Distance education appears to be an increasingly popular option for students here at Coastal Carolina University, a public, mainly undergraduate institution with about 7,000 students. We offer one online section of our Introduction to Biological Science course for majors (BIOL 121), however, we have not tried doing the co-requisite lab online. In an effort to determine whether online labs are worth considering, this study compares student learning and attitudes when performing an online versus a traditional in-class version of a lab exercise on cell division.

Studies have shown that online content delivery can work as well as more traditional classroom work (Johnson, 2002; King & Hildreth, 2001; O’Connell, 2001). So called “hybrid” courses, where there is some face-to-face contact, and some online work can also be effective (Riffell & Sibley, 2003; Prothero, 2000; Tuckman, 2002; Reed, 1998). The latter is not surprising in light of the reports from the National Research Council suggesting that science knowledge is most effectively gained when students apply a range of cognitive processes (National Research Council, 1996a; b). There is controversy, however, with fears that online instruction may eliminate valuable peer interactions, and some students have a clear preference for an instructor-oriented environment (Dewhurst et al., 2000). Generally, computer-assisted learning can be helpful, but only if the instructor really knows how to integrate it well (Cepni et al., 2004; Chang, 2001).

Most of these studies have been done with K-12 students and non-science majors, and perhaps most scientists would agree that students really miss something if they don’t have a real lab experience. Does it affect their learning though? As coordinator of a multi-section lab course, I found there are situations where an online lab could be helpful. If classes are canceled for a holiday or weather event for just one day, lab students that day will fall behind those meeting the rest of the week. The options are to cancel lab for the whole week (or to “redirect” as our administrators prefer we say), or to find some take-home exercise the affected students can do instead of the traditional lab. Also when a student has to miss a lab for legitimate reasons, being able to offer her/him a make-up that does not involve physically trying to set up a lab exercise can be helpful when space, equipment, and time are tight. Can students learn science effectively this way though, or are they short-changed? This study looks at the effectiveness of an online lab exercise for traditional freshmen science majors in our BIOL 121 course.

Materials & Methods

The cell division laboratory exercise used here is “Chromosomes and Cell Division” from Laboratory Investigations for Biology (Dickey, 2003). An online version of this lab exercise was assembled as a WebCT page. WebCT is an electronic course management system that allows faculty to create what its authors call a “Virtual Course Environment” (WebCT 4.1, 2004). Downloadable instructions, links, and e-mail to the instructor can easily be accessed by the students. It is also possible to include survey (or quiz) questions that the students can answer online. The advantage of this system over a simple Web page is that it’s reasonably user-friendly for students and faculty, and the content is password protected so there are few issues with copyrights.

The activities of the two labs are summarized in Table 1, including the Web sites to which the online students were directed. The students doing the online lab were asked to refer to their lab manual so they could read the same background information associated with each activity as the in-class students. They were also asked to draw the various phases of mitosis and meiosis based on what they found online, just as the students in the class drew based on their inspection of slides and work with pop beads. In short, an effort was made to make the two versions of the lab as similar as possible.

A pilot version of this experiment was conducted with the author’s two lab sections in fall 2003. The sample size was 26, approximately evenly split between sections so one section did the online version and one section did the lab in class. It was found that the students who did the online version of the exercise performed significantly worse on the post-exercise content quiz, however, this particular group of students did worse than the other section nearly every week. Based on their surveys, they also strongly disliked doing the online lab, however that was their apparent attitude in class as well. It was therefore decided that the online exercise was sufficiently user-friendly for the students to do, but for assessment, a

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