

Chapter 5

Becoming Part of the Solution: Learning about Activism, Learning through Activism, Learning from Activism

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Abstract After making the case for an action-oriented science curriculum as a major component of education for responsible citizenship, the author contends that building such a curriculum has four key elements. First, learning about the issues, that is, focusing on the science and technology aspects of important socioscientific issues (SSI), recognizing the social, cultural and economic contexts in which they are located, developing the nature of science knowledge that builds robust understanding of contemporary scientific practice, and acquiring the media literacy necessary to access and read with critical understanding a wide variety of information sources. Second, learning to care about issues and the people impacted by them, including a focus on dealing with controversy, addressing values and developing concern for the views, needs and interests of others. Third, engaging and managing the powerful emotions often generated by SSI. Fourth, learning about sociopolitical action, taking action and evaluating action. For this key fourth element, the author advocates a 3-stage apprenticeship approach comprising modelling, guided practice and application.

Keywords Individual action • Collective action • Direct action • Indirect action • Apprenticeship

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Making the Case for an Action-Oriented Science Curriculum

If you are not part of the solution, you are part of the problem¹

The past decade has seen a number of calls for a much more radical, politicized form of science and technology education in which students not only address complex and often controversial environmental and socioscientific issues (SSI) and formulate their own position concerning them, but also prepare for, and engage in, sociopolitical actions that they believe will ‘make a difference,’ asking critical questions about how research priorities in science are determined, who has access to science, how science could (and perhaps should) be conducted differently, how scientific and technological knowledge are deployed, whose voices are heard, whose reading of a situation or interpretation of an issue are considered in formulating policy, and how action can be taken at individual, group and community level in order to influence policy and practice (Roth and Désautels 2002; Hodson 2003, 2011; Alsop and Bencze 2012). This chapter addresses some of the issues relating to the establishment of this particular curriculum emphasis (to use Roberts’ (1982) terminology). It looks at ways of enabling young people to be part of the solution to society’s problems rather than contributing to them. It can be summed up as a plea for: (i) assisting and supporting students in understanding complex issues, including exploration of the complex sociopolitical context in which the problem/issue is located; (ii) resolving conflicts of interest, considering any moral-ethical dimensions the issue raises and establishing a personal view; and (iii) building a commitment to taking appropriate sociopolitical action, both individually and collectively.

What makes this kind of curriculum unique is its commitment to student action. The simple point is that it is almost always much easier to proclaim that one cares about an issue than to do something about it, and to do it consistently, coherently and effectively. An action-oriented curriculum is predicated on the premise that our opinions and values are worth very little until we live them. Rhetoric and espoused values won’t bring about a reappraisal of policy, establish social justice with respect to SSI, or halt environmental degradation. Not only must we change our behaviour, we must take action to change the behaviour of others, and we must ensure that alternative voices and their underlying interests and values, are brought to bear on policy decisions.

There is no doubt that political apathy is increasingly widespread and that many citizens have lost faith and trust in politicians. It is also the case that opportunities to

¹ This quotation is variously attributed to Martin Luther King, Eldridge Cleaver and advertising guru Charles Rosner. Cleaver’s exact words, in a speech delivered to the San Francisco Barristers Club in September 1968, were: “there is no more neutrality in the world. You either have to be part of the solution, or you’re part of the problem”.

participate in key decision-making have declined substantially with the rise of mega-corporations and the increasingly convoluted bureaucracies of local, regional and national governments. Teachers can play a key role in halting this decline in civic participation and firing up citizens to seize opportunities to take control of local matters and to influence national and international decision-making. If this is to happen on any substantial and meaningful scale, students currently in school need opportunities to work together, take responsibility and engage in activities designed to effect change. We need to cultivate a sense of community and develop an awareness of ties to others, obligations and responsibilities and we need to show students how to establish, support and sustain politically active communities. Advocates of STS and STSE education have long argued that it is important for students to learn that scientific/technological activity is influenced by a complex of social, political and economic forces, to formulate their own views on a range of contemporary issues and problems, and to care passionately about them. Erminia Pedretti and Joanne Nazir (2011) have described variations and shifts in the focus of STSE in terms of six “currents”: *application/design* (practical problem solving through designing new technology or adapting old technologies); *historical* (understanding the sociocultural embeddedness of science and technology); *logical reasoning* (using a range of perspectives, including many outside science, to understand scientific and technological developments); *value-centred* (addressing the multidimensionality of socioscientific issues, including moral-ethical concerns); *sociocultural* (recognizing and critiquing science and technology as social institutions); *socio-ecojustice* (critiquing and addressing socioscientific issues through direct and indirect action). The position adopted here is that the curriculum needs to focus very overtly on the final two “currents”. Students need to learn how to participate, and they need to experience participation. Moreover, they need to encourage others to participate, too: parents, grandparents, friends, relatives, neighbours, local businesses, etc. It is not enough for students to be armchair critics. As Bill Kyle (1996) puts it: “Education must be transformed from the passive, technical, and apolitical orientation that is reflective of most students’ school-based experiences to an active, critical, and politicized life-long endeavour that transcends the boundaries of classrooms and schools” (p. 1). In words that would have substantial currency in my native North of England working class community, students need to “put their money where their mouth is!”; that is, they need to engage in action rather than just talk about it Hodson (2009). Indeed, all of us (students, teachers and other citizens) need to “put our money where our mouths are.” With that in mind, I have much in sympathy with Mark Elam and Margareta Bertilsson’s (2003) notion of the *radical scientific citizen*:

