

'Astrophysics: History and Theory,' an undergraduate, interdisciplinary, asynchronous Astrophysics course taught in the physics program

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Abstract

This project produced an online astronomy course based on the free, online OpenStax textbook. When this project was conceived, about a year before the Covid-19 pandemic, the authors had no idea that in a short period of time, most college and university classes would be online. This abrupt change in modalities of courses, from traditional, face-to-face lectures and laboratories to a more modern online format, sparked energetic discussions about the effectiveness of online courses. The success of this course is examined using a 100-question pretest and posttest based on content knowledge. A survey was also completed of the students to evaluate the perceived success of the online course and the acceptance of online courses. The survey was adjusted to include opinions about the in-person labs which were cancelled due to the Covid-19 pandemic.

Opening the Observatory



[Professor of Physics Joseph Trout with students Courtney Weber, Tara Jacobsen, Briana Feltner and Colleen Lindenau in the observatory. Students missing from photo are Miriam Saad and Gracie Buondonno. (Photo by Susan Allen)]



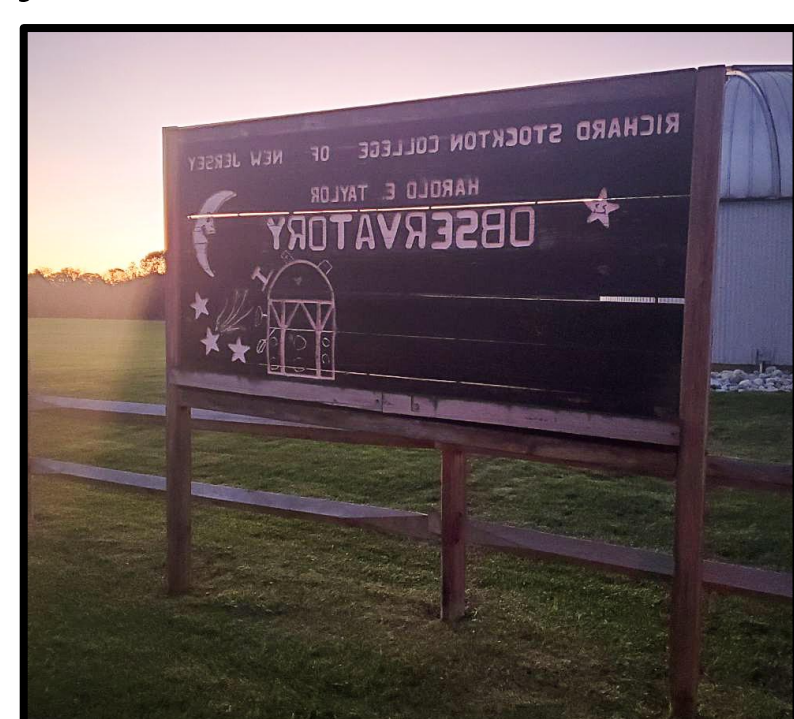
[Students Tara Jacobsen, Briana Feltner, Gracie Weber, and Colleen Lindenau in the observatory.]



[Harold E. Taylor in the observatory.]

