

## **Incorporating research into an introductory meteorology course**

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Virginia Wesleyan College is a private liberal arts college with an enrollment of about 1,400 undergraduates. EES 210: Meteorology is one of four introductory courses that we offer which are taken by both majors and non-majors. About 80% of the students in the course are there to satisfy the "Natural Science Laboratory" requirement in general studies and 20% are Earth & Environmental Science majors who are required to take either Meteorology or Oceanography. For a liberal arts college we have a diverse student body in terms of high school preparation, income, and ethnicity. The enrollment in our introductory courses reflects this with about 1/3 of students being African American and at least 10% first-generation college students. Although we are the smallest of the science departments in terms of faculty, we provide a significant percentage of the Natural Science Laboratory courses. In 2013, 42% of students enrolled in laboratory courses intended for non-science majors were in our EES department's courses. Our college has grown in student enrollment over the last few years with plans to continue. We have not had a commensurate increase in our faculty size however, and as a result our class sizes have increased. Several years ago my meteorology course was typically 18-20 students total for one section of lecture and lab. This year I have two lab sections of 22 each which combine for a lecture of 44. We do not have any TAs or laboratory staff.

Teaching a course that meets the needs of non-majors and majors has been a challenge, especially since many of our non-science majors come in with weak quantitative skills and low confidence and/or interest in science. I have incorporated interactive lecturing, hands on laboratories and real world examples into my courses to engage students and enhance their learning. During lecture and laboratory I make an effort to interact with students on an individual basis so that they are comfortable coming to office hours and asking questions. For the laboratory section of the course, the first 5 weeks are stand-alone experiments and activities. The remainder of the semester's laboratory time is devoted to taking students through their own independent research project, including hypothesis formation, graphical analysis of data, and hypothesis testing using basic statistics. At the end of the semester the students present their projects and write a final paper. This requires students to investigate one topic in atmospheric science in detail and learn about the scientific method first-hand. One advantage of individual projects is that students are accountable for their own progress, unlike the group laboratory exercises. Another advantage is that the project can be tailored to the students' interests and ability levels. For example, a non-major with minimal experience in math and science might use data from the internet to compare temperature and humidity at a coastal and inland location. More advanced students can design more elaborate projects that involve sample collection or exploration of more in-depth topics. Past examples of these projects include measurements of evaporation rates over man-made and natural surfaces and model simulation of atmospheric deposition of pollutants from a proposed power plant.

While I feel that I do a good job overall in this courses, there is always room for improvement, especially with our growing enrollment. On the whole I get good student evaluations, have good attendance, and good student engagement. Virtually all the students take ownership of their independent project and give thoughtful presentations, sometimes after initial feelings of being overwhelmed by the scope of the project. For some students who do poorly on the lecture exams the research project is an opportunity to excel in the course. We have had some students take additional courses in the major after taking Meteorology for a general studies requirement, but I do not have any quantitative data. For majors, the research project introduces students to the methods and processes of scientific research, preparing them for later research projects in upper-level courses and optional independent research. We recently initiated a more formal assessment of student learning outcomes in our department, but it will be a couple more years before we have meaningful data.