TÜRK FEN EĞİTİMİ DERGİSİ
Yıl 8, Sayı 4, Aralık 2011

Journal of
TURKISH SCIENCE EDUCATION
Volume 8, Issue 4, December 2011

http://www.tused.org

BOOK REVIEW

Looking to the Future: Building a Curriculum for Social Activism		
Authors	**Publication Year:**	2011
Derek Hodson	**ISBN:**	978-94-6091-470-6
	Edition Number:	First
	Publishing Company and Address:	Sense Publishers: Rotterdam, The Netherlands
	Distributed by:	Sense Publishers: Rotterdam, The Netherlands

Donovan A. McFarlane[1]

[1] Chief Academic Officer and Director, The Donovan Society LLC, USA

Received: 28.06.2011 **Revised:** 15.10.2011 **Accepted:** 16.10.2011

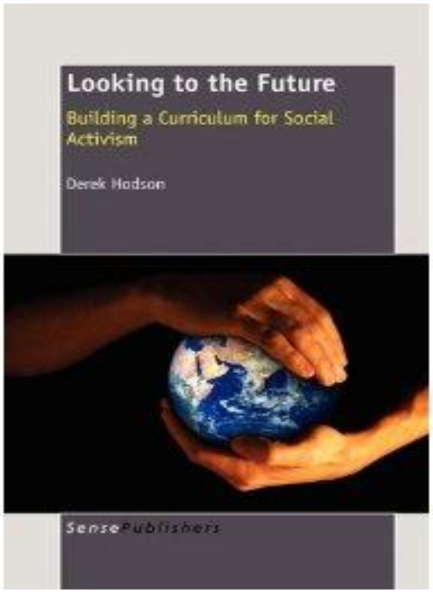
The original language of article is English (v.8, n.4, December 2011, pp.215-226)

GENERAL INTRODUCTION

Science education has become increasingly important as a result of dramatic changes and developments occurring not only in technology, but the proliferation of environmental movements, significant attention to pro-environmental behaviors and influences on living standards, economic growth and well-being, and the general physical environment (Kollmus & Agyeman, 2002; Nordlund & Garvill, 2002). Furthermore, studies and assertions concerning the economic global impact of science education as reflected in associated technological literacy, scientific literacy, and environmental literacy as interrelated and defining factors constituting competitiveness among nations have presented strong evidences and rationale for increased attention to science education via curriculum development and

Corresponding Author email: don_anthoni@yahoo.com

implementation (Hanushek & Woessmann, 2007). Additionally, the impact of changed environmental politics and natural occurrences including disasters on human life and cultures across the globe has brought increased awareness to individuals of the legitimate scientific relationships between human activities and environment, thereby making citizenship education in science more viable and respected as a public need of many societies. These, among other factors, have created opportunities for transformative intellectual aspirations in science education (Hodson, 2011; 2003), and have significantly cemented the rationale for scientific knowledge as indispensable to learning science, learning about science, doing science and applying scientific knowledge to social and political actions at all levels. As Hodson (2011) notes, scientific literacy is becoming "increasingly prominent in international debate about science education" (p. 1), and this reflects "a trend mirrored by a similarly expanding interest in technological literacy and environmental literacy" (p. 1).



Looking to the Future: Science Education and Socioscientific Issues

Scientific literacy as described in *Looking to the Future*: *Building a Curriculum for Social Activism* has become more obvious as a result of the above developments. Scientific literacy conceived of as perceived benefits of science, benefits to individuals, and benefits to society as a whole (Hodson, 2011, p.2), requires understanding these changes and developing and implementing science education programs and curriculum to respond and adapt to them. Hodson provides us with the major elements of science education as the basis for building such a curriculum: (a) learning science: acquiring and developing conceptual and theoretical knowledge; (b) learning about science: developing an understanding of the nature and methods of science, appreciation of its history and development, awareness of the complex interactions among science, technology, society and environment, and sensitivity to the personal, social and ethical implications of particular technologies; (c) doing science: engaging in and developing expertise in scientific inquiry and problem solving, and developing confidence in tackling a wide range of "real world" tasks and problems; and (d) engaging in sociopolitical action: acquiring (through guided participation) the capacity and commitment to take appropriate, responsible and effective action on science/technology-related matters of social, economic, environmental and moral ethical concern (Hodson, 2011, p. ix; Hodson, 2003). Chapter 1 of Hodson's *Looking to the Future* revisits scientific literacy as the basis for understanding the theoretical, philosophical, methodological and pedagogical ideas and assumptions underlying science education. Hodson demonstrates how these have changed to embrace the present environment where science has become an imperative such that a public understanding of science is necessary.