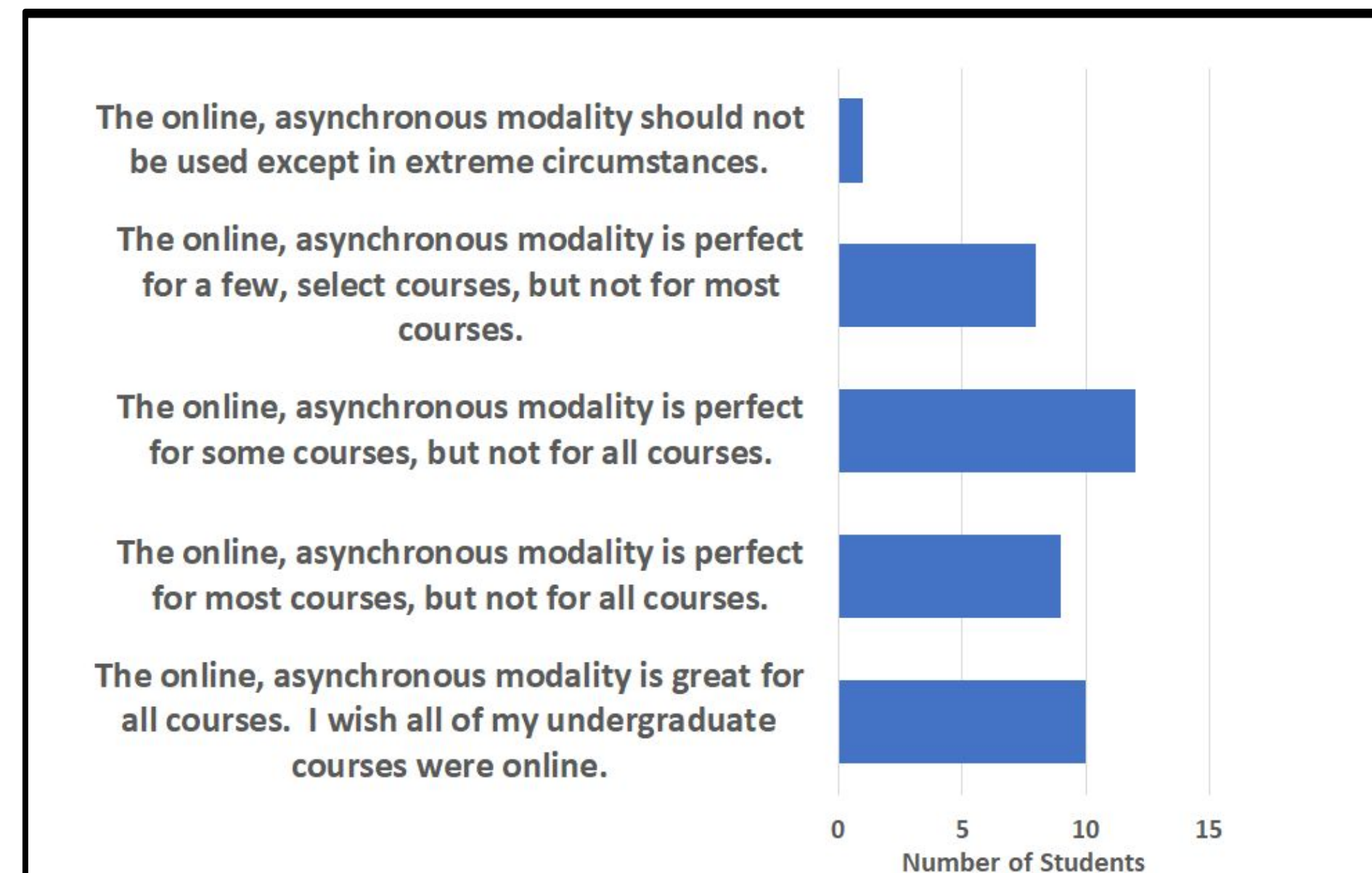
This course was made possible due to the opening of the Harold E. Taylor Observatory at Stockton. This opening was made possible by Dr. Trout and a team of undergraduate female Physics majors. Being included as a contributor in this opening is a huge honor, however the credit should be given in entirety to Dr. Trout and the physics students who went in and got their hands dirty spending hours cleaning the room and fixing up the computer and circuit boards.

The official observatory opening was held on November 9th, 2019. The local community came to support the reopening of the observatory. I spoke with many people who remember visiting the observatory as a child, remember it shutting down, and being delighted and full of excitement that they would be able to bring their children and, in some cases, grandchildren, to the observatory once again. It was a huge honor to be able to honor Harold E. Taylor and his love for astronomy once again.

