Distributed Telescope Observing In An Undergraduate Astronomy Course

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Introduction

The study of astronomy, at least at a distance, is rather different. If one were to think about it at a basic level, one really cannot experience or observe closely a phenomenon occurring, like in another discipline. To that degree, carrying out any astronomy similar experiment is near impossible, even for the most decorated researcher. There is only so much we can do on earth. However, what if we were to give students access to several high-level telescopes to record data for their own projects? In fact, what if we were to give access to this technology to non-science majors?

Well, we actually can! Called Skynet, this network is actually a series of automated telescopes supported by the University of North Carolina Department of Astronomy. Founded by Dr. Dan Reichart, they, the Skynet administrators, have somehow connected several telescopes from around the world together, to one database. When one wants to collect data from a certain telescope, all one must do is input the job request, and the telescope will proceed to carry out the quest, in the proper conditions. Additionally, they have simplified the process to use their system at any age level, allowing one to assume that this system, as a whole is rather easy to use. With this apparent ease, we could more than easily train science majors, and possibly even train non-majors in the use of the telescope (“Skynet:Home.”).

With this in mind, why would we not want to apply this to our Introduction to Astronomy classes? This quickly became my primary goal for the summer, to find some way to allow an easy way to use Skynet in class and lab. Additionally, several other goals quickly come to mind. For example, how would we make sure that the way we use it is truly beneficial for the students in their comprehension? We can go further on this as well, but in the end, it all goes around the best way to convey the material.

Results

In order to reach the goals, I carried out several parts to create a finished project. The primary bulk of this six-week project consisted of straight up discussion. As a 20-year-old student, I have never had the opportunity to read up and learn about basic principles of education and pedagogy. However, I quickly learned through several planning and mini-lesson sessions, that the focus of pedagogy really boils down to making sure the students understand and comprehend the main point of the lessons taught. Resources, while a vital part of every class, should only be provided as a supplement, and not a way to necessarily teach.

With all this in mind, and my class experience partially remembered, I proceeded to work on a lab, as a trial-run of sorts. The primary focus of this lab is to introduce students to a measuring technique that astronomers use to measure objects, while also introducing them to several applications that astronomers and other scientists use to compile and analyze data. While this lab is vital to the course, in the past, the small angle formula was always introduced alongside the lab. This would quickly create issues with the students, since we were trying to get them to understand several major concepts in a three-hour span. After discussing this, it was decided that we would instead use the thin-lens equation to find these values, over the small-angle formula. The thin-lens equation, while rather vital in physics, is known to actually be one of the more conceptually-easy formulas, allowing the lecturer to spend less time unpacking the small-angle formula, and more time helping the students better use the tools at their disposal.

In order to carry-out this change, the data sheets used for the lab were edited, in respect to changes. Several trials were ran with provided data as well, to provide us an understanding of certain issues that could occur with the data entering. After receiving certain values, with a small percent error, the lab was then rewritten, procedure and all, to reflect the new edition of the lab.

With this trial-run of sorts completed, progress on the main project was continued. In order to use Skynet in the lab session, lessons had to be taken on how to use it. What soon followed, over the course of the first few weeks, was 10 pre-recorded lectures, all lasting a significant amount of time. Provided by Dr. Reichart, all the lectures focused on labs that his department uses for their Introduction to Astronomy classes. While many of the lectures tended to actually walk instructors through there labs, they did provide a solid amount of instructions on how to use the Skynet database. These lectures also provided a solid amount

of ideas on how to go about finding certain values, which is quite a plus.

With Skynet in mind, work was then started on redoing a different lab, focused around using Kepler's 3rd law to find the mass of Jupiter. While in the past, we had used Galileo's data of Jupiter's Moons to find said information, it was never productive in the end. Students would first have to go through his data, which could take anywhere from 10-30 minutes to sieve through. They would then have to figure out which moon is which and use that knowledge to go through data compilations.

However, what if we created a more active learning environment? To this end, it was decided that we would substitute Galileo's work, for the students' own work. Using Skynet, each group would make a series of observations of the Jupiter planetary system, for several nights. Then, when the lab rolls around, each group would edit the photos and collect the data needed. With this in mind, trials runs were made with pre recorded data to check viability. Additional changes, similar to the prior lab, were also made.

Furthermore, in order to use the Skynet system in a higher capacity, we started the process of connecting our observatory on campus, to the overall Skynet system. While there was a significant amount of delay, due to the Skynet staffer working with us remotely, the observatory all had the proper instrument specifications, allowing a relatively easy connection. Tests are still currently being run, however, in order to make sure the telescope does not get damaged by a power surge or a faulty part.

Last, but not least, a small introductory lab manual has been mostly compiled. While not completely completed, the vast majority is done, and currently going through revisions. This lab manual, unlike others at Hampden-Sydney College, just focuses on walking students through using certain applications at their disposal, such as Microsoft Excel and Stellarium. In order to keep the flexibility each professor has in their section, they are going to be allowed to pick and choose which labs to use, instead of being stuck in the same 14 each semester. Additionally, by creating this, we are allowing the instructors more time focusing on lecturing and answering questions on vital concepts, instead of reteaching how to use Excel.

Conclusion

Without a doubt, this project was a learning experience. I truly got to learn and appreciate how much time teachers and professors put into their lesson plans and class development. It truly is a project to balance covering needed material, while ensuring comprehension. Additionally, as a person looking into possibly teaching, it really gave me an idea as to what to expect.

As for the effect of my project, the connection to the Skynet network is a definite plus. By connecting the telescope up, we allowed longer observation times for our classes and research. The revised labs allow us to focus more on making the Introduction to Astronomy lab truly active and experiential learning based, a positive for the college as it focuses on the *Compass* initiative. Last, but not least, the lab manual, when completed and revised, will be used for several semesters to come, making the lab similar to the other introduction labs.

REFERENCES

-"Skynet: Home." *Skynet: Home*, skynet.unc.edu/.