The introductory paragraph of this review presents several challenges that have brought more serious attention to science education and scientific knowledge and literacy. Primary among these is the need to confront socioscientific issues (SSI) as individuals and groups. We must apply our knowledge of and about science to address and resolve past, contemporary and emerging or future problems that naturally and inextricably link humans and their environments. Chapter 2 of *Looking to the Future* provides several strategies for confronting socioscientific issues (SSI), and Hodson views SSI as an effective way of learning science and acquiring scientific knowledge. In order to achieve this, Hodson proposes and recommends a 3-Phase Approach consisting of the following components: (1) modeling: science teachers should approach teaching science by demonstrating and explaining the desired or appropriate approach to students; (2) guided practice: teachers should provide help and support to students as they perform specified and assigned tasks in the science classroom; and (3) application: teachers should develop lessons and approaches in which students are taught and equipped to perform independently of the teacher in assigned tasks and projects in science. There are several assumptions behind Hodson's 3-Phase Approach to science education. One of these assumptions is that careful observation of someone skilled in scientific approach or methods by the students will facilitate the learning of successful strategies for addressing socioscientific issues (SSI). A second assumption is that when students work through a carefully sequence program of investigative exercises with the teacher acting as learning resource, facilitator, critic and consultant, students will become more skillful and confident in their ability to address and confront socioscientific issues through practice and experience, and the evaluated feedback provided by their science teacher, as well as from insights and understanding gain from inter-group criticism and discussion and from intra-group reflection and activities. Hodson views this as very important in the scientific teaching and learning process because students are no longer passive learners, but have become co-investigators and are able to ask questions, contribute their ideas and make criticisms, as well as lend support; they become skilled in scientific debate. The final assumption is that assisted performance resulting from phase 2 (guided practice), in time, enables students to use and apply their own understanding and knowledge of science in addressing new socioscientific issues (SSI), as well as in building and developing new understanding (Hodson, 2011). Additionally, Hodson advocates a "Personalized Approach" to science education, which he describes as "attending to the particular needs, interests, experiences, aspirations and values of every learner, and to the affective and social dimensions of learning environments" (p. 35). This, according to Hodson, is necessary because the acquisition of scientific knowledge by students becomes better facilitated when the teachers' perspectives are viewing "*science-as-culture*" and its value as "functional science" (p. 37).

Hodson believes that scientific reporting with regard to instruction and students' learning and knowledge must involve "*evidentiary competence*" (p. 39) and its components as postulated by Jeong, Songer, and Lee (2007): identification of data relevant to the investigation, understanding of dependent and independent variables, choice of appropriate sample size and design of fair tests [planning stage], need for objectivity and accuracy in data collection, establishment of reliability through successive replication [data collection stage], the ability to interpret graphs and tables of data, how to code data in these ways, and how to deal with anomalous data [interpretation stage]. Science educators or teachers must bear in mind the approaches they apply in teaching about the nature of (NOS). There are two major approaches presented by Hodson: explicit approach and implicit approach. According to Hodson (2011), the explicit approach regards the understanding of the nature of science (NOS) as content which must be approached both carefully and systematically and entails understanding that students will not simply develop knowledge of the nature of science (NOS) as a result of their engagement in learning activities. This approach is regarded as more effective than an implicit approach, which fosters less sophisticated conceptions of the nature of science (NOS) among students as it lacks conceptual tools that facilitate thinking and reflection about activities in which students are engaged in understanding the nature of science (NOS). Furthermore, Hodson believes that students' understanding of the nature of technology (NOT), and practical knowledge for action based on the idea that, "knowledge requirements are not restricted to science and the nature of science or nature of technology" (p. 42), are essential in developing and implementing effective science teaching strategies.