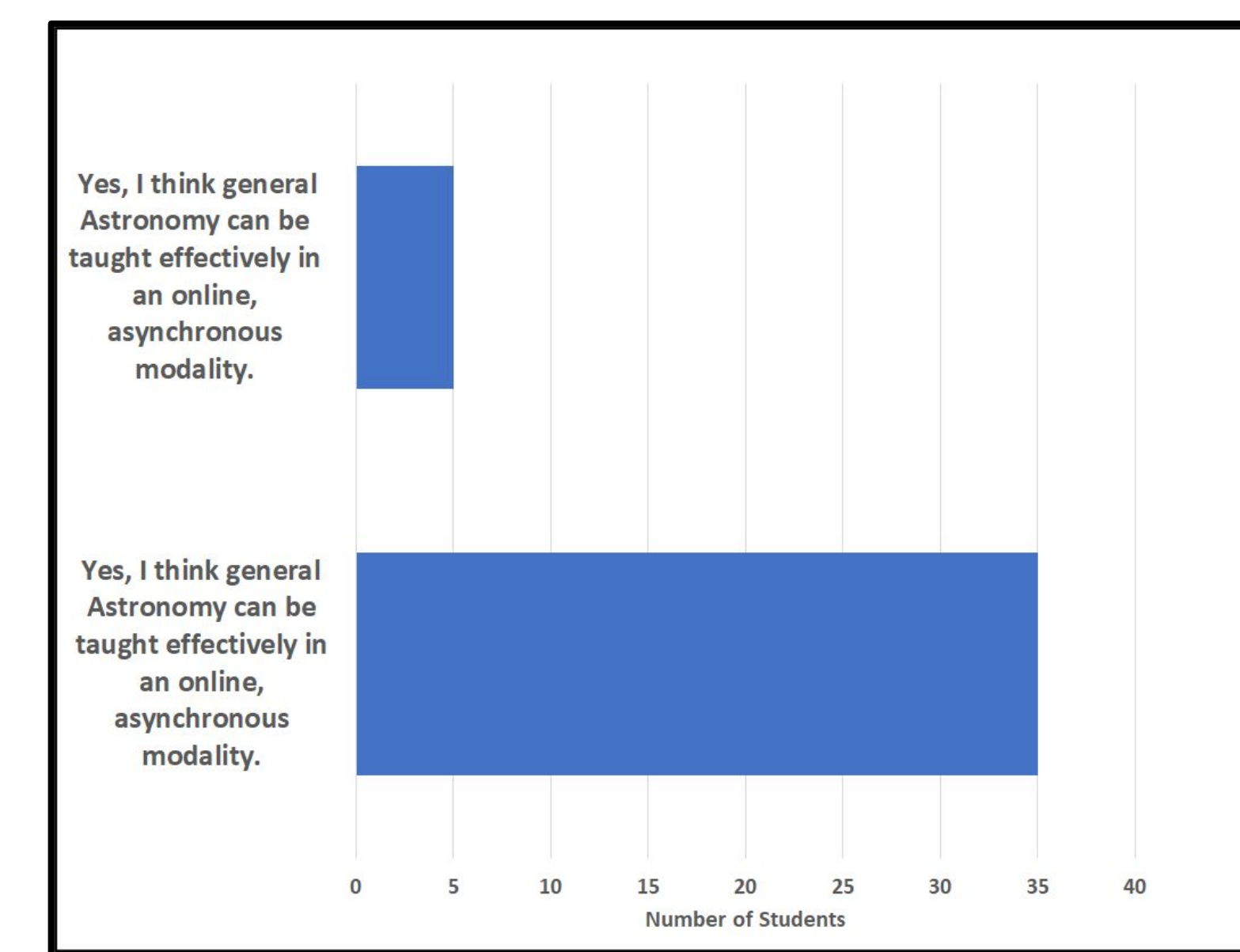


Survey

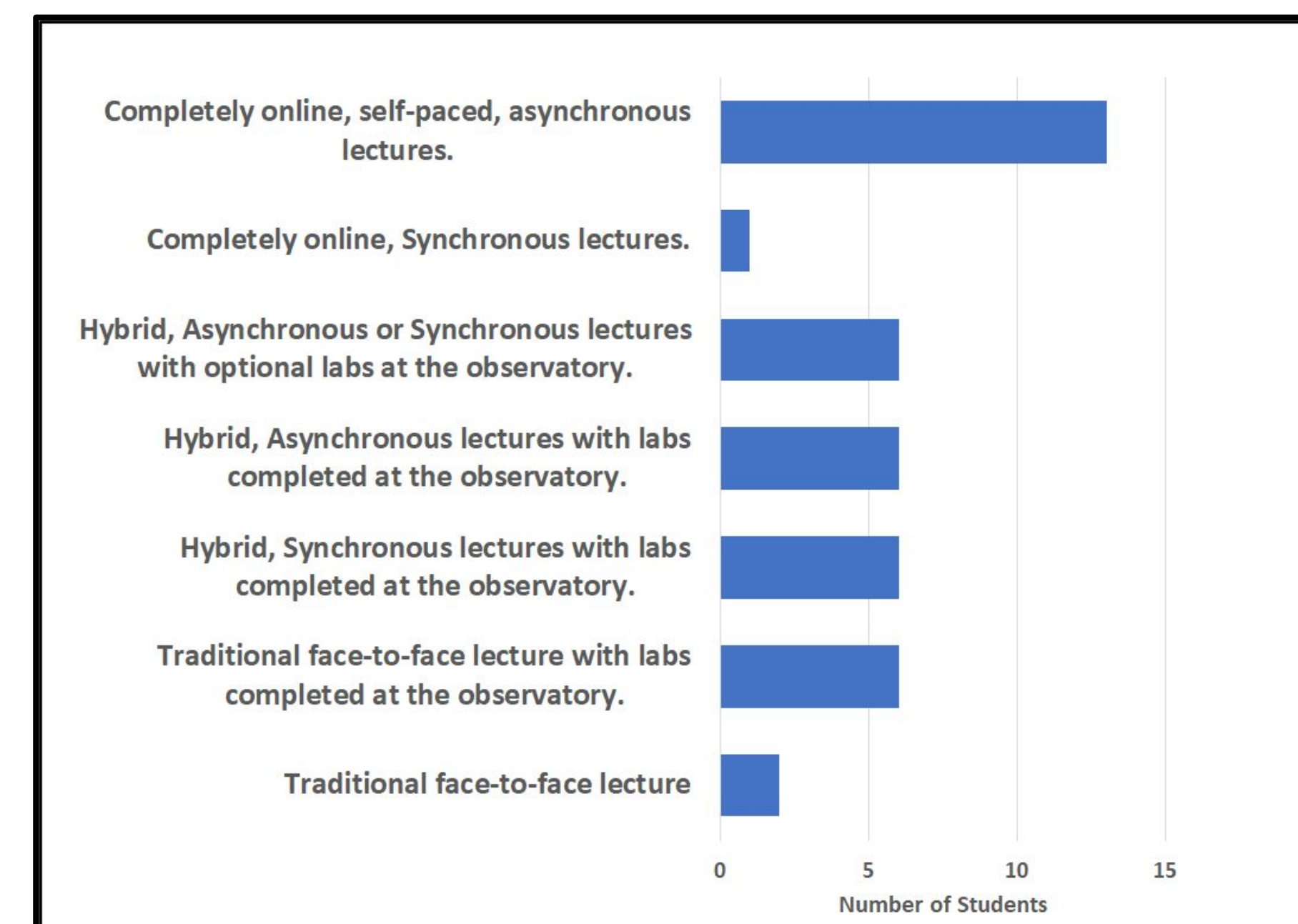
Students were given a non-mandatory survey after completing the course to gather information on their views on online courses, online astronomy courses, and their missing out on the observatory laboratory meetings. Of the eighty students enrolled, forty students responded to the survey.



