

ASSESSMENT OF INTERACTIVE, HANDS-ON METEOROLOGY EXERCISES IN A COURSE FOR UNDERGRADUATE NON-MAJORS

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1. INTRODUCTION

The incorporation of active learning in the classroom and the development of computer-based programs to aid instruction has been conducted in many disciplines, including meteorology, for several years. Some textbooks have accompanying workbooks with exercises that could be used for active learning in the classroom or lecture hall. Additionally, several collections of web based Java applets are available for students to investigate atmospheric or physical phenomena. To the authors' knowledge, at this point in time, there has been no project to link these two learning tools together. Doing so would provide a comprehensive basis for the incorporation of active learning using computer technology in the classroom.

The Department of Atmospheric Sciences (DAS) at the University of Illinois (UIUC) has undertaken the task of developing in-class exercises (Charlevoix *et al.*, 2003) to enhance learning and instruction in the classroom. Some of the in-class exercises are linked to Java applications (Bramer *et al.*, 2003) that were designed to address traditionally difficult or hard-to-conceptualize atmospheric topics. This comprehensive project: Hands-On Meteorology, was part of a curriculum redesign of the Introduction to Meteorology course offered by DAS by DAS. The curriculum redesign was requested and partially funded by the College of Liberal Arts and Sciences.

2. HANDS-ON METEOROLOGY

Beginning in fall 2002, the Introduction to Meteorology (ATMOS 100) course at UIUC is being offered as a lecture/discussion that meets a total of three hours per week. The discussion meetings are held in a computer lab. The course is designated as a survey of meteorology and therefore covers many topics over the semester. The course is taken primarily by non-majors and fulfills the general education requirements for physical sciences and for quantitative reasoning. The discussion meeting does not follow a typical "discussion" format in that it is a meeting of the class to conduct hands-on, computer-based exercises relating to current class topics.

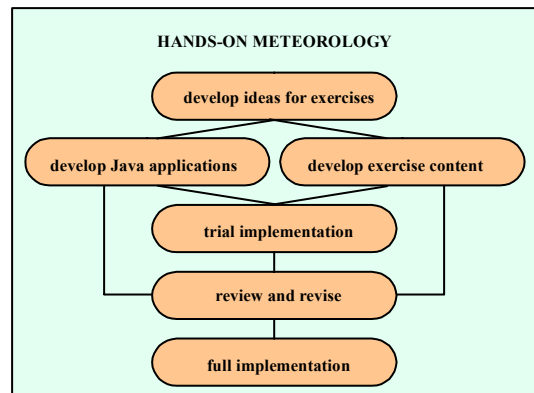
The curriculum restructuring project began in December 2001 with the goal of finishing the

preliminary work by summer 2002 when a trial run of the new course format would be tested. Full implementation of the revised course and new format was implemented in fall 2002.

The goal of the curriculum redevelopment was to (1) develop a quantitative element to the course (2) provide many opportunities for meaningful active learning, and (3) utilize current technology.

The curriculum redevelopment is summarized in the flow chart shown in Figure 1. The three faculty members involved in the project identified topics that would benefit from active learning and/or visual representation via computer programs. The programmer developed Java applications for areas identified as benefiting from a dynamic representation. A graduate student with both teaching and educational research experience worked on developing the exercises that would accompany the computer programs or that would be used by themselves in the lecture classes. The project was named "Hands-On Meteorology" to convey the interactive nature of the exercises.

Figure 1: Development of Hands-On Meteorology



After all development for Hands-On Meteorology was completed we had a suite of thirty-five (35) exercises and twenty-one (21) Java applications. In a single course offering all exercises and Java applications would not be incorporated. Rather, each instructor can focus on topics of their choice and still have options available for in-class exercises, both computer-based and non-computer-based.

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3. IMPLEMENTATION

During summer 2002, the AMTOS 100 course was offered during the eight week summer session at UIUC in the new "Hands-On Meteorology" format. The class met two hours per day three times per week in a computer lab.

The students completed seventeen in-class exercises. All of the exercises incorporated either a Java application developed specifically for this course, or current or archived weather data accessed from the computer or Internet. The convenience of holding each class meeting in the computer lab allowed us to have students view weather maps and imagery in color. If the equivalent exercise was done in a lecture hall during a semester offering, photocopied maps and imagery would be provided to the students. Of the seventeen exercises completed, three were "extended exercises" – students had a take-home portion to complete that built on the concepts and ideas addressed in class. They returned the completed exercises one week later to be graded. The other thirteen exercises were completed by the students during the class period. The class and instructor went over the exercise and discussed what the correct answers were. Students turned in completed exercises for credit, but they were not graded. The credit/no credit policy was instituted for these exercises to encourage students to explore the topic without the pressure of providing the answer the instructor expected.

4. ASSESSMENT

Assessing the effectiveness of the Hands-On Meteorology lessons is difficult. At the time of this printing, data was available from the trial implementation in summer 2002 and limited data was gathered in the fifth week of the fall semester. We refrain from making conclusions of the effectiveness of the project using only the data from the summer class since it is not typical of the fall and spring semester offerings of the same course. During the summer, fifteen students were enrolled. During fall and spring semesters, 300 students are enrolled and are split evenly into two lecture sections and 10 Hands-On sessions.

Regardless of the differences, some helpful information from the initial implementation of the Hands-On sessions was obtained.

Students from the summer class had a favorable reaction to the Hands-On format, both the in-class exercises and the computer programs. Class attendance and participation was high, near 100% on most days. Anonymous comments regarding the summer class included:

"I really liked the applications we did, they helped to understand things."

"The computer programs/exercises were very helpful."

Students were very engaged in class, often asking questions of the instructor or teaching assistant. They often asked for help from their fellow students. Upon reflection of the summer class, the instructor and TA both felt that the incorporation of the in-class exercises and the computer programs was a positive change to the course.

The Hands-On Meteorology format was fully implemented in fall 2002. Two sections of the course with a total of 300 students enrolled are meeting twice per week in lecture and once per week in the computer lab for a Hands-On session. Reactions to the overall course format and the Hands-On Meteorology component of the course were gathered from students five weeks in to the semester. Reactions to the Hands-On Meteorology sessions was favorable. All students thought the lecture based in-class exercises were beneficial. Many students commented that they enjoyed working on the computer programs in the Hands-On sessions and felt that they were learning the material better. However, they also felt that the sessions were too short (or the exercises were too long); they felt rushed in completing exercises within the time allotted. The instructors of the course plan to adjust the exercises for the remainder of the semester accordingly.

Further data will be collected at the end of the fall 2002 semester and will be presented at the annual meeting and posted on the web site: <http://uiatma.atmos.uiuc.edu/~charlevo/home/>

5. ACKNOWLEDGEMENTS

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6. REFERENCES

Bramer, D., D. Charlevoix, G. McFarquhar, R. Herman, L. Avilés, L. Di Girolamo, M. Ramamurthy, and R. Wilhelmson, 2003: Developing Interactive Models to Support a Digital Collection of Earth System Science Resources. Proceedings of the Twelfth Symposium on Education, Long Beach, CA, American Meteorological Society.

Charlevoix, D., R. Herman, L. Di Girolamo, and G. McFarquhar, 2003: Development of In-Class Exercises to Accompany Interactive, Hands-On Meteorology for Undergraduate Non-Majors. Proceedings of the Twelfth Symposium on Education, Long Beach, CA, American Meteorological Society.