In order to teach students how to effectively confront socioscientific issues (SSI), the new curriculum in science education and new science programs should be based on fostering and understanding that "Science is a creative, collaborative and culturally embedded activity…" (p. 110). This provides rationale for students to fully participate actively in learning science and learning about science, and in doing science by engaging in sociopolitical activities. In chapter 4 of *Looking to the Future,* Hodson examines the "Constitutive Values of Science" which place the subject into the spotlight or fullness of vision. Hodson believes that there are four prevailing perspectives that stand out as paramount concepts in our understanding of the nature of science (NOS) and the confrontation of socioscientific issues (SSI): (a) universalism – science is universal because evaluation of knowledge claims in science uses objective, rational and impersonal criteria rather than criteria based on personal, national or political interests, and is independent of the particular scientists involved. Furthermore, science is universal because it is a community open to all regardless of race and other factors; (b) commonality – science is a cooperative endeavor and the knowledge it generates is publicly owned as scientists are required to act in the common good and required to publish findings and methods to share with all; (c) disinterestedness – science represents a search for truth simply for the sake of finding truth, and as such, is free from economic, political and social motivation or strictures; and (d) organized skepticism – all scientific knowledge and their methods are subject to rigorous scrutiny by the community of scientists who abide by clearly established procedures (pp. 11-112). Hodson believes that it is important to develop a "*personal framework of understanding*" or "contextual values" (p. 115) in science education: teaching and learning, as this affects individual scientific views and science as a social activity involving investigations.

The spotlight on science has created more opportunities and calls for focusing on science education, and in Chapter 5 of *Looking to the Future,* Hodson argues that the values that impregnate science education should be seen as essential in the affirmation of the need for scientific knowledge and literacy in our society, and that such values should be projected through schools' science curriculum. Hodson believes that science education curriculum should contain values derived from three major sources: (i) science values, (ii) education values, and (iii) values of the surrounding society (p. 137). In developing an effective science curriculum, it is important to ask four major questions: (1) what values are included? (ii) whose values are included? (iii) whose values are excluded? and (iv) what should be made *explicit* and what should remain implicit? (pp. 137-138). Reflecting on the connections between education and economic growth (Hanushek & Woessmann, 2007), Hodson argues that there is a decisively "Consumerist Agenda" characterizing the approach to science education and impacting the answers to the above four major questions. According to Hodson (2011) science plays an important role in promoting economic growth and technological development, and these in turn act as drivers of science education and science programs in terms of contents and methodologies and strategies applied in the teaching of science. Several concepts prevalent in the approach to science education as presented by Bencze (2001) include compartmentalization, standardization, intensification, idealization, regulation, saturation, and isolation, and these impact the teaching or planned curriculum for science education, and the methods and process of acquiring and applying scientific knowledge or literacy. Hodson believes that technological literacy and technology should be directed in ways that benefit the goals of scientific literacy.

Teachers of science or science educators in the 21st century, especially those engaged in curriculum planning and implementation must focus specifically on three criteria for success: strategies, responsibilities and outcomes (Hodson, 2011). Chapter 6 of *Looking to the Future*, "Strategies, Responsibilities and Outcomes" discusses several approaches to teaching science, identifies several resources to enhance scientific knowledge and understanding, and focuses on the roles of multimedia and Internet-based activities in developing a curriculum to focus on SSI. Three important strategies in science education to which Hodson devotes much attention in the chapter are (1) discussion, (2) debate, and (3) group work. Discussion, debate, and group work are active learning strategies that engage students as co-investigators in learning about science, learning science, doing science and applying scientific knowledge to sociopolitical actions. Hodson criticizes the traditional approach to discussion as being non-conducive to the exploration of ideas and engagement in criticism and argument which the socioscientific issues (SSI) approach to teaching and learning science demands. In presenting these three important strategies: discussion, debate and group work, Hodson communicates that their importance is seen in how talk contributes to learning facts and acquiring knowledge. There are several kinds of talks that these methods employ in the science classroom or science education: exploratory and presentational talk (Barnes, 1988), and disputational, cumulative, and exploratory talks (Mercer, 1995, 2000). Exploratory talk involves talk which allows students to articulate, consider and reorganize their ideas as they listen to themselves thinking (Thier & Daviss, 2002). Presentational talk allows students to report to others formally what they currently understand about science methods and knowledge and what they have learned (Hodson, 2011). Disputational talk involves an exchange of opposing views wherein disagreements are emphasized, while in cumulative talk students strive to build positively but uncritically on what their colleagues have said (Mercer, 1995, 2000). Mercer's definition of exploratory talks in the science classroom involves talks where students engage critically with each other and exercise support for each other by collaboratively reconstructing ideas (Hodson, 2011). Kim and Song (2006) provide four stages of group discussion which Hodson thinks are critical to science teaching strategies: focusing, exchanging, debating, and closing. Teachers are responsible for establishing the focus for discussion in their science classrooms and must equip students to exchange information, to define gaps in their knowledge and to seek to establish appropriate frames of reference. Students must also be taught how to skillfully criticize the views of others and how to respond respectfully and rationally to criticisms of their own ideas. Finally, Kim and Song (2006) argue that teachers have a responsibility to teach their science students how to reach effective and explicit closure in discussions. Hodson argues that there is evidence that "SSI-oriented teaching promotes conceptual understanding" (p. 176), and looks at several problems, difficulties and anxieties that teachers face in planning science curriculum and education. These include lack of expertise, self-efficacy issues, lack of job satisfaction, loss of experienced teachers from the profession, lack of time to plan lessons and prepare materials, social, economic and moral-ethical dilemmas and concerns, difficulties associated with design and assessment of evaluation strategies, among other factors.