The radical scientific citizen is fully prepared to participate in demonstrations... street marches, boycotts and sit-ins and other means of publicly confronting those ruling over science and technology... While the scientific citizen as activist may be taking a partisan position in defence of a particular individual or group in society, they are also understood as assuming a moral stance in defence of general ethico-political principles... which are accepted as existing through many different and conflicting interpretations... and subjecting them to continuous contestation. (p. 245)

Building a Curriculum: Learning About the Issues

Before proceeding to the substance of this chapter, it is important to make a number of key points about building an issues-based, action-oriented curriculum. The first concerns the selection of appropriate SSI and their organization into a coherent and theoretically justifiable programme. What should be the criteria of selection? Student interest? Perceived importance in contemporary society? Topicality? Cutting edge science and technology? Lively and public controversy? Ready availability of curriculum resources or conversely the lack of readily available material, thus requiring students to search for further knowledge and information (an important learning goal in itself)? My inclination would be to provide a judicious mix of all these categories, a mix of local, regional/national and global issues, together with a range of idiosyncratic personal interests. For me, coherence would be located in the selection of issues that contribute to rigorous consideration of seven areas of concern: human health; land, water and mineral resources; food and agriculture; energy resources, consumption levels and sustainability; industry (including manufacturing industry, the leisure and service industries, biotechnology, and so on); communications technology and transportation; ethics and social responsibility, including freedom, control and sponsorship in science and technology (Hodson, 1994, 2003).

No matter what the criteria of selection, students need scientific knowledge if they are to get to grips with SSI at any level beyond the merely superficial. Simple common sense tells us that content knowledge is crucial, and that those who know more about the topic/issue under consideration will be better positioned to understand the underlying issues, evaluate different positions, make an informed decision on where they stand in relation to the issue, and argue their point of view. Key questions concern the depth of knowledge required and the manner in which it should be acquired. It seems almost trite to state that the level of scientific knowledge needed is that which enables students to understand the nature of the problem and what might constitute appropriate evidence on which to base their decision-making, and that it will vary substantially from issue to issue, but that is simply the reality of the situation. Whether that scientific knowledge should be acquired through prior instruction or on a 'need to know' basis when dealing with a particular issue is best decided on an issue by issue basis. As is so often the case in education, there is no universal answer; different situations demand different approaches and different SSI create widely different knowledge needs. Much depends on whether the entire curriculum is given over to an SSI-oriented approach or SSI are included as occasional add-ons to an otherwise content-oriented curriculum, and on whether that particular science content is likely to be taught and utilized elsewhere in the curriculum.

Of course, no science curriculum can equip students with thorough first-hand knowledge of *all* the science underlying *every* important issue. Indeed, given the pace of scientific and technological development, some of the scientific knowledge students will need to know in order to make important decisions on the many

important SSI they will encounter during their lifetimes has yet to be developed. However, we *do* know what knowledge, skills and attitudes are essential for appraising scientific reports, evaluating scientific arguments and moving towards a personal opinion about the science and technology dimensions of real world issues. It includes understanding of the status of scientific knowledge, the ways in which it is generated, communicated and scrutinized by the community of scientists, and the extent to which it can be relied upon to inform critical decisions about SSI. In other words, students need to have a clear understanding of what counts as *good* science, that is, a well-designed inquiry and a well-argued conclusion. They need to be able to interpret reports, make sense of disagreements, evaluate knowledge claims, scrutinize arguments, distinguish among facts, arguments and opinions, make judgements about good science, bad science and non-science, detect error, bias and vested interest, and so on – all the things we have come to know as nature of science (NOS) understanding.

Stein Kolstø (2001) sums up the NOS knowledge and understanding needed for addressing SSI in terms of eight major elements: (i) the ability to distinguish between science-in-the-making, where dispute, disagreement and uncertainty are to be expected, and ready-made science, on which we can rely; (ii) recognizing that sociocultural, political, economic and religious factors can impact on priorities for scientific research and development, and on the knowledge claims that are accepted; (iii) ability to evaluate the quality of scientific and statistical evidence, and to judge the appropriateness of anecdotal and experiential knowledge; (iv) ability to appraise the degree of support for a knowledge claim and the quality of the argument that establishes the warrant for belief; (v) a skeptical approach that includes both a critical, questioning stance and a commitment not to jump to conclusions until compelling evidence and arguments have been assembled; (vi) awareness of the importance of contextual factors when evaluating knowledge claims, including the social status of the actors and their institutional allegiance; (vii) sensitivity to the underlying values, ideologies and potential for bias in the design and reporting of scientific investigations; and (viii) awareness of the constraints that might limit the application of generalized theoretical knowledge to particular real world situations. With regard to reports of specific research studies, a simple checklist of questions can be enormously helpful. For example, who conducted the research and where was it conducted? How was the research funded? Was the research sponsored and, if so, by whom? What is being claimed? What evidence supports the claim? How was the evidence collected? How was the evidence interpreted? What assumptions are made and what theories are used in arguing from evidence to conclusion? Do the authors use well-established theory or do they challenge such theories? Are alternative interpretations and conclusions possible? What additional evidence would help to clarify or resolve issues? Have there been other studies conducted by these scientists or by others?