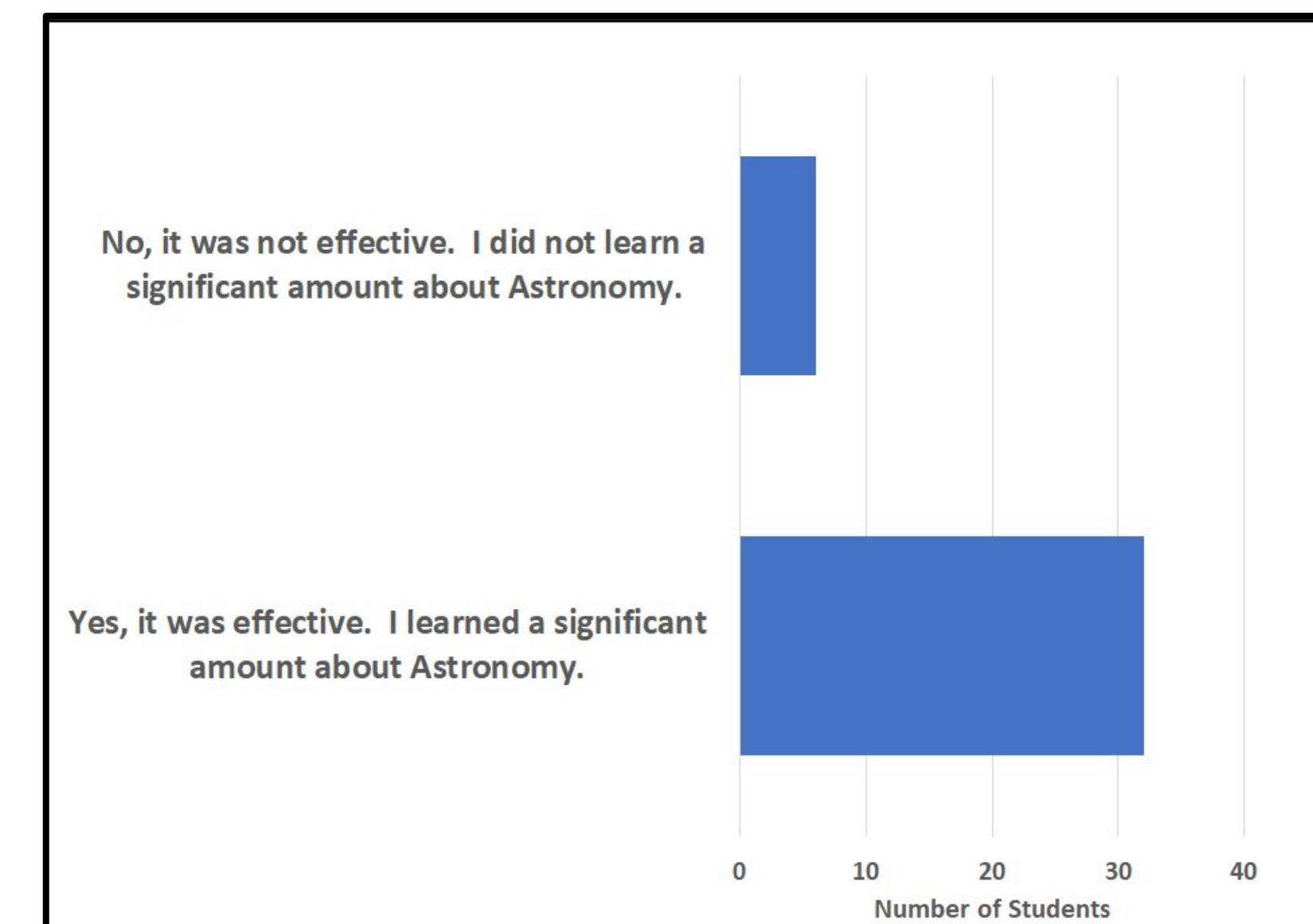
[Student response to "What are your general impressions of online, asynchronous courses?"]



[Student response to "Do you feel that General Astronomy lends itself to the asynchronous, online format?"]



[Student response to "What modality would you choose to take for General Astronomy?"]



[Student response to "Was the online, asynchronous modality effective?"]

