Book Reviews

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Peer Instruction for Astronomy, by Paul J. Green, Prentice Hall (Pearson Education, Inc.), Upper Saddle River, NJ (2003), 178 pages plus CD-ROM, $31.60.

Even if you don't teach astronomy, you'll find Paul Green's *Peer Instruction for Astronomy* worth a read. Although its stated purpose is to provide ConcepTests à la Eric Mazur for introductory astronomy courses, I found the other half of the book to be a delightful overview of collaborative learning and a useful collection of references of active and collective learning methods.

For those familiar with Mazur's contribution to physics instruction, the "peer instruction" (PI) method poses a conceptual physics question (the ConcepTest) that can be solved with little or no math. Students are asked to think briefly about the problem and then to pick from a list of possible answers. Depending upon the number of correct responses, the instructor can move to new material or continue with the current by having the students discuss the problem among themselves. After a minute or two of discussion, the instructor again polls the students, often finding that most of them now report the correct answer. As an instructor who has used the PI method in several flavors of introductory college physics courses, I am often amazed at how students, who individually couldn't find their way to the answer, can collectively build a solution.

Whereas Mazur's original ConcepTest questions were about introductory physics, Green and 32 colleagues have produced questions using this methodology for astronomy. Twenty-five topics are included, matching roughly the chapter structure of a typical introductory astronomy text: historical topics, telescopes, scales of size and distance, radiation, the night sky, Earth and the planets, the Sun and stars, the Milky Way galaxy and other galaxies, all the way to cosmology and dark matter. Almost 500 questions, fairly evenly distributed between the 25 topics, are provided along with their answers. This number continues to grow as Green and colleagues write new questions and post them on the PI for Astronomy website.

Questions vary from pure recall ("The density of an object is its *mass divided by its volume*") to application ("Two stars have the same surface temperature but the radius of one is 100 times that of the other. The larger star is *10,000 times more luminous*"). The CD-ROM included with the book includes Microsoft Word and PDF files of the questions so you can present the questions in a variety of media formats. The disk supports Windows 98/2000/XP and Mac OS 8/9/X.

Even if you do not use the PI method in your class, or you do not teach astronomy, you will find that this book is a handy reference to active learning methods. Mazur's *Peer Instruction* is, as the subtitle suggests, "a user's manual" to the peer instruction method. Mazur includes some justification for his instructional method, as well as some results from its use and a few hints on how to use it in the classroom. But Green's book describes the educational research that provides the foundation for active learning techniques.

Part of the book is a user's guide to introducing PI into your classroom, with hints about how to poll students (flash cards versus electronic technologies) and how to build student collaborations. *Peer Instruction for Astronomy* describes various choices on how to break students into groups and how to overcome resistance to using PI, both from students in the course and from fellow instructors. It provides a lot more how-to than Mazur's volume.

Green also provides a short chapter on how to write ConcepTests and how to use feedback to assess the questions. Another chapter addresses assessment and evaluation in order to keep track of student learning and whether the PI method is functioning as we would like. Good assessment, as Green points out, enables students to adjust their learning strategies and for instructors to adjust their pace and content.

An extensive section on readings and resources provides references to some of the literature on active learning and astronomy education, including web resources. For instructors wanting to access the Astronomy Diagnostic Test (ADT) for their own assessment (astronomy's equivalent of the Force Concept Inventory or FCI), the ADT is provided in an appendix.

Peer Instruction for Astronomy is a gem, particularly for astronomy instructors. Physics instructors already using peer instruction will find more information about educational research that supports the use of PI. All physics and astronomy instructors, PI users or not, will find something in this book that will improve their teaching.

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DOI: 10.1119/1.2136472

• ***Albert Einstein's Vision: Remarkable Discoveries That Shaped Modern Science,*** by Barry R. Parker, published by Prometheus Books, Amherst, NY (2004), 286 pp.; ISBN: 1591021863 (hardcover alkaline paper).

Einstein affected more than the scientific world, as his effect on politics and the world at large is made clear through this work.

DOI: 10.1119/1.2136475

• ***Special Relativity: From Einstein to Strings,*** by Patricia M. Schwarz and John H. Schwarz, published by Cambridge University Press, Cambridge, U.K. and New York (2004), xii+376 pp.; ISBN:

and Sam Elworthy, and with a foreword by Roger Penrose, published by Princeton University Press, Princeton, NJ (1998), xv+198 pp., $16.95; ISBN: 0691059381 (paperback, cloth alkaline paper).

Buy this book and study it!

DOI: 10.1119/1.2136477

• ***Relativity: An Introduction to Special and General Relativity*** (3rd ed.), by Hans Stephani, published by Cambridge University Press, New York (2004), xx+396 pp.; ISBN: 0521811856.

The author says "undergraduate," but I claim "graduate" with tensor calculus and Riemannian geometry in their background