Because much of the information needed to address SSI is of the science-in-the-making kind, rather than well-established science, and may even be located at or near the cutting edge of research, it is unlikely that students will be able to locate all of it in traditional sources of information like textbooks and reference books. It will

need to be accessed from academic journals, magazines, newspapers, TV and radio broadcasts, and Internet sources, thus raising important issues of *media literacy*. Being media literate means being able to access, comprehend, analyze, evaluate, compare and contrast information from a variety of sources and utilize that information judiciously and appropriately to synthesize one's own detailed summary of the topic or issue under consideration. It means recognizing that the deployment of particular language, symbols, images and sound in a multimedia presentation can each play a role in determining a message's impact, and will have a profound influence on its perceived value and credibility. It means being able to ascertain the writer's purpose and intent, determine any sub-text and implicit meaning, detect bias and vested interest. It means being able to distinguish between good, reliable information and poor, unreliable information. It involves the ability to recognize what Nicholas Burbules and Thomas Callister (2000) call *misinformation*, *malinformation*, *messed-up information* and *useless information*. Students who are media literate understand that those skilled in producing printed, graphic and spoken media use particular vocabulary, grammar, syntax, metaphor and referencing to capture our attention, trigger our emotions, persuade us of a point of view and, on occasions, by-pass our critical faculties altogether. They understand that material may be biased and may use a range of journalistic techniques such as emotive language, hyperbole and innuendo, provocative pictures and images, and emotionally manipulative background music, to persuade readers, viewers and listeners of a particular point of view.

Building a Curriculum: Learning to Care

The kind of curriculum being advocated here has a major concern with supporting students in their attempts to formulate their own opinions on important issues and establishing their own value positions, rather than with promoting official or textbook views (the prime motive of what Ralph Levinson (2010) calls the 'deficit view' of citizenship education). It focuses much more overtly than traditional STS or STSE education on values clarification, developing strong feelings about issues, addressing moral-ethical concerns, and actively thinking about what it means to act wisely, justly and rightly in particular social, political and environmental contexts. It is geared towards helping students to become committed to the fight to establish more socially just and environmentally sustainable practices and building the confidence, mindset, insights and skills necessary for effective and responsible change advocacy and change agency. It has much in common with the goals of Peace Education, Multicultural and Antiracist Education, Global Education and Humane Education. It begins with the fostering of self-esteem and personal well-being in each individual, and extends to acceptance of diversity in ideas, opinions, perspectives, practices and values, concern for the welfare of others, respect for the rights of others, building empathy and mutual trust, the pursuit of fairness, equity, justice and freedom, cooperative decision-making, creative resolution of disagreements and conflict between individuals, within and

between communities, and throughout the world. It is driven by a deep commitment to *anti-discriminatory* education, that is, exposing the common roots of sexism, racism, homophobia, Eurocentrism and Westism (or Northism) in the tendency to dichotomize and generate a sense of *other*, and working actively to confront the 'us and them' mentality that invariably sees 'us' as the norm, the desirable and the superior. It culminates in a commitment to the belief that alternative voices can and should be heard in order that decisions in science and technology reflect wisdom and justice, rather than powerful sectional interests. Nicholas Maxwell (1984, 1992) defines wisdom as the capacity to realize what is of value in life for oneself and others. He continues as follows:

In a world in which international affairs are conducted at the intellectual and moral level of gang warfare (as they all too often are), the mere provision of new knowledge and technology, dissociated from a more fundamental concern to help humanity resolve its conflicts and problems of living in more cooperative ways, is an obvious recipe for disaster. It merely increases our power to *act*, without at the same time increasing our power to act humanely, cooperatively and rationally. . . We urgently need a new, more rational kind of academic inquiry, which gives intellectual priority to the tasks of articulating our problems of living, proposing and critically assessing possible cooperative solutions. (1992, p. 207)

Many SSI are highly controversial: GM crops, governmental DNA banks, gene therapy, cloning, stem cell research, health hazards associated with mobile phones and overhead power lines, toxic waste disposal, euthanasia, abortion, nuclear power generation and nuclear weapons, deep space exploration, xenotransplantation, animal experiments, food irradiation, compulsory MMR vaccination, smart ID cards, priorities for deployment of scarce resources for medical services and for medical research, and ways to deal with ozone depletion, desertification, loss of biodiversity and other environmental crises. Controversy may be *internal* to science, that is, the scientific information required to formulate a judgement about it is incomplete, insufficient, inconclusive or extremely complex and difficult to interpret, or it may be *external* to science, that is, rooted in social, political, economic, cultural, religious, environmental, aesthetic and/or moral-ethical concerns, beliefs, values and feelings. The capacity to address internal controversy depends crucially on students' NOS knowledge and critical reading skills; the capacity and willingness to address external controversy hinges on a consideration of values and feelings, and on the ability to balance rationalistic reasoning with reasoning driven by emotions, feelings, personal experience and sociocultural influences.