An important consideration underlying the strategies, responsibilities, and outcomes of science curriculum and program planning and implementation, and the teaching of science, is ethics. Hodson sees the teaching of ethics as very instrumental to scientific literacy. Because modern science education is highly entrenched in confronting socioscientific issues (SSI), approaches or methods of teaching science, or science curriculum and programs must have components that deal with ethics. As Hodson (2011) notes in chapter 7 of *Looking to the*

Future, “almost any discussion of a topical SSI is likely to raise questions about what is the *right* decision and what *ought* we to do?” (p. 195). Hodson provides examples of several contemporary topics and issues in science which demand asking several ethics-based questions and argues that many SSI issues as Conway (2000) demonstrates, put value on one kind of person at the expense of another, and this inherently constitutes ethical issues. Ethics-related issues dominate new scientific developments and policy decisions today, and range from human to non-human concerns, and students must be appropriately educated to be able to understand and contribute to the discussion of these issues as they are relevant stakeholders, and many times these issues directly involve them as a group in the education system. Human health issues and rights are among some of the prominent issues in ethical science debates. For example, advances in genetics and stem cell research and the definition of what constitutes human life have become important issues of focus where SSI topics are concerned in modern science education. Several ethical theories with implications for scientific modeling, guided practice, and application are presented: social construct (contract) theory, consequentialists-utilitarian theory, deontological ethics, virtue ethics, and the meaning of right and unacceptable as used in science research and education. Social construct theory or social contract theory is explored as especially important where application of scientific knowledge for social and political actions or pro-environmental behaviors are concerned as it specifically deals with positions of individuals related to understanding of harmful and hurtful actions and behaviors. Consequentialist theories of ethics in science education allow students to understand consequences of particular actions based in scientific knowledge and its applications. Deontological ethics concerns itself with actions that can be judged as right or wrong regardless of consequences, while virtue ethics with its origin in the writings of Plato and Aristotle, attempts to answer the question: “what would a good person do in a particular situation?” (Hodson, 2011, p. 201). Hodson answers the question of why and how to teach ethics in science by arguing that scientific practice has its own code of ethics and scientific literacy demands that students must be educated on this and act in accordance when conducting their own science research or experiments.

Hodson presents a plethora of issues and activities in science which require ethical conduct and argues that students must be taught the importance of science’s objective methods and trust, which is the bedrock of the scientific enterprise. According to Hodson (2011), students must be implored to “trust in the moral-ethical values that underpin the identification of research priorities and daily conduct of scientists” (p. 210). Moreover, ethical responsibility must be taught as part of scientific values. Several approaches to teaching professional ethics in science include the use of case studies, formal course, and “the ethics moments” which deals with issues as they arise (Kovac, 1999). Hodson agrees with Davis (1999) and Reiss (1999) who argue that ethics is essential in science curriculum and education because it: (i) raises ethical sensitivity by helping students to recognize previously ‘invisible’ moral-ethical issues in daily life; (ii) increases ethical knowledge by providing students with the intellectual resources to recognize relationships existing among interests, obligations, rights and duties; (iii) improves ethical judgment by providing students with experiences and events that help them to reach ethically defensible decisions and actions; and (iv) fosters ethical conduct by equipping students with the knowledge, skills, attitudes and experiences that lead to sound ethical behaviors and actions (Hodson, 2011, p. 213). Science education must equip students by developing in them moral sensitivity, moral reasoning, moral commitment and moral courage to act and think in acceptable and reasonable ethical ways (Rest, 1986). It is the responsibility of science educators to devise strategies to teach students of science in ways where they will ethically apply their knowledge for the best outcomes under all circumstances.

