GLEN S. AIKENHEAD. *Science Education for Everyday Life: Evidence-based practice*. London, ON: The Althouse Press (2006). 185 pp. $32.95. (ISBN 0-920354-61-0).

Science Education for Everyday life offers a powerful framework for thinking about the diverse issues impacting the quality and usefulness of science education (as well as education in general). The choices facing educators in science education are characterized in the opening pages through a foundational dichotomy that is used throughout the book as an organizing principle: "pipeline versus humanistic science." Pipeline science is the science curriculum that most of us have been exposed to in secondary education and beyond. The goal of this curriculum is to transmit science's history, conclusions, and methods to students in order to create scientists or like-minded citizens who can understand the problems and solutions society faces. Humanitarian science attempts to develop a student's self-identity within the context of a relevant problem that students address with a variety of tools, including those that science offers. Although these definitions are necessarily brief, Aikenhead devotes much of the first chapter to mapping out the differences between these two perspectives in order to highlight the failure of pipeline science and the potential of humanistic science education.

Aikenhead invites the reader to evaluate the humanistic approach through evidence rather than through philosophical or political argumentation. With nearly 40 pages of references, Aikenhead's documents the failure of pipeline science and the importance of replacing this traditional program with a humanitarian curriculum in science education. The book is succinct. In eight chapters and 136 pages, the author quickly identifies major themes, and then upon the weight of the references he sets out to tip the balance towards a humanitarian perspective.

Pipeline versus humanistic science is the first of several dichotomies that Aikenhead uses to consider how major factors such as "curriculum policy," "classroom materials," "teacher orientation" and "student learning" impact the implementation of a humanitarian science curriculum. In the introductory chapter a second critical dichotomy focuses on the importance and perspective of the student. This dichotomy is the outcome of two opposing political positions that emerged in the 19th century in response to Spencer's (1859) question, "what knowledge is of most worth?" At one extreme, policy-makers value empirically tested approaches to evaluate what is best for students, while at the other extreme policy-makers often ignore research in order to meet or sustain political realities. However, out of this tension emerges a key goal for the author as well as the focus of humanitarian science – science education should develop the student's self-identity.

Each chapter reviews the literature and evidence that supports the humanistic

perspective. This quest begins in earnest in the second chapter with a "short history of humanistic science." Here we encounter a third dichotomy that ultimately leads to overarching distinction between pipeline and humanitarian science: "Takers and Leavers." While Takers focus on how earth's natural resources can serve personal ends, Leavers focus on how to live in harmony with the available resources. From this tension emerges a more familiar tension in science: "indigenous versus Western science." Here the major distinction is that in the indigenous sciences, knowledge is intimately intertwined in one's culture and is essentially inseparable from the individual's way of life. Western science, in contrast, is a knowledge system that allows those who follow this philosophy to exercise "power and dominion over nature."

Although the historical basis of this view is succinctly explored, the legacy of Western science feels unbalanced in its characterization. Even though I am a product of a Western science education program and an advocate of humanitarian science, a more balanced view would leave the reader with a less negative perspective of Western science and scientists, and as a result, more open to the ideas in the book. The risk of using opposing positions to organize the book's main points is to leave some readers in a defensive position.

Aikenhead does recognize the challenge (and risks) in using dichotomies because the success of humanistic science rests on paying attention to the student's perspective. The task of the author, as well as any humanistic educator, is in crafting an interaction that respectfully recognizes a student's perspective and providing the content and experience that allows him or her to build upon his or her foundation. Even though Aikenhead aptly demonstrates the value of the humanistic approach, more attention to the reader's background would help support the transition from traditional to humanistic science.

Even though I find, like the author, that dichotomies do provide descriptive opposites that help organize ideas around easily recognizable positions, at times I wondered if the two ideologies had not become too stereotyped to be credible. At the close of the second chapter, we are left with the following synopsis of pipeline and humanistic science: "a humanistic perspective that promotes practical utility, human values, and a connectedness with societal events to achieve inclusiveness and a student orientation, versus a traditional perspective that promotes professional science associations, the rigors of mental training, and academic screening to achieve exclusiveness and a scientist orientation" (p. 22). Although the positions that individual educators might take would fit better along a continuum between the positions, Aikenhead walks a tightrope between aiming for succinctness while potentially leaving readers wondering how to relate to either position.