Once a decision has been made to include externally controversial issues in the curriculum, teachers have to decide the most appropriate way to do so. Should they take a neutral position, adopt the devil's advocate role or try to present a balanced view? One form of neutrality, *affirmative neutrality*, describes a situation in which teachers present multiple sides of a controversy without revealing which side they support. In *procedural neutrality*, information about the controversy and different points of view are elicited from the students, possibly after opportunity for library-based or Internet-based research. Quite apart from the danger of encouraging relativism, where any idea is accepted as long as it is someone's opinion, neutrality is a position that seriously threatens the teacher's credibility as critic, guide and mentor.

The notion of even-handedness or presenting a ‘balanced view’ is also extremely problematic. What counts as balance? Whose judgement of balance and selection of perspectives is to count? Who decides what counts as relevant or not relevant, accurate or inaccurate, admissible or inadmissible, important or unimportant? Who decides what should be regarded as facts and what is deemed to be opinion? If all students express similar views, who will provide the alternatives? How should the teacher or the class respond to opinions that seem designed for no other reason than to shock, provoke or ‘wind people up’? The key point is that *all* views embody a particular position, and that position needs to be rationalized and justified if indoctrination is to be avoided. Following some supposed notion of even-handedness prevents students from developing the critical skills necessary for judging the worth and validity of different positions, and requires teachers to give equal time, consideration and weight to views and arguments that are clearly not of equal merit.

Understanding the nature of controversy itself entails knowing that views may differ because they are based on different information, different interpretations of the same information or differences in worldviews, values, attitudes, interests, experiences, feelings or emotions. It entails knowing that different value judgements are sometimes a consequence of differences in moral codes or ethical principles deriving from different religious, political or philosophical positions. When addressing a *particular* controversial SSI, students need to ascertain the nature and extent of the disagreement. Is it a consequence of insufficient evidence, evidence of the ‘wrong kind’, evidence that is conflicting, confusing or inconsistent, or too complex and difficult to interpret? Is the problem of resolution located in the absence of clear criteria for making a judgment? Is it the case that different criteria point to different solutions or actions? And so on. They need to know that individual feelings and emotions or personal experiences can impact the ways in which issues are viewed, data are interpreted, conclusions evaluated and courses of action advocated. This applies to scrutiny of their own views, the views of other students, views expressed in curriculum materials, newspapers, Internet websites and so on, and the teacher’s views. With regard to this latter point, it is my experience that confrontation of controversy invariably invites questions about the teacher’s view. It is absurd for teachers to pretend that they don’t have a view. It is deplorable for teachers to refuse to state that view when requested to do so, especially when they encourage or even require students to state theirs. Even if they choose to remain silent, teachers’ views are likely to be evident to the more perceptive students from the questions they ask and the ways in which they respond to (or ignore) student comments, and through tone of voice, maintenance of eye contact (or not), and the ever-potent and revealing classroom body language.

While I acknowledge the right of an individual student to remain silent on a particular issue, I would not extend that privilege to teachers. I believe that students have a right to know their teacher’s views on SSI addressed in the curriculum. However, I would not be supportive of teachers who used their own views as justification for excluding opportunities for students to address issues such as abortion, birth control, genetic engineering and cloning. I believe that it is incumbent on teachers to make provision for students to address a wide range of

controversial SSI, particularly those in which they express an interest and those with direct impact on their lives. And I believe that it is incumbent on teachers to share their views on these matters with students and to make explicit the ways in which they have arrived at their particular position. It is also incumbent on teachers to adopt the same stance of critical reflection and open-mindedness that they demand of their students, and to be willing to change or modify their views in the light of new evidence, a new way of interpreting evidence, a reappraisal of underlying values, or whatever. Some years ago, Thomas Kelly (1986) proposed the broadly similar approach of “committed impartiality”, in which teachers present multiple sides of an issue or argument and, at some stage, share their own views with the class. In my view, it is crucial that teachers identify, clarify and challenge the assumptions of *all* available positions (including their own), acknowledge the influence of sociocultural context, religious beliefs, emotions and feelings, address issues of rationality, equity and social justice, and encourage critical reflection. Kelly (1986) argued that when students are encouraged to debate and challenge their teacher’s ideas without fear of sanctions, they not only develop argumentation skills, but also build the courage for social commitment.

