

Australia, they lead sometimes to a careful re-crafting of curricula. But, will the AQUA take into account what Gallagher terms “some unresolved issues” (p. 47) — most notably “academic workloads rising as pressures to publish, teach, undertake new administrative tasks and raise funds all reduce time for quality thinking” (i.e., thinking which is often the benefit derived by the lone researcher and a couple of students); and the fact that diverse demands for specific flexibly-arranged course content modules may undermine curriculum coherence. For opinions on these and other unresolved issues one needs to turn back to the criticisms of the Senate report mentioned earlier in this review. But Gallagher has produced a valuable report for the scholar interested in comparative education and modes of educational change. Perhaps its most valuable feature, whether or nor intended, lies in the message that postsecondary sectors with decades of heavy reliance on public funding do not shift easily into entrepreneurial mode; and some institutions may derive few benefits from trying to do so.



Taylor, Peter C., Gilmer, Penny J., & Tobin, Kenneth, (Eds). (2002). *Transforming Undergraduate Science Teaching: Social Constructivist Perspectives*. New York, NY: Peter Lang. Pages: xxiv, 481. Price: \$32.95 USD (paper).

Reviewed by Janice Dodd, The University of Manitoba

The current reform movement in science education was undertaken, at least in part, in the hope of improving (American) standings in international measures of math and science proficiency, technological and computer literacy, and economic competitiveness. This capitalist agenda to increase the scientific workforce has had the positive effect of increased funding for research into science education and classroom reform. In many K–12 schools, changes have been introduced that replace memorization of science facts with learner-centered scientific inquiry. However, similar reforms have not filtered

into the undergraduate science classrooms that (re)produce the future science teachers (and scientists).

This new volume in the Counterpoints series is a collection of reports of research projects that address educational reform in the undergraduate science classroom. The researchers are primarily science educators but notably include a number of scientists who identify pedagogy as a critical part of their professional responsibilities as college and university professors of math, physics, chemistry or biology. Several of the projects reported in this collection were funded through the National Science Foundation to improve college and university science teaching, particularly in courses targeted to prospective science schoolteachers. As indicated by the editors, although the discourse community is science educators, the target audience is professors of undergraduate science.

The contributors share the epistemological standpoint of social constructivism. This position claims that science is a social construction and that learners must become part of the discourse community in order to gain mastery over the content. Students are not empty vessels but join their post-secondary education with values, beliefs, experiences, and language. The challenge in science education is to recognize each student's location, and to structure opportunities for them to become co-participants with the professor and each other in the development of a discourse community. The seventeen chapters in this collection include projects that illustrate the current problems in undergraduate science classrooms, and that present examples of effective transformations that facilitate co-participation and learning by students. A useful addition to the Preface is a chart (pp. xii–xv) that allows the browsing reader to identify chapters by author and content including: research method (interpretive ethnography, action research, critical autobiography, participant observation); course (math, physics, chemistry, biochemistry, business computing, science education); issues addressed (power in the classroom, technical language, metaphors, feminist pedagogy, assessments of learning, problem-based learning, team teaching, border crossings); and student population (prospective science teachers, elementary and high school science teachers, liberal arts students, science majors, community college professors).

The editors have placed the chapters into sections entitled: (I) Identifying Barriers; (II) Pushing the Envelope; (III) Potentialities...; (IV) ...Being Realized. These groupings seem forced and are not helpful in identifying the content. Because each chapter reports a separate research project, the barriers, strategies and reflections are part of each contribution. An important addition is the Metalogue by the editors at the end of each chapter. It is in these conversational responses to the projects that issues of research ethics, methodology, and validity are discussed, and theory developed. In the process, the editors model the functioning of a discourse community. An example is the discussion of teaching certification of university professors that follows Chapter 8 (pp. 224–225). This seemingly sensible idea meets with resistance at almost every turn. The introduction of student evaluations of teaching in many postsecondary institutions has spawned the formation of teaching service programs to help professors gain or polish their classroom skills. Nonetheless, in many science and professional faculties at research-intensive universities, the process of hiring new faculty focuses on research productivity and pays little attention to teaching effectiveness. Indeed, in many science disciplines, the opportunity to learn to teach is not part of the either formal doctoral or post-doctoral training.