Science education in the 21st century is overwhelmed with environmental issues which the student of science must confront in dealing with other socioscientific issues (SSI). Hodson believes that the extent and seriousness of environmental issues that we face have created a paradigm shift in science education focus where a more integrative approach embracing science literacy, technology literacy and environmental literacy is the predominant model of science education. Curriculum planners and science educators must bear this in mind and understand this relationship; understand this intricate balance in order to effectively educate their pupils in accordance with the need for a public understanding of science. Chapter 8 of Hodson's *Looking to the Future* focuses on "Confronting Environmental Issues". Hodson believes that citizens remain "blissfully unaware of the extent of the problems" (p. 223) associated with the environment in which we live, play, work, and learn and in which we must survive. He presents several barriers to effective environmental education as part of the science agenda or curriculum as identified by Orr (1994): unwillingness to accept that science and technology cannot solve our problems, the lack of biophilic imagination, and being comfortable with the ugliness or that which is, rather than trying to bring about what should or ought to be. Science education without education about the environment is not practical or possible, because we interdependently exist with so many aspects of nature.

Hodson recommends that teachers should start with students' existing knowledge or their particular conceptions of the environment as bound in values and culture and then proceed to more sophisticated views of the environment. In doing so, Hodson points out that the science teacher's role will sometimes include helping students to overcome biophobic attitudes and perceptions that prevent them from developing a more intimate and broader picture of environment relative to our own survival and existence. Teachers and educators of science must also deal with denials that prevent environmental science education from taking effect. These denials may range from denial of outcome severity and denial of stakeholder inclusion to denial of self-involvement; three kinds of denials identified by Opotow and Weiss (2000). According to Hodson (2011), "To enable students to address environmental issues carefully and critically, teachers need to help students build their self-esteem and foster their feelings of empowerment" (p. 232). This is very important because empowerment is critical in engaging scientific knowledge to address sociopolitical actions or for social activism. Hodson believes that curricular activities are slowly shifting toward environment in science education and the adoption of a more ecocentric view of environmental issues as evident in ecocentricity practices of sustainability across many schools and colleges. Ecocentricity can be defined as:

> a high regard for nature; respect for the natural and social limits to growth; empathy with other species, other people and future generations; support for careful planning in order to minimize threats to nature and the quality of life; and a desire for change in the way most societies conduct their economic and political affairs (p. 4).

Behaviors that seek to minimize the negative impact of individuals' actions on the natural and built world – pro-environmental behavior (Kollmus & Agyeman, 2002) must become an important aspect of what teachers teach in their science curriculum and classrooms. Hodson believes that in order to achieve a delicate balance between the application of scientific knowledge and the preservation of environment, we should teach the environment as a social rather than as a physical construct, and in doing so, should engage in education for sustainable citizenship, which is part of Devall and Sessions' deep ecology construct. Deep ecology encompasses consideration about: (i) the well-being and flourishing of all lives on earth, human and non-human; (ii) understanding that the richness and diversity of life forms contribute to the realization of such values; (iii) humans have no right to reduce this diversity;

(iv) human life and culture must be adjusted to encompass smaller populations; (v) present human interference with the non-human world is excessive; (vi) policies that affect economic, technological and ideological structures must be change; and (vii) those who understand and subscribe to these values and believes are obligated to implement change (Devall & Sessions, 1985). Science educators have a responsibility in educating their pupils to understand the fundamental interdependence of all phenomena and individuals and societies as part of a deep ecology conception (Capra, 1996).