It is inevitable that some teachers will lack confidence and expertise in handling unstructured, open-ended discussions on controversial issues, and it is unsurprising that teachers unfamiliar with them often express a concern, bordering on anxiety, that they will be accused of bias, and may possibly lay themselves open to charges of indoctrination. I would make two points in response. First, adoption of the critical approach discussed here (what Ratcliffe and Grace (2003) refer to as the “stated commitment” approach) constitutes a legitimate defence against such charges. As Ivan Snook (1975) reminds us, we are guilty of indoctrination when, and only when, we intend students to believe a proposition (or set of propositions) in the absence of, or despite/regardless of, the evidence. Or when we deliberately suppress or distort evidence to the contrary. What is proposed here is better described as “adopting a critical perspective”. Second, the views of students often indicate the exact opposite, with many of the students with whom I have worked expressing the view that confronting socioscientific issues in this critical and collaborative way “opened my eyes to other perspectives”, “helped me to sort out my own views” and “enabled me to think more clearly and more carefully” about such matters. Far from feeling that they had been indoctrinated, many students report that the approach provided a stabilizing framework within which their existing views could be accommodated, enriched and used more critically and more effectively.

Almost any discussion of a topical SSI is likely to raise questions not only about what we *can* or *could* do, but also about what is the *right* decision and what *ought* we to do? However, because we live in an increasingly pluralist society, we cannot assume a shared set of moral values and reaching agreement is likely to be difficult. One response is to allow the views of the majority to prevail – a position that necessarily disregards or marginalizes the needs, interests, values and rights of minorities. Even critical discourse between and among all interested parties may fail to bring about consensus, and if consensus were reached there would be no guarantee that it had reached the *right* answer. Ascertaining the right answer (what

we *ought* to do) raises questions and concerns about morality (what it is right or wrong to do) and ethics (the reasons and justifications for judging these things to be right or wrong). I am certainly not advocating that students be required to follow a rigorous course in moral philosophy, any more than I would advocate the promotion of a morality based on a particular religion or set of laws and cultural precedents, but I am advocating that they be equipped with some intellectual tools for addressing and resolving contentious issues that cannot be solved solely by scientific considerations – at the very least, some basic understanding of egoism, consequentialist notions (including utilitarianism, deontological ethics, social construct theory (or social contract theory) and virtue ethics).

Patrick Fullick and Mary Ratcliffe (1996) describe a number of strategies that can help to direct student attention to the ethical concerns embedded in SSI and assist them in dealing with ethical dilemmas in a systematic and rational way. Strategies include: consequence mapping or “future wheels” (through which students are asked to consider a range of personal, social, economic, legal, environmental and ethical implications surrounding an issue and the possible responses to it); use of a goals-rights-duties framework (for each player or constituency involved in a controversy, students consider the intentions, rights/expectations and obligations towards others and the environment); and group discussions around carefully focused questions (oral or written questions direct student attention to the nature of the problem, possible solutions, reasons why one solution may be preferred to another, and stimulate reflection on students’ own value positions). The New Zealand Biotechnology Learning Hub (www.biotechlearn.org.nz) provides support for students addressing ethical issues in the form of two interactive “thinking tools”. The *ethics thinking tool* enables students to structure and evaluate their ideas in relation to four sets of ethical guidelines: benefits and harms; rights and responsibilities; freedom of choice; virtues. The *futures thinking tool* encourages students to consider the existing situation, analyze trends, identify the driving forces and causes of those trends, identify possible and probable futures, and select preferred futures. Use of these tools, together with a wide range of other teaching and learning strategies, is discussed by several authors in the edited collection: *Ethics in the Science and Technology Classroom* (Jones et al. 2010).

Engaging Emotions, Managing Emotions

Personal investment in an issue and commitment to problem solving and action derive, in part, from emotional involvement. The stronger one’s emotional involvement, the more likely one is to take positive action – a situation that is well illustrated in students’ responses to SSI when they impact directly on their own lives, or those of family members and people in the local community. Reliance on secondary experience, information and knowledge, which is likely to be the case for many students for many SSI, removes them emotionally from the issue and is likely to result in non-involvement and non-action. It is easy to react to sudden and catastrophic change brought about by earthquakes and tsunamis, but environmental degradation and

