated research into physics education has this classroom been transformed. In this section, four different types of post-secondary physics classrooms are reviewed. This review follows a chronological order and shows how technologies have influenced these classrooms. This section will also serve as a foundation for the rest of the chapter as several terms used later will be defined here as well as setting the stage for the comparisons of Section two.

The Traditional Offline Classroom

The first classroom reviewed has remained relatively unchanged for hundreds of years. The traditional offline classroom refers to the conventional brick and mortar classroom. While the size and content of these classes may be different, their setup is essentially the same in pre-or post secondary education. These classrooms are typically broken up into two distinct rooms: the lecture hall and the lab room. Broadly speaking, the lecture hall will present the theoretical understanding of physics while the lab room will present its experimental side.

As the name implies, the lecture hall is where the professor will stand in front of their students to talk about the day’s material. The professor may outline that week’s content, solve a few problems related to the material, talk about the subject, or any number of other non-interactive activities. These classes usually last an hour a day, 2 to 4 times a week (McMicken College, 2008, pg. 153). The entire class can take anywhere from three