Scientific knowledge, science literacy and their application must take place in places and communities, and our collective actions affect each other and the environment. This is communicated in chapter 9 of Hodson's *Looking to Future*, and represents an important consideration in developing and implementing science education programs. Teachers of science must remember the rationale of scientific literacy: benefits to individuals, and benefits to society as a whole, and that these benefits exist in various contexts, small and large, and impact human and non-human lives and well-beings. Teachers must therefore consider developing a sense of place when planning curriculum and teaching strategies as students need a context in which to apply ethically-sound scientific principles, knowledge and practices. According to Hodson (2011), a sense of place means "focusing learning on the immediate community in which students live, seeking out local resources, focusing on local issues and helping students learn how to ask and answer questions about the phenomena and events that surround them" (pp. 271-272). Bowers (2001) describes this as part of a strategy or approach of promoting "pedagogy that strengthens the local traditions of intergenerational knowledge, skills, and patterns of mutual support that enable members of a community" (p. 9) to recognize interdependence. Hodson believes that teachers should constantly strive to broader students' conceptions of the environment and their roles and responsibilities in the environment. Hodson also believes that teachers should actively prepare their science students for activism by equipping them with appropriate scientific knowledge, and the right attitudes and values to be productive and contributing rather than dysfunctional and destructive members of their communities or society. This involves placing importance on political literacy as it affects and influences science literacy and environmental literacy and actions. Most important, as have plagued numerous generations with regard to application of scientific knowledge and environmental lessons, Hodson impresses upon science educators the need to cultivate within their pupils, the importance of learning from others; learning from both their errors and right decisions with regard to consequences for individuals, non-humans, and the environment.

Building a Curriculum for Social Activism

Chapter 3 of Hodson's *Looking to the Future* was reserved for this section because it ties together all the philosophical, theoretical, practical and methodological strategies and recommendations, ideas and propositions together in "Building Curriculum" for social activism; essentially, building a curriculum that encourages and fosters the development of scientific literacy for positive sociopolitical changes that will impact humans and the environment. Equipped with better understanding of the issues discussed in the above chapters, the reader can better understand and appreciate the challenges and how much consideration and what factors need to go into building a coherent curriculum for change. Hodson believes that the focus in curriculum building for social activism should include fostering and developing scientific literacy or science literacy, technology or technological literacy, and environmental literacy simultaneously and interactively. According to Hodson (2011):

> science and technology education has the responsibility of educating students about the complex but intimate relationships among the technological products we consume, the processes that produce them, the values that underpin our needs and wishes to acquire them, and the biosphere that sustains them (p. 71).

Hodson goes on to discuss the responsibility of science and technology education in presenting students with moral-ethical dilemmas and the responsibility of helping students to confront a variety of socioscientific issues (SSI) rationally, critically, vigorously, fearlessly, and confidently, and how to argue and appropriately persuade others on their views. Additionally, it has the responsibility of motivating and enabling students to express their views and ideas and challenge existing assumptions and present their own, and to motivate and enable students to question beliefs, attitudes and values including their own (Hodson, 2011). These considerations; the action-oriented outcomes-basis of scientific literacy must be effectively integrated into curriculum building at all levels of schools and methodologically taught to students. Most importantly, Hodson argues that science and technology education should equip students with sociopolitical skills to take appropriate actions in addressing the various issues which they must confront daily. Building a curriculum in science for social activism requires educational planners to integrate citizenship education which teaches the pro-environmental behaviors of Kollmus and Agyeman (2002) and the deep ecology and interdependent ideals of Devall and Sessions (1985) and Capra (1996).

Hodson (2011) proposes an issues-based curriculum for social activism, which consists of what he calls "four levels of sophistication": (a) *Level 1* – Appreciating the societal impact of scientific and technological change, and recognizing that science and technology are, to an extent, culturally determined; (b) *Level 2* – Recognizing that decisions about scientific and technological development are taken in pursuit of particular interests, and that benefits accruing to some may be at the expense of others. Recognizing that scientific and technological development are inextricably linked with distribution of wealth and power; (c) *Level 3* – Developing one's own views and establishing one's own underlying value positions; and (d) *Level 4* – Preparing for and taking action on socioscientific and environmental issues (p. 78). These are viable columns on which to build a science education curriculum for social activism as students are equipped with both the understanding of science and its interrelated roles and responsibilities in various contexts. Hodson discusses the roles of thoughts, values, and aspirations in relation to the status quo of society and science education and literacy. He believes that it is important that science curriculum give students a full grasp of the understanding they need to examine science's struggles against social and political norms to assert a more dominant place in individual and societal worldviews.

