1-1-2008

University Astronomy: Instructional Strategies for the Visually Impaired

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EPO and a Changing World
ASP Conference Series, Vol. 389, © 2008
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Abstract. While teaching a spring laboratory course in general university astronomy, I agreed to provide instruction to a student who had been advised against laboratory work in chemistry and biology because of her significant visual impairment. This poster describes our mutual learning experience as we developed tactile concept demonstrations and laboratory exercises. Progress assessment issues and gaps in educational resources will also be discussed.

1. Introduction

In the spring of 2007, I was asked to accommodate Ashley C., who is severely visually impaired, with a cataract in one eye and very low vision in the other, in my general astronomy class. She had been advised not to take chemistry or biology laboratory science courses because of the potential for injury from the equipment and be-cause laboratory experiments normally require close visual work.

General Astronomy is also a laboratory course. How was I to present materials and activities in astronomy, which is in general a hugely visual science, in ways which were at a level equivalent to knowledge gained by sighted students?

2. Methodology

Ashley had difficulty using a standard astronomy textbook with two columns of text per page and numerous figures and images; her scanner could not properly translate the multimedia format. Not all publishers have Braille equivalents of the recent editions of their textbooks or access to online text which can be read through JAWS or similar software. Organizations like the National Printing House for the Blind have a modest selection of textbooks, but they are often several years out of date.

Dawson and Grice (2005) developed tactile versions of celestial objects to assess their learning enhancement potential on sighted people during planetarium shows and sky viewing sessions at the WCSU 20-inch telescope as part of the NASA SEE Project (http://analyzer.depaul.edu/SEE_Project).

I created tactile concept diagrams and lab exercises by photocopying pages onto sheets of thermal expansion paper and running them through a ZY-Fuse Heater thermal machine (Zychem Ltd.; http://www.zychem-ltd.co.uk/).

I adapted six laboratory exercises to tactile format: (1) the Moon's sidereal period; (2) determination of the Moon's mass; (3) spectral classification; (4) the

Sun's rotation; (5) lunar cratering; and (6) the spiral structure of our galaxy. The first two exercises were modified from visual versions in Hoff and Wilkerson (2006), the manual used by the class. Solar full-disk images for the fourth exercise were downloaded from the Project SEE website. The lunar cratering exercise was based on one that I had developed for a planetary science course. The visual version of the spiral structure exercise is in my own lab manual (Dawson 2002).

2.1. Discussion

Ashley and I found that tactile exercises were most comprehensible when the units of information (e.g., data points, graph subdivisions, line and area textures) were kept to limited but appropriate amounts. The solar rotation and lunar cratering exercises were least well negotiated because of information crowding on the tactiles. Compromises had to be made between an accurate portrayal of the physical situation and an intelligible rendition of the concept.

To deal with mathematical manipulations beyond basic operations requires that instructor and student be familiar with Nemeth code or a similar markup language. That was beyond the scope of the current work because of time constraints.

3. Conclusions

I plan to develop other lab exercises as well as a tactile set of fundamental concepts figures for use with blind or visually impaired students who may attend my other classes. Tactile images of many celestial objects are also available (e.g. Grice 2002).

Improvements in assistive technology have made the sciences ever more accessible to people with disabilities, especially when there are creative ways to address them. It is only in failing to try that we make progress impossible. The mind's eye is never blind.

Acknowledgments. I thank Noreen Grice, and the WCSU Office of Disability Services, in particular its director Jack Sikora, for constructive consultations during the work.

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