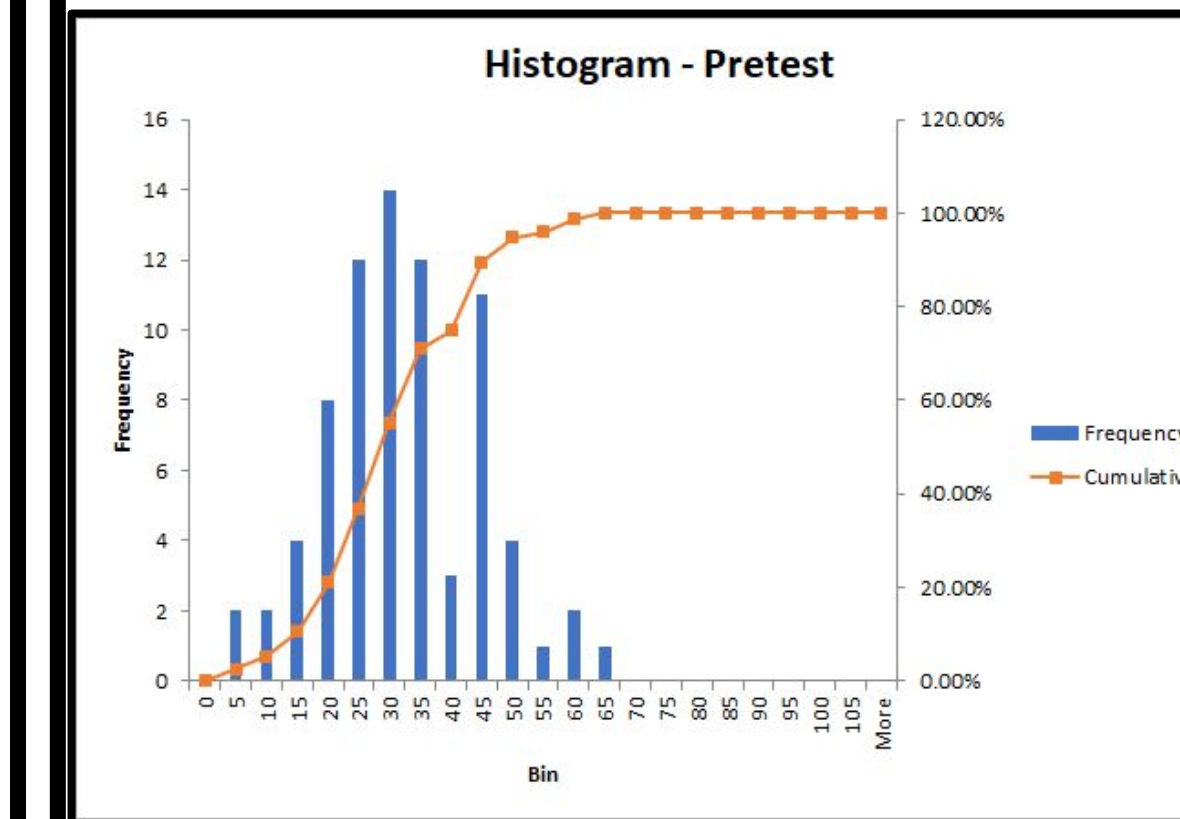
While these responses are student opinions, it is significant to note that the majority of respondents agree that not every course should be taught asynchronously online, but they believe astronomy courses do lend themselves to this modality. After experiencing this course, completely online and asynchronous, the majority of respondents believe that they learned a significant amount of astronomy through the course.