The book does contain examples of neat classroom tricks for teaching science, but its real value is as a series of reflections by colleagues on their own experiences with innovative science courses. Craig Bowen (Chapter 2) describes the use of a professional development framework to work with scientists to change their use of scientific language and symbols in teaching. Professors are helped to structure the opportunities for students to use the language and symbols appropriately which will enhance their entry into the discourse community. Noelle Griffiths (Chapter 3) examines the recurring theme of border crossings as points of connection between discourse communities. She outlines ways in which teachers can look for the points of connection between the scientific world and students' experiences and language. Hedy Moscovici (Chapter 4) examines how professors can remain the scientific authority while sharing the power in the classroom in order to enable students to be co-participants in scientific inquiry. Kathryn Scantlebury (Chapter 5)

tackles the place of feminist pedagogy in science education and argues for gender-inclusive curriculum projects. She also addresses the potential for marginalization of faculty in the role of science educators in traditional physical science departments. Several contributors detail the work required to develop innovative teaching strategies and the need for recognition of these contributions in promotion and tenure decisions.

Postsecondary institutions often cite the efficiencies of professor-centered lectures for delivery of content as a reason not to embrace educational reform. Harold B. White III (Chapter 9) critiques this resistance and describes his use of problem-based learning, a format widely implemented in medical schools but not often attempted in undergraduate science classes. The managed frustration which students experience helps them develop skills for independent research and collaborative interaction. Kenneth Tobin (Chapter 13) describes his experience with developing internet resources for creating discourse communities for a variety of learners over the past decade. He identifies the early problems, some corrected by advances in technology, others by the re-design of assignments. Although of obvious utility for distance education, the approach also works with on-campus courses. To Tobin's surprise, the internet communications did not duplicate the classroom discussions and a different subset of students were able to express their views on-line. These projects have the added benefit for some mature learners of improving their computer literacy.

Most of the contributors have been frank about the problems encountered in attempting to transform undergraduate teaching. Several stressed the importance of respectful and trusting curriculum committees as part of this process. The availability of funds for research in science education has brought together science professors and educational researchers, in many instances for the first time. Outcomes were most positive when discussions about teaching philosophies and styles were held at the outset. Tensions were most obvious when researchers sought to change classroom dynamics, curriculum content and grading without a thorough examination of teaching values held by their scientist colleagues. Sabitra Brush (Chapter 11) considers the pros and cons of team teaching, while Susan Mattson (Chapter 12) describes the struggle

to adjust assessments of student learning away from completely objective criteria.

Everyone in science education would agree that too many students are turned off of science. If educational transformation from a social constructivist perspective results in schoolteachers who do not fear math and science, and who have experienced a learner-centered classroom, the projects will have succeeded. The question remains however, of the effect of these approaches on courses for science majors and those intending to make their careers in science-based professions (engineering, medicine, dentistry, pharmacy, architecture). If these transformations were broadly applied, would we get a scientific community that is more creative, more connected to society, and more socially responsible?

The last four chapters present quite radical transformations through under-explored research methodologies including Jungian psychology, dream analysis, spiritual reflection and autobiography. It is courageous of the editors to include these contributions that use research approaches outside the discourse most science professors would recognize. As a faculty member in Women's Studies, I have reached a level of comfort with profoundly personal reflections as valid subjects for research; as a member of the scientific community, I am aware that such offerings will be viewed with skepticism. Openness will be required to attempt these border crossings. Perhaps the key lesson from these last chapters is the importance of personal well-being and spiritual grounding (in its broadest sense) in finding the energy to work for and create reform, to be fully attentive to students, and to teach science with passion