climate change are both slow and cumulative. There is a tendency, therefore, to over-estimate the long-term significance of hurricanes and earthquakes and seriously underestimate the long-term significance of small increases in the mean temperature of the oceans. Large-scale, global environmental problems (such as ozone depletion, loss of habitat and greenhouse gas build-up) are not immediately tangible. We don't see it happen and so it "slips off the radar". The long time-lag between the emission of greenhouse gases and their effects on the climate impedes a proper understanding of the relationship. So, too, the anticipated time lag between any actions taken to reduce emissions and the positive effects they might produce. For many people in the affluent West/North, tangible impact is elsewhere: melting ice caps in Antarctica, rising sea levels in the islands of the South Pacific, pollution of waterways in China. For many people, the fact that the effects are not uniform across different parts of the world seems to be at variance with predictions that associate climate change with mean increase in temperature across the globe. Moreover, predictions by the IPCC and other bodies lose precision at finer geographical scales and so may seem to contradict local experience (González-Gaudiano and Meira-Carrea 2010). Thus, environmental degradation and climate change are seen as distant or future problems, not immediate and local ones. Despite repeated warnings from climate change scientists that the longer we delay measures to reduce greenhouse gas emissions the deeper and more irreversible will be the consequences, significant action at the political level is not forthcoming. Many aspects of SSI relating to health, resource use, industrial and scientific practice may also seem distant to students. Making these issues real means finding ways to stimulate, provoke, irritate, offend, outrage, amuse or delight students as a way of gaining their attention and building involvement and commitment. We need to find ways to make the impact more real, to precipitate feelings of fear, anger, sadness, pain, empathy, compassion and guilt, and link them to positive feelings of agency, control and empowerment. Emotional involvement can be fostered through case studies, drama and role play, literature, art, photographs, movies and music, site visits, interviews with those directly impacted, and so on. Interestingly, Benjamin Lester et al. (2006) have shown that carefully designed writing activities can also play an important role in developing personal investment in an issue and in increasing students' awareness of the need for sociopolitical action, especially when students assume the role of investigative journalist. Site visits (hospitals, factory farms, laboratories, etc.) and guided experiences in areas of ecological significance can play a profound role in raising awareness and engaging emotions. Best of all, of course, is direct engagement with locally based issues, as discussed below. It is important to note that informal learning experiences seem to be much more effective than formal schooling in bringing about awareness of issues, attitudinal shifts, values reorientation and willingness to engage in sociopolitical action.

A sense of wonder and feelings of empathy, respect and compassion towards other living things can also be fostered by such easily organized activities as investigating a rock pool, noting what lives in a wall or hedgerow, taking digital photographs to examine the feathers of birds in a suburban garden, watching a spider spin a web, observing insects through a magnifying lens or pond water under a microscope (see Lindemann-Matthies (2005) for further suggestions along these lines). Nor should we under-estimate the value of caring for pets, growing

vegetables, observing activity in an ant colony and watching the dramatic events in the life history of frogs and butterflies. An important part of these experiences is the delight that students experience in becoming absorbed in their observations, the feelings of surprise at seeing the world in new ways, the thrill of encountering previously unfamiliar living organisms and habitats, recognizing new possibilities and seeing new relationships (Liston 2004). Mark Girod, Cheryl Rau and Adele Schepige (2003) refer to this kind of experience as “re-seeing”:

Re-seeing is an attempt to focus our perception on the nuance and detail of the world. Re-seeing requires that we look carefully when we might be tempted to assume we see everything. Re-seeing is also a disposition that causes us to ask questions of what we perceive, such as ‘What’s really going on here?’ ‘Why do things look the way they do?’ And ‘What kinds of things do I need to know more about to really re-see this?’ (p. 579)

There is substantial evidence of the power of television, movies, drama, role-play, multi-media materials and language-based activities of various kinds to stimulate interest in an issue, provoke an emotional response, present alternative positions, challenge values and precipitate debate. Stories juxtapose different opinions, voices and perspectives, encouraging the reader (or listener) to deliberate, evaluate and decide on where they stand, or to adopt a different stance. Through stories, and especially through drama, students are stimulated to address issues and events from the perspectives of others, explore and develop understanding, establish new relationships and consolidate existing ones. In other words, engaging with narrative is as much a way of knowing ourselves as it is a way of understanding the views of others. Improvised drama enables students to enrich these explorations with personal experiences, thoughts and linguistic preferences. Poetry is an especially powerful means of generating emotional response and provoking the shift of perspective encapsulated in the notion of “re-seeing”. Encouraging students to write poetry and stories creates opportunities for them to explore their ideas, express them in less formal language, manipulate and critique them by placing them in the mouths of others, explore ambiguity and uncertainty, wrestle with dilemmas and, crucially, express the way they feel about their ideas and the ideas of others.

The social context in which the student is located outside school is likely to be a major factor impacting learning. Rejecting knowledge and beliefs that are strongly held within social groups to which the student belongs, or wishes to belong, may be so emotionally stressful that it becomes virtually impossible. Similarly, accepting views that are in opposition to the dominant views within those groups is likely to be a formidable undertaking. The science teacher’s job can be seen, in part, as helping students to gain an understanding of what, for many, are alien cultures (the subcultures of science, school and school science) and assisting them in moving freely and painlessly within and between these subcultures and the subcultures of home and community. It is fair to say that many teachers have seriously underestimated the difficulties faced by some students. As Jay Lemke (2001) comments, a student “spends most of every day, before and after science class, in other subject-area classes, in social interactions in school but outside the curriculum, and in life outside school. We have imagined that the few minutes of the science lesson somehow create an isolated and nearly autonomous learning universe, ignoring

the sociocultural reality that students' beliefs, attitudes, values, and personal identities – all of which are critical to their achievement in science learning – are formed along trajectories that pass briefly through our classes” (p. 305).