In describing the struggle between science and societal values that affect perceptions of the value of science and what goes into building a curriculum for social activism, Hodson presents two sides to this struggle. The first side consists of those individuals and groups "who seek to maintain science education's current preoccupation with abstract, theoretical knowledge and with pre-professional preparation courses" and the second side consists of those "who regard the reformulation of science education in terms of more overtly political goals as undesirable" (p. 74). Students must come to understand how their knowledge of science and their understanding of, and confrontation of socioscientific and environmental issues affect both sides. According to Hodson (2011) the new curriculum for science education should be one which "aims to encourage and support students to ask awkward questions, formulate an alternative view of what is desirable, and work towards changing the status quo, both within and between societies" (p. 75). This invariably leads into Hodson's discussion of democracy and citizenship education in science curriculum, and the roles of priorities, interests, values and social justice as perceived by various interest groups and stakeholders of science education to impact the development and implementation of a curriculum for social activism. Finally, Hodson believes that a coherent curriculum should involve and integrate key issues that are common to individuals and societies and which become the SSI that we face daily: human health; land, water and mineral resources; food and agriculture; energy resources; industry; IT and transportation; and ethics, etc.

The final chapter of *Looking to the Future*, Chapter 10, “Making It Happen” was also reserved for this section of this review essay because it represents Hodson’s final call to leaders, policymakers, scientists, environmental activists, curriculum planners and teachers to recognize the challenges and problems we face and the roles and responsibility of effective and well-developed scientific literacy in understanding and addressing these problems and challenges. Using Hodson’s 3-Phase Approach: the principles of modeling, guided practice, and application; activism should become universal in our public understanding of the role of science as an applied field of study as we strive to bolster efforts and performance in learning science and using it to our advantage, the advantage of non-humans and the physical environment conceived of as a social construct. This is what Hodson meant when he referred to teachers and educators of science becoming “transformative intellectuals” (p. 302); they must seek to develop and apply new paradigms that capture the best of all philosophies, theories, ideas, recommendations and proposals, and impart scientific knowledge innovatively to equip individuals and society to respond appropriate and wisely to changes. Building a curriculum for social activism entails understanding science by learning about science, learning science, doing science and engaging sociopolitical action based on scientific knowledge to create a better life for now and the future we look towards.

The Future of Science Education

At the writing of *Looking to the Future: Building a Curriculum for Social Activism*, Derek Hodson was Emeritus Professor of Science Education at the Ontario Institute for Studies in Education (University of Toronto), Adjunct Professor of Science at the University of Auckland, and Visiting professor of Science at the University of Hong Kong. Hodson’s writing and versatility on science education and literacy issues no doubt correspond with his illustrious offices and merits as a scholar at the apex of his field. Professor Hodson’s proposals and ideas concerning science education and curriculum seem to be just what nations like the United States and others need as they are currently finding it difficult to match up to the scientific literacy levels of their counterparts. Reading through the preface and ten chapters of this book would lead most scholars to conclude that Hodson has not held back anything in this volume. This publication represents a capstone of his publications as it is rich in every aspect of quality scholarly work – from the language of science and intellect to the diversity of theories and constructs, this book in science education is at the top of science education literature. One of the most notable characteristic of this book is the application of the same principles and ideals advocated in building a robust science curriculum, applied in the laying out its chapters, discussions, and propositions.

Hodson clearly understands what needs to be done and what is at stake, and alludes with vibrant urgency to the issues and challenges we face because of failure to foster an appreciable and reasonable public understanding of science, failure to educate ourselves in scientific knowledge and principles, and failure to recognize the interrelationships between science literacy, technological literacy and environmental literacy in terms of a social construct that would place us in a position of responsibility. We still fail by wide and far to see that “Many of today’s environmental problems are, at least to some extent, direct or indirect consequences of people’s everyday behaviors (Nordlund & Garvill, 2002, p. 740). The new science curriculum which requires us to examine ourselves and take a personalized approach to science education will allow us to understand this more as we better understand our place in the scheme of things, recognize science as culture, and see science as extremely functional.

The future of science education rests with our actions and appreciation of the subject matters of science today, how much we learn and the ways in which we apply our knowledge of science in meeting our needs and wants, and the consequential impact on the environment and people, things, non-humans and places around us. “Looking to the Future” is not an empty phrase, but a directionality of purpose as Hodson is pointing us in the direction where we must equip ourselves to go, and we will only reach there by understanding who we are and our roles and responsibilities in the grand scheme of things. As we “Look to the Future” we must come to recognize the power of science to shape the road or path we will travel, and our actions and behaviors today are what shape that road or path. It is the responsibility of teachers of science, science administrators, and governments to recognize the value and importance of science to progress and well-being, and therefore, they must endeavor to create better opportunities for science literacy. Science education should equip students with the skills, knowledge, attitudes and values that will allow them to effectively confront socioscientific issues, which Hodson argues, are often very complex and sometimes very ill-defined and affect our lives as citizens in an increasingly volatile environment and technological world. An action-oriented and issues-based curriculum is just the right prescription for science education as our problems and the challenges we face in our world change and increase daily.

