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Strategies for the Science Classroom. [Book Review]

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Handbook of College Science Teaching. Eds. Joel J. Mintzes and William H. Leonard. Arlington VA: NSTA Press, 2006, 416 pp., $49.95 (PB), ISBN 978-0-87355-260-8

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Teaching science at the college level can be quite daunting for a novice professor. On the other hand, it can be intimidating for a seasoned professor to deal with the changes in student expectations and behaviors that characterize today's milieu. Millennial students expect and require more than the simple lecture-based curriculum many university science courses offer. *The Handbook of College Science Teaching* can be used effectively by both novice and seasoned professor alike to not only understand their student population better, but to also improve their own approach to instruction, as well as the techniques they use.

The handbook (Mintzes & Leonard, 2006), is separated into eight units, each of which begins with a preface written by the editor that provides background information and a summary of the unit's contents. There are thirty-eight chapters – each written by different authors and including a small biography of the respective author with his or her credentials. Each article also has a substantial list of references and many include tables, graphs, and graphics.

Unit One discusses issues of student motivation. Chapter one begins the book by detailing the research of Jeffrey Mall on science anxiety, a term he introduced to the world (p. 3). He discusses anxiety as it relates to students who are pursuing degrees in the sciences versus those who may be forced to take a science course for a general education credit as well as anxiety based on gender. Mallow also discusses nine practices to use in the classroom to help reduce anxiety including: group work, laboratory exercises, and learning styles (p. 8-9). Chapter two details the research findings of biology professors who changed their introductory courses from a traditional course sequence to one that infuses learning with scenarios, multimedia, field trips, and application of concepts rather than regurgitation (p. 16-17). They detail their research and conclude that overall attitudes towards learning biology were improved due to this style of learning. The final chapter in this section is more of a theoretical discussion of motivation and the sciences and further discusses the

use of questionnaires in assessing student attitudes and motivations. The authors of this chapter discuss the use of their own questionnaire: the Student Motivation Questionnaire (SMQ).

Unit Two details various strategies to engage science students in active learning. The sciences are fortunate because they have a unique situation of requiring laboratory components for their courses. One of the challenges for many science professors is that they are forced to teach in large lecture style classrooms. Chapters four and five address active learning in two ways: experiential learning and interactive lectures, where students can participate in answering questions or in demonstrations during lecture. Chapter six details the importance of allowing undergraduates a chance to participate with professors in research, something this reviewer found to be one of the most rewarding experiences in her undergraduate career. It allows students to make connections between theory and practice as well as see a professor in their element, which is very exciting. Chapters seven and eight discuss specific active learning techniques one of which is concept mapping, which is used in many humanities courses and peer mentoring, and is now being used campuswide at many institutions, especially with first year students. The final two chapters discuss laboratories, which as shown by research in unit one, are an essential part of science learning.

Unit Three includes chapters 11-15 that consider instructor responses to students who have difficulty or resistance to learning, especially when the teachers themselves find no difficulty in understanding the material (p. 108). The chapters focus on a sequence of learning, reasoning and critical thinking skills, and on relating these concepts to coursework. Readers who found Unit Two interesting will most likely find chapter fifteen on active learning relevant. Chapters eleven through fourteen focus more on theories of learning.

Units Four and Five give specific examples of various teaching strategies used by professors in the classroom. Primary literature is often excluded from introductory curriculum in the sciences and chapter sixteen details the uses of biological literature to contribute to learning. Table 16.1 details the various sources used by the author of this chapter to select relevant literature (p.161). Chapter nineteen includes an interdisciplinary approach to general biological education using poetry. For campuses looking for collaborative cross disciplinary interactions this chapter may be of particular interest. Unit Five focuses on the use of technology in the classroom. However, this reviewer cautions when using technology for education it is important to remember that it becomes dated very quickly. The only chapter that probably has longevity is twenty-six which describes an assignment that requires students to investigate and evaluate science information on the internet.

The unique portion of this handbook is Unit Six. This unit speaks to the special challenges of reaching out to specific subsets of students, such as those with learning disabilities, students with knowledge gaps, and students who, although bright, may have difficulty with some concepts. Although useful to anyone in the profession, this section is probably most helpful to the professor who instructs in a large urban university. As a member of such an institution, this reviewer has found an increased number of diverse and learning disabled students, as well as students coming from high school with inadequate background in science preparation, all of whom then struggle to succeed in general credit natural and physical science courses. The chapters in this unit can help increase the ability of science professors to notice the students who may be struggling quietly—as well as learn how to motivate and help them.

For high school teachers and those professors who primarily work with first year college students Unit Seven provides three chapters that outline some of the struggles and solutions to problems that arise

during the high college transition. This unit may help those who are working on partnerships between high schools to align science curricula with the skills necessary to succeed in college courses.

The book concludes with Unit Eight which navigates the process of continually examining and improving instruction. The four chapters in this unit are mostly theoretical. Chapter thirty eight is probably most useful for those who are interested in instruction as it shows how to conduct instructional research and how to use it to improve the classroom.

This handbook provides significant insights into students and science instruction at the college level. Longtime instructors who would like new ideas for the classroom, or those teaching more advanced courses, may find the contents to be of less interest, since many chapters are of a theoretical nature. They may be more interested in Druger, Siebert, and Crow's *Teaching Tips: Innovations in Undergraduate Science Instruction* (2004). But for graduate student teachers or new faculty, *The Handbook of College Science Teaching* would make a great addition to their library.

References

Druger, M., Siebert, E. D., & Crow, L. W. (Eds.). (2004). *Teaching Tips : Innovations in Undergraduate Science Instruction.* Arlington: NSTA, National Science Teachers Association Press.