

STAR PARTIES AND BARN DOOR TRACKERS: OUTREACH WRITING IN ASTRONOMY

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The *Badger Herald* accepted our students' project!" My TA and I delighted in the news, because it marked the first time that a group from Astronomy 104: Exploration of the Solar System had managed to publish their final project. Four of our students had worked together to build a barn door tracker—a contraption designed to eliminate star trails when taking photos of the night sky—and the article they'd written about their work, along with the photos they'd taken with the tracker, was going to be published. Expecting a

postage-stamp article in the back under the Chancellor's cheese preference, we gasped when the first entry on the front page led us to a full-page color spread.

Even better, this project was only one of over 30 high-quality educational group projects created and written by the 150 students in the course that semester. YouTube videos, an interactive activity at the local children's museum, children's books, an outing with Boy Scouts, and a residence hall star party are just a further sampling of group projects planned and executed by students that semester in this introductory astronomy course geared toward non-science majors.

A Golden Opportunity

I came back to teaching introductory astronomy in 2006 after teaching at other levels and learning a great deal from education innovators in the process. This return was a golden opportunity to build the course afresh with a broader perspective, new insights, and clearer goals. One of the most rewarding and fascinating elements of the new course proved to be group projects. Rather than have students write a traditional term paper, I decided to have groups of students plan, write, and disseminate astronomy-related outreach products targeted at a non-specialist audience.

These projects would serve several purposes. First, students could experience the complexities of scientific communication firsthand by actually practicing it, thereby becoming more astute consumers of scientific information. Second, they could tailor part of the course to their own interests and skills. They could also gain experience in group management and peer review. And they could set learning goals and devise evaluation methods, which, I hoped, would lead to a greater awareness of their own learning needs and accomplishments.

I was amazed the first time I tried these outreach projects. Many of my students became deeply invested in their projects and went to great lengths to see them through. In the years since, I've been delighted by how enthusiastically

students jump into a wide diversity of projects. In addition to newspaper articles, groups have:

- written and produced a video for middle school students about black holes in other galaxies,
- worked with the program administrator at the Madison Children's Museum to lead an interactive activity with an accurate scale model of the solar system (in terms of both size and distance—can you picture that?),
- created a Facebook page analyzing the treatment of astronomical topics in science fiction movies,
- given a presentation at the Space Place, the Astronomy Department's outreach center,
- written and produced YouTube videos explaining complex astronomical topics,
- organized a residence hall star party, where people come together for night-sky observations—a common event for amateur astronomers, but new for the students,
- and much more.

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The Course Structure

Every time I've taught the course since, I've fiddled with it here and there, but I've kept the basic structure the same.

From the beginning of the semester, students start brainstorming for their final projects. Meanwhile, they're getting a necessary foundation in the field through homework assignments like problem sets and online research, which challenge their understandings of how astronomers work and augment what they're learning from the textbook and class lectures. We also do night-sky observations—this is astronomy, after all! Then, in addition to a midterm and a final exam, the second half of the semester is devoted to the final group projects. For these, students go through the following steps:

1. Brainstorming

Early in the semester, each student submits three possible astronomy topics for a group project, along with a method or medium for presenting that topic. The topics can be historical, philosophical—anything that's related to astronomy. My grader and I categorize the hundreds of ideas into 10 to 20 main topic headings and a similar number of media categories, each of which becomes a separate thread on the course website's discussion board.

2. Group Formation

The students then self-organize around common interests into groups of two to eight people. Many use the web discussion board to do so, while others find neighbors in class or in discussion sections.

(Continued on page 5)

STAR PARTIES AND BARN DOOR TRACKERS *continued*

(Continued from page 3)

3. Progress Reports

Around the middle of the semester, each group reports its progress. Since the bulk of the work on the group project happens in the second half of the semester, most groups don't have a draft at this point. Rather, they list resources gathered to date, discuss the group management plan, address the feasibility of the project, establish preliminary learning goals for their intended audience, and describe how they plan to evaluate the success of those learning goals. These reports serve to nudge students along so they don't get stuck in an unfinished mess at the end of the semester. And I provide feedback to each group to ensure that the medium and topic they're working with are still the best fit for the audience they've chosen.

4. Peer Discussions

Once students have submitted progress reports, one week of the discussion section is devoted to informal chats among students from different groups, facilitated by the TA. Students share current plans for the projects and receive feedback from outside perspectives. Since members of each group are scattered across different discussion sections, the groups benefit from several sets of feedback.

5. First Drafts

About ten weeks into the semester, the groups submit their first drafts to me. I require these to be at least half complete, though not fully polished, and request an outline for any missing portions. Students also update their progress reports on management, learning goals, and evaluation plans. And they report on the peer discussions, including new ideas and suggestions gleaned from others. I, in turn, provide feedback on the content and delivery of the projects. Sometimes, I need to push students to add more meat to their work. More often, I encourage them to scale down their plans. I also help them accomplish the exciting challenges they've set for themselves by suggesting contacts for setting up events.

6. Peer Review

Each group also shares its first draft with a different, randomly selected group. This peer review is itself a graded assignment,

consisting of several guidelines and questions to apply to a project draft. Students provide copies of their reviews to the original group as well as submitting them for a grade.

7. Meeting with Instructors

Once the groups have had a chance to incorporate feedback on their first drafts, they meet with their TA. The TA devotes all office hours during one week near the end of the semester to scheduled ten-minute discussions with each group to check on progress and iron out last-minute snags. I also meet with groups as needed or requested.

8. Final Submission

The final draft consists of either the product itself, if it's written or visual, or a description of the event. In addition, the students assess how well they met the learning goals, describe how they

incorporated feedback from peer reviews and from discussions with the instructors, and provide a final management report on the relative effort expended by the group members.

The Pay Off

As I talk with students along the way each semester, I hear about the challenging projects and goals they've set for themselves. Their work shows me how much they're learning about astronomy as they strive to communicate about it effectively to others. And when I see their final projects in action—especially when my schedule allows me to attend their events—my students' pride is palpable when they watch their audiences learn something new about astronomy.

Since this course fulfills a general education science requirement, I want students to be able to morph their work to their own interests as much as possible. This is a pretty tough class. I'm asking a lot, so I want students to be really engaged. Through these outreach projects, they convey their engagement in creative, smart ways.

I'm so impressed with the work my students do. And if you take a look at the *Badger Herald* archives or check out the handmade children's book displayed in the Astronomy Department office, I think you will be too. ●

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