Conclusions

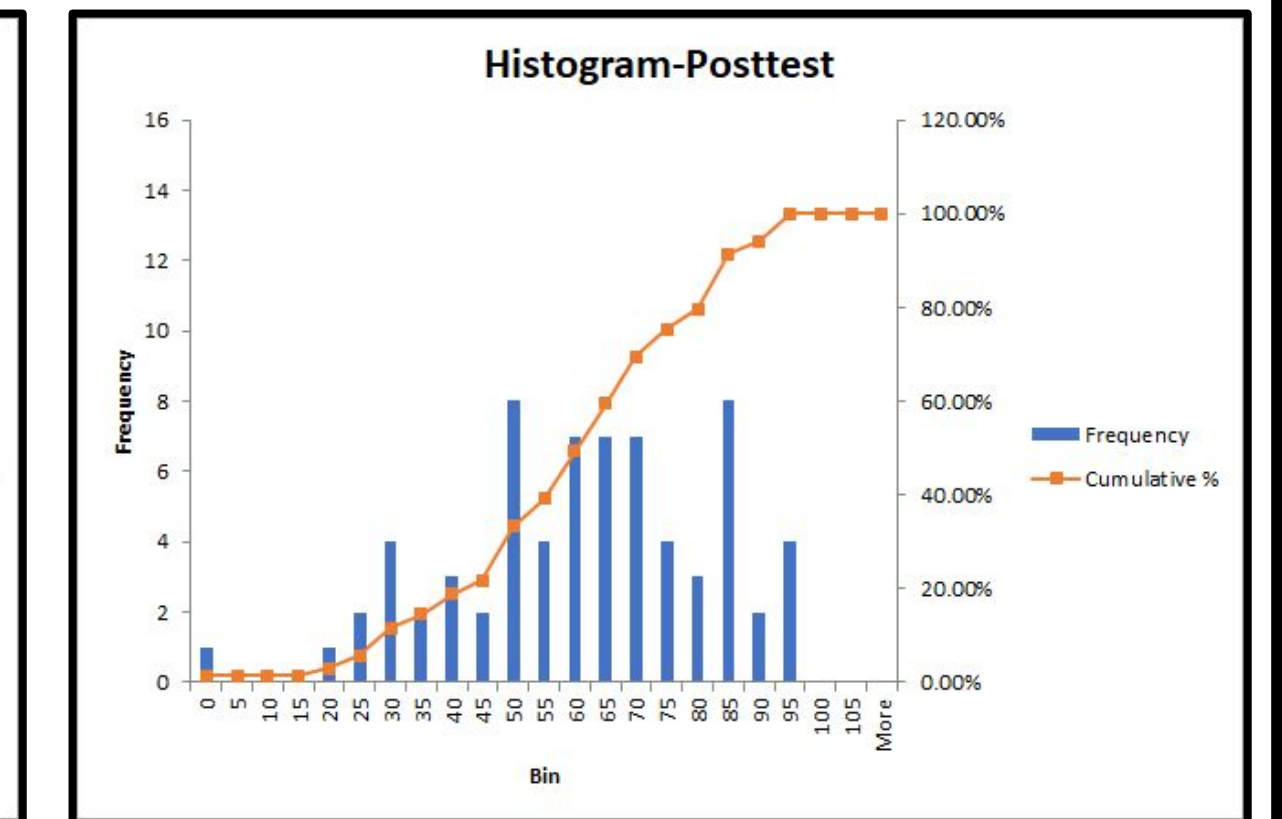
From the data collected via the pre- and post-tests, it is clear that there was a significant increase in overall student performance on an astronomy test before and after completing the course. This, combined with the opinion of the students surveyed, provides evidence that general astronomy courses can be effective when implemented online and asynchronously. The percent increase and student response to the survey also demonstrates that students increased their understanding of astronomy through taking this course online and asynchronously. This lends to the conclusion that astronomy can be taught effectively in an online, asynchronous environment. Students show quantitative and perceived increase in understanding of astronomy after taking this course. Further studies are needed to demonstrate whether or not this course provides students with the same level of understanding as astronomy courses taken with different modalities.

Overall, the opinion of the students in this class is that not all courses can be taught using the online, asynchronous modality. Further studies can explore the effectiveness of teaching different subjects with this modality. Other studies can also explore the effectiveness of different levels of studies taught with this modality. Again, this was a general science course which did not delve into many complexities which upper level science courses do. It would be interesting to explore whether any of these upper level courses can lend well to the online, asynchronous modality.

Pre-Post Test



[Histogram of pre-test score results, in points earned on the horizontal axis and frequency on the vertical axis. The horizontal line traces cumulative percentage of students.]



[Histogram of post-test score results, in points earned on the horizontal axis and frequency on the vertical axis. The horizontal line traces cumulative percentage of students.]

Before beginning the course, students were given a pre-test on their astronomy, science, and Physics knowledge. The test was primarily conceptual and closed notes and book. Students were told that this would not count towards their grade and to try their best to answer the questions to their best knowledge. This test gives a starting point for the students' knowledge on the content covered in the course. 76 students completed the pre-test.

After working through the course, students were given the same test again. The goal for this was to see the growth of the students' astronomy, science, and Physics knowledge gained throughout the course. 69 students completed the post-test.

When given the pre-test, 76 of the 80 students completed it. The mean score of the pre-test was a 30.4 with a standard deviation of 12.19. As seen in the histogram of the pre-test, the highest frequency of scores was centered around 30 and 35. No student scored above a 65 on the pre-test.

For the post-test, students were instructed to not prepare for the test and to use the knowledge they retained from the course. 69 students completed the post-test. The highest score was a 95, with a mean of 59.27 with a standard deviation of 20.72. Scores of 50 and 85 had the highest frequency of responses, as seen in the histogram of the post-test.

At first glance, students improved their overall performance from the pre- and post-tests. The percent increase in the mean score from pre-test to post-test is 94.97%. This is a significant increase in students' overall performance on the test.

References

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Acknowledgments

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