This book is a very formidable volume on science education and should prove equally interesting and valuable to practitioners and non-practitioners alike. It traverses the entire terrain of knowledge and constructs in the field in one way or another, and it communicates the author’s adeptness in the subject. Universities and colleges of higher education should welcome this volume, whether or not they teach science or any of its sister literacy constructs such as environmental literacy and technological literacy because this book holds an unbelievable wealth of ideas and information. Whether a scholar or a regular person who appreciates depth and clarity, truth and reason, or an individual who reads Hodson’s Looking to Future: Building a Curriculum for Social Activism simply for the sake of reading, he or she will become instantly much more aware of the importance of science and science literacy, the environment and human social and political actions as they affect the earth and our needs, wants and survival. Hodson’s book can serve as an effective guide in science philosophy and history, and also as a manual on teaching strategies and curricular development, especially as his ideas for teaching conceived in his 3-Phase Approach and “four levels of sophistication” in building an issues-based curriculum make practical sense.

REFERENCES

Barnes, D. (1988). Oral language and learning. In S. Hyns, & D. Rubin (Eds.), *Perspectives on talk and learning* (pp. 41-54). Urbana, IL: National Council of Teachers of English.

Bencze, J.L. (2001). Subverting corporatism in school science. *Canadian Journal of Science, Mathematics and Technology Education, 1*(3), 349-355.

Bowers, C.A. (2001). *Educating for eco-justice and community*. Athens, GA: University of Georgia Press.

Capra, F. (1996). The web of life: *A new synthesis of mind and matter*. London: Harper Collins.

Conway, R. (2000). Ethical judgments in genetic engineering: Implications for technology education. *International Journal of Technology and Design Education, 10*, 239-254.

Davis, M. (1999). *Ethics and the University*. London: Routledge.

Devall, B., & Sessions, G. (1985). *Deep ecology*. Layton, UT: Peregrine Smith.

Hanushek, E.A., & Woessmann, L. (2007). *Education quality and Economic growth*. Washington, D.C.: The International Bank for Reconstruction and Development/The World Bank.

Hodson, D. (2011). *Looking to the future: Building a curriculum for social activism*. Rotterdam, The Netherlands: Sense Publishers.

Hodson, D. (2003).Time for action: Science education for an alternative future. *International Journal of Science Education*, 25(6), 645-670.

Jeong, H., Songer, N.B., & Lee, S-Y. (2007). Evidentiary competence: Sixth graders' understanding for gathering and interpreting evidence in scientific investigations. *Research in Science Investigation, 37*, 75-97.

Kim, H., & Song, J. (2006). The features of peer argumentation in middle school students' scientific inquiry. *Research in Science Education, 36*(3), 211-233.

Kollmus, A., & Agyeman, J. (2002). Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, 8, 239-260.

Kovac, J. (1999). Professional ethics in the college and university science curriculum. *Science & Education 8*, 309-319.

Mercer, N. (1995). *The guided construction of knowledge: Talk amongst teachers and learners*. Clevedon, UK: Multilingual Matters.

Mercer, N. (2000). *Words and minds: How we use language to think together*. London, England: Routledge.

Nordlund, A.M., & Garvill, J. (2002). Value structures behind proenvironmental behavior. *Environmental Behavior*, Vol. 34 No. 6, November 2002, 740-756.

Opotow, S., & Weiss, L. L. (2000). Denial and the process of moral exclusion in environmental conflict. *Journal of Social Issues, 56*(3), 475-490.

Orr, D.W. (1994). *Earth in mind*. Washington, DC: Island Press.

Reiss, M. (1999). Teaching ethics in science. *Studies in Science Education, 34*, 115-140.

Rest, J. (1986). *Moral development: Advances in Research and theory*. New York: Praeger.

Thier, M., & Daviss, B. (2002). *The new science literacy: Using language skills to help students learn*. Porthsmouth, NH: Heinemann.