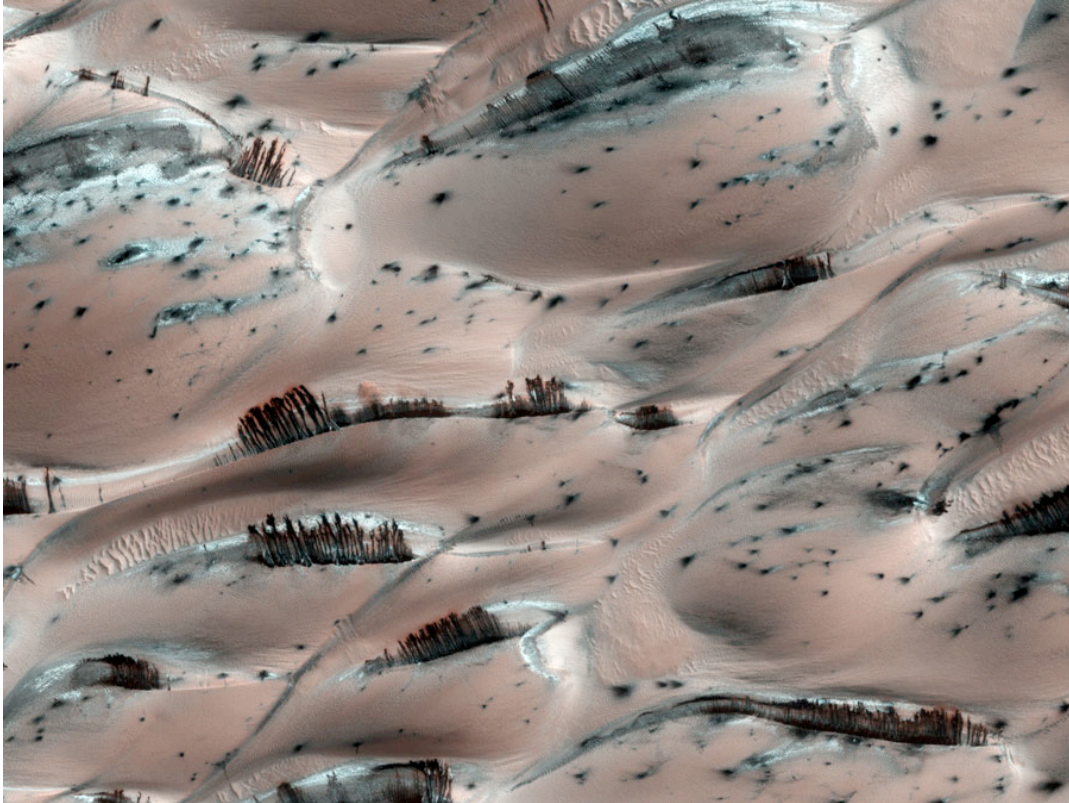


N A N C Y C H A N O V E R
New Mexico State University Astronomy Department

2010 TEACHING ACADEMY INNOVATION AWARD



Martian sand dunes with streaks of dark sand cascading down as the Sun melts the carbon dioxide frost.
(<http://apod.nasa.gov/apod/ap100119.html>)

1. Contact Information

Dr. Nancy J. Chanover
Astronomy Department
Box 30001/MSC 4500
New Mexico State University
Las Cruces, NM 88003
phone: 575.646.2567
FAX: 575.646.1602
email: nchanove@nmsu.edu

2. Teaching Innovation: Description and Application

In the Fall of 2008 I began teaching ASTR 305V (*Life in the Universe*), a Viewing the Wider World class, using the paradigm of Team Based Learning (TBL). Current research in teaching pedagogy tells us that students learn better, i.e. have better retention and a higher degree of understanding, when they are required to be *active* in the classroom. Peer groups are an effective means of encouraging student interaction and participation. There are numerous pedagogical descriptions for active learning situations where students work in groups: informal cooperative groups, formal base groups, inquiry based learning, team based learning, problem based learning, etc. The TBL paradigm, first proposed by Michaelsen, Knight and Fink (2002), is a specific example of one of these approaches to teaching. A comprehensive web site devoted to TBL can be found at the following URL: <http://teambasedlearning.apsc.ubc.ca/>.

There are several key characteristics of TBL. First, students work in assigned peer groups ("teams") for the entire semester. A substantial fraction of class time is spent by students working in teams on a common activity designed around the behavioral objectives of the class. Students are responsible for acquiring some of the basic course content on their own through frequent reading assignments; they are assessed on their learning outside of class through short daily reading quizzes, which they take first individually and then again in teams. Students' grades are computed based on individual performance, team performance, and peer evaluation.

The advantages of TBL are that it provides increased accountability for all students, it develops students' team skills, it promotes active learning in the classroom, and it enhances students' meta-cognitive skills when they are forced to discuss or explain their conceptual frameworks to their peers. It also enhances interpersonal skills and generally results in a more positive impression about a course.