It is also likely that addressing SSI in class will generate strong feelings and emotions, with students' views and assumptions being strongly influenced by personal experiences and the experiences of friends and family, and by socioculturally determined predispositions and worldviews. A student's sense of identity, comprising ethnicity, gender, social class, family and community relationships, economic status and personal experiences extending over many years, will necessarily impact on their values, priorities and preferences, and influence the ways in which they engage in discussion and the conclusions they reach. Teachers introducing SSI into the curriculum need to be sensitive to these influences and will need to assist students in dealing with potentially stressful and disconcerting learning situations. It is here that notions of *emotional intelligence*, *emotional literacy* and *emotional competence* can be helpful.² Although these three terms are closely related, Brian Matthews (2005) chooses to draw a distinction between the individualistic nature of emotional intelligence and the strongly social nature of emotional literacy. Thus, he argues, emotional intelligence refers to an individual's ability to perceive, describe, appraise and express emotions, understand emotions and emotional knowledge, access and/or generate appropriate feelings when they facilitate thought, or manage them productively when they might inhibit, while emotional literacy is the capacity to be receptive to a wide range of feelings, empathize with others, and continuously monitor the emotional climate in which one is located. Emotional competence may be seen as an amalgam of the two. In general, the goal of emotional literacy is awareness and management of one's emotions in both joyful and stressful situations, the confidence and self-assurance to understand one's own emotions, and the capacity to deal with them in a positive and intentional way. It is closely related to notions of self-awareness, self-image, self-esteem and sense of identity, and less directly with self-efficacy and agency.

Building a Curriculum: Learning to Act

The most distinctive feature of the issues-based approach advocated here is concern with students finding ways of putting their values and convictions into action, helping them to prepare for and engage in responsible action, and assisting them in developing the skills, attitudes and values that will enable them to take control of their lives, cooperate with others to bring about change, and work towards a more just and sustainable world in which power, wealth and resources are more equitably

²The following provide a good introduction to the key issues: Goleman (1985, 1996, 1998), Matthews et al. (2004a, b), Saarni (1990, 1999), Salovey and Meyer (1990), Salovey and Shaytor (1997), Steiner (1997), Sharp (2001), Zeidner et al. (2009).

shared. An interesting and thoughtful essay by Alexandra Dimick (2012) discusses a range of issues relating to science education for social justice in terms of three dimensions of student empowerment: social empowerment (provision of a safe, supportive and non-discriminatory environment within the classroom/school); political empowerment (recognition and critical examination of structures and forces that establish and maintain power inequities); and academic empowerment (access to key knowledge and skills, and the capacity to adapt them to specific SSI). Arguments employed in this chapter extend these ideas into the world outside the classroom.

Writing from the perspective of environmental education, Bjarne Jensen (2002) categorizes the knowledge that is likely to inform and promote sociopolitical action and pro-environmental behaviour into four dimensions: (i) scientific and technological knowledge that informs the issue or problem; (ii) knowledge about the underlying social, political and economic issues, conditions and structures, and how they contribute to creating social and environmental problems; (iii) knowledge about how to bring about changes in society through direct or indirect action; and (iv) knowledge about the likely outcome or direction of possible actions, and the desirability of those outcomes. Although formulated as a model for environmental education, Jensen's arguments are readily applicable to the kind of curriculum being advocated here. Little needs to be said about dimensions 1 and 2 in Jensen's framework beyond the discussion earlier in this chapter. With regard to dimension 3, students need knowledge of actions that are likely to have positive impact and knowledge of how to engage in them. It is essential that they gain robust knowledge of the social, legal and political system(s) that prevail in the communities in which they live, and develop a clear understanding of how decisions are made within local, regional and national government, and within industry, commerce, health authorities, environmental agencies and the military. Without knowledge of where and with whom power of decision-making is located, and awareness of the mechanisms by which decisions are reached, effective intervention is not possible. This kind of understanding requires a concurrent programme designed to achieve a measure of *political literacy*, including knowledge of how to engage in collective action with individuals who have different competencies, backgrounds and attitudes, but share a common interest in a particular SSI. Dimension 3 also includes knowledge of likely sympathisers and potential allies, and strategies for encouraging cooperative action and group interventions. What Jensen does not mention, but constitutes a key element of dimension 3 knowledge, is the NOS-oriented knowledge that would enable students to appraise the statements, reports and arguments of scientists, politicians and journalists, and to present their own supporting or opposing arguments in a coherent, robust and convincing way. Jensen's fourth category includes awareness of how (and why) others have sought to bring about change and entails formulation of a vision of the kind of world in which we (and our families and communities) wish to live. It is important for students to explore and develop their ideas, visions, dreams and aspirations for themselves, for their neighbours and families, and for the wider communities at the local, regional, national and global levels – a clear overlap with Futures Studies (Lloyd and Wallace 2004).