The argument does become more nuanced in the third chapter, which focuses on curriculum policy. This chapter offers readers several important perspectives. The first emerges at the end of a short tour of the "major failures of the traditional science curriculum." This issue is fundamental to all educators and one that focuses on the student's perspective: "What goal is the student attending to?" Most curricula focus on the goals of the discipline, the curriculum, and/or the teacher. Comparatively speaking, education rarely focuses on the perspective of students, who are trying to identify the *problem* for which the lecture, the homework, the lab, the test and the textbook are *solutions*. Consequently, many students are left in one of several difficult positions: trying to figure out what the teacher wants and reproducing what is expected; failing that, inventing alternative goals (which can be disruptive); or, failing that, abandoning school (which may underscore the declining enrolments that Aikenhead highlights as the first major failure of pipeline science). Students who succeed at the first option understand how to decipher the implicit expectations of the curriculum and the teacher. According to Aikenhead, these students are using "Fatima's rules." Fatima is a student who understands that to succeed one must remember two rules: "rote memorization and going through the motions of learning without being intellectually engaged" (p. 28). You may recognize this strategy from Holt's (1964) book, *How Children Fail*. Holt asks one of his second grade students a math question, and she responds by closely watching her teacher while producing a number of different answers. Holt is left wondering why she is staring at him so intently; the answer isn't written on his forehead. Upon further reflection he realizes that the answer is on his forehead. This student at an early age had already recognized that the way to succeed is to guess what the teacher wants and to reproduce it upon command. As a strategy for success in pipeline science (and traditional education in general), Fatima's rules are essential and re-appear throughout the book as a relevant option for students.

In the second half of the third chapter, Aikenhead explores the nature of science programs. As a new perspective on science education, he offers the reader seven types of programs that are distinguished from each other on the basis of relevance. The fundamental question is, "To whom is the science relevant – scientists, the general public, people in science-related occupations, the media, experts, students, or sociologists?" Each answer provides a different framework for organizing science curricula. These seven types of relevance reappear in the following chapters as a means to elaborate on the answers to three implicit questions in any educational program: who develops the curriculum, how is it taught, and what is learned? In other terms, these are "the intended, the taught and the learned curricula" (p. 7).

The three curricula are treated as separate chapters to further develop the importance of the actors (i.e., curriculum planners, teachers, and students)

that are central to each curriculum. Aikenhead maps out the tensions that each group faces in either maintaining the pipeline ideology, transitioning to a humanistic ideology, or preserving humanistic science in classrooms and/or schools. The tensions are treated carefully as interacting factors in a dynamic enterprise that include many players, positions, and goals.

As I finished reading the book, I wondered about the book's intended audience. Who will read the book and what will they gain? As a fellow researcher I found the synthesis of perspectives useful in thinking about the history and agenda of the traditional and humanistic movement in science. As a former high school teacher, I probably would have been unaffected, not so much because I agree or disagree with points raised in the book, but because it is not clear how I could take action in my context. Even though supporting teachers in making this transition is a central issue to a "Teacher's Orientation" (chapter 5), Aikenhead still concludes that most teachers simply do not have the time to do more than address problems in ways that seem best to them in their present situation. In essence, teachers are facing the same problem as their students: if the goal is not learn science as they did, then what is the goal and how should they take action? Just as a student's self-identity is central to a curriculum success, curricular reform depends on a teacher's self-identity. In the absence of a clearly defined target that allows teachers to recognize what they are aiming at, they can justify any strategy they are using. As a former member of an administrative team in a K-12 district in the United States, I would agree with Aikenhead's assessment that administrators are addressing so many different political agendas and daily realities that changing the direction and momentum of the district's policy would be unrealistic. Administrators can easily fall into the dangerous situation of choosing goals that only they recognize and strategies (to reach those goals) that only they can justify.

Change requires not only a vision, but the ability and means to take action. Aikenhead might consider a sequel demonstrating how teachers, curriculum planners, and administrators can take action in order to empower students. As Aikenhead notes, "Changing personal deep-seated ideas about humanistic and science content often requires much more than a methods course; it takes a whole university" (p. 77). I suspect that Aikenhead would agree that it takes even more than a university. Each party needs to be able to recognize how they can respond to the problem Aikenhead raises, which is that traditional science curriculum has lost its relevancy for everyone except those teaching and evaluating science. The issue for all concerned is how to organize this change. This path is not clear to me; however, like most dynamic problems, the path is created by interested and committed individuals, which Aikenhead clearly is.

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