When I implemented TBL into my ASTR 305V classes, I added some new variations that differ slightly from the traditional approach suggested by Michaelsen *et al.* For one, I assessed students' reading done outside of class almost daily using readiness assessment quizzes (2-question, multiple choice quizzes) rather than at the start of each learning module. This made the reading assignments shorter and more tractable for my students and resulted in a greater likelihood that they would complete the reading before coming to class. Second, I used rapid response systems ("clickers") for team quizzes and clicker questions throughout the class period. Clickers are an effective means of quickly assessing

students' understanding, preconceptions, and attitudes, and they enabled me to reteach or revisit concepts if a large fraction of the teams had difficulty with it. Finally, I implemented a team poster project that represented the culmination of several learning modules. Each team was assigned a "mystery" fake planet with a set of known characteristics, and their task was to design a spacecraft mission to visit their planet with the objective of searching for evidence of life. This month-long project culminated in a class poster session toward the end of the term, which enabled the teams to showcase their work and also provided them with a glimpse of the poster session environment at a professional scientific conference.

3. Impact on Student Learning

The impact of TBL on student learning in ASTR 305V can be characterized in several different ways. Having never taught ASTR 305V *without* using the TBL paradigm, I cannot legitimately compare student performance on specific test questions prior to and after the implementation of TBL. However, I can address the grade distribution in the class overall. The grades for the class were determined by a combination of individual performance (e.g. mid-term exam), team activities (e.g. poster project), and a peer evaluation grade. Students must be passing the class individually before adding in the generally higher team component to their grades. The resultant grade distributions in my ASTR 305V courses were thus weighted more toward the A-B range than the C-D range; students who were earning C's individually ended up with B's after their team scores were factored into their grades.

Student feedback is also an important means of assessing teaching effectiveness. Below are some sample comments on my student evaluation forms from the Fall 2009 ASTR 305V class:

One of the more interesting academic courses I've taken. Most lectures are just that, a teacher talking for 90 minutes, not very engaging. But this class was about half lecture, and the other half went toward group work. Pacing of the readings and assignments fit very well with the lecture materials.

it was very organized and engaging with the students, i like the fact that each class we students were asked to answer questions with eachother rather than just be lectured to.

Professor Chanover's use of daily quizzes with the incorporation of group cooperation is a very productive way of conveying the subject and making sure that students complete the daily reading required for the class.

I liked the fact that a student must be passing on their own accord to receive any points from their group.

I think the poster project was a great way for the class to see how professional scientists present their research to colleagues. I like the clicker quiz before every lecture.

I enjoyed working in groups on material in class.

In addition to the Astronomy Department evaluations that are conducted each semester for all classes, I conducted IDEA evaluations for both the Fall 2008 and Fall 2009 ASTR 305V classes. The IDEA Student Ratings of Instruction solicits students' feedback on their own learning progress, effort, and motivation, as well as their perceptions of the instructor's use of 20 instructional strategies and teaching methods. Rather than emphasizing teaching style or personality, the IDEA system focuses on student learning and the methods used to facilitate it.

For my Fall 2008 ASTR 305V class, the IDEA evaluations found that for the three learning objectives that I defined as essential for my class, the percentage of students who felt that they made substantial or exceptional progress in those areas was 68%, 70%, and 60%. In the Fall 2009 semester, the IDEA evaluations found that for those same three essential learning objectives, those numbers increased to 88%, 83%, and 79%. For both the Fall 2008 and Fall 2009 ASTR 305V courses, my nationally normed summary score placed my teaching effectiveness similar to or higher than all other instructors of physical sciences classes in the IDEA database. In 2009, for **all** of the teaching methods that are related to my learning objectives, my students rated my use of these methods between 4.2-5.0 (on a five-point scale). The detailed IDEA reports for my ASTR 305V classes are provided as attachments.

4. Relationship to Teaching Academy

I first learned about the TBL paradigm by attending a four-day workshop at the Teaching Academy conducted on 13-16 May 2008 by Dr. Laura Madson of the Psychology Department. I was so inspired and motivated by this workshop that I began implementing TBL in my classes in the Fall 2008 semester and have not taught a purely lecture-style class since! Dr. Madson and I now collaborate on the effective uses of TBL techniques in the physical and social sciences, and we presented a talk on our respective implementations of TBL at the International Conference on College Teaching and Learning in Jacksonville, FL, in April 2009. In November 2009 we gave a workshop about TBL at the Teaching Academy. The 15 participant evaluation forms that we received were overwhelmingly positive. All participants felt that the workshop provided them with concrete ideas that were useful and that could be implemented in their own classes, and many people suggested that they would like to see a longer workshop devoted to the implementation of TBL.

5. Student Letters of Support

Three student letters of support are provided as attachments to this application.