The likelihood of students becoming active citizens in later life is increased substantially by encouraging them to take action *now* (in school), by providing opportunities for them to do so, and by providing detailed examples of successful actions and interventions engaged in by others. It is also the case that all who become active at the collective level in later life have, at one time, engaged in individual action. With respect to an environmental focus (by way of illustration), suitable action might include any (or all) of the following: conducting surveys of dump sites, public footpaths and environmentally sensitive areas, monitoring pollution levels in local waterways, disseminating advice to householders, farmers and local industries on safe disposal of toxic waste, generating data for community groups such as birdwatchers and rambblers, establishing neighbourhood “nature watch” initiatives, instituting recycling programmes for glass, paper and aluminium cans, organizing consumer boycotts of environmentally unsafe products and practices, publishing newsletters, lobbying local government officials on policy matters and regulations (for example, traffic conditions and recreational facilities), working on environmental clean-up projects, establishing an “adopt a stream/creek/river/pond/lake” scheme, creating nature trails, conservation ponds and butterfly gardens, planting trees, building a community garden, designing, building and installing nesting boxes for endangered birds or bats, organizing a school “environmental awareness day”, setting up a garbage-free lunch programme, assuming responsibility for environmental enhancement of the school grounds (including planting of indigenous species and encouragement of biodiversity), monitoring the school’s consumption of energy and material resources in order to formulate more appropriate practices (including use of solar panels, for example), reducing water consumption through recycling schemes, monitoring use and disposal of potentially hazardous materials within the school, setting up a “green purchasing” network, and so on. Suitable actions on other matters might include: making public statements and writing letters, building informative Websites, writing to newspapers, organizing petitions and community meetings, working for local action groups and citizen working groups, making posters, distributing leaflets, demonstrating, making informative multimedia materials for public education, and exerting political pressure through regular involvement in local government affairs.

It is sometimes useful to distinguish between *direct* and *indirect* action. The former includes such things as recycling, cleaning up a stream or a beach, building a compost heap, using a bicycle rather than a car or bus, switching off lights, and using “green bags” at the supermarket; the latter includes compiling petitions, distributing leaflets, writing to newspapers and making submissions to the local council. Bjarne Jensen and Karsten Schnack (1997) characterize these two kinds of action in terms of orientation towards people-environment relations or people-people relations. Oddly, some environmental educators tend to de-value indirect actions as “mere classroom exercises”, while extolling the virtues of direct action. Before reaching such a judgement we should look carefully at the likely *effectiveness* and *social significance* of particular actions, both in the short-term and long-term. While direct action can be enormously important and can have some significant impact, it can also divert attention from the root causes of the problem in

our social, political and economic activities. It fails to confront the real causes and agents of environmental degradation, avoids critique and questioning, and “deceptively universalizes the different positions individuals have in relation to the distribution of environmental resources, risks, responsibilities, and decision-making power” (Lousley 1999, p. 299). It depoliticizes environmental problems and shifts the burden of responsibility onto individuals and families and away from governments, corporations, the policies that might have long-term and significant impact, and the political negotiations that might lead to change. Cleaning up a beach will have immediate beneficial impact, of course, but without an investigation of the causes and appropriate intervention aimed at those causes there will be no long-lasting solution. While recycling and buying so-called “environmentally friendly” products enable us to feel that we are doing something constructive, they may have no impact whatsoever on the underlying social and economic structures that have created the problems. Setting up a recycling programme may prolong the active life of one or two landfill sites but it doesn’t address (and it certainly doesn’t change) the unsustainable economy of resource use, production and consumption. Of course, indirect action needs to be *authentic* action: not just a classroom exercise in which a letter to an imaginary newspaper editor is composed, but a real letter to a real newspaper editor, to express real concerns or to make a series of real debating points or policy recommendations, or the preparation of a report for submission to a local government body, or provision of material assistance for an individual or group involved in a local dispute. It is important for students to recognize that individual actions can sometimes be fairly limited in their impact. Much more effective are collective actions that can exert pressure on governments (local, regional and national) to dismantle barriers to change and create alternative, more equitable and ethically and environmentally responsible policies and practices. Ronald Mitchell, Bradley Agle and Donna Wood (1997) remind us that changes at fundamental levels will only result when three key elements of persuasion are in place: *legitimacy* – perception that the action is desirable or morally right; *urgency* – the need for the issue to be addressed quickly; and *power* – the capacity to force another to do something counter to their current practice, using financial means, voting power, etc. It is group action that provides this final element. In other words, collective action is probably the only route to fundamental change in society.

Jensen and Schnack (1997) draw a distinction between *activities* and *actions*. For them, actions must be consciously chosen and focused on solutions to the problem or issue being addressed, or directed towards changing the conditions or circumstances that led to the problem(s). Thus, investigating nitrate and phosphate levels in waterways is classified as an activity; boycotting chemically-based agricultural products and promoting the use of organic fertilisers is classified as an action.³ Conducting the

³ In a later publication dealing with the problem-solving nature of actions, Jensen (2004) differentiates between *scientific investigative actions* (for example, student-initiated testing of pollution levels in waterways) and *social investigative actions* (for example, interviewing people in the local community about a socioscientific issue). Morgensen and Schnack (2010) provide further elaboration of these distinctions.

analysis, publicizing the data arising from it, identifying the likely cause of the pollution as run-off from local farms and parks, alerting farmers, ground maintenance staff in sports facilities, park keepers and domestic gardeners to both the causes and the adverse environmental impact of chemically-based products, making them aware of organic alternatives, and encouraging farm suppliers and garden centres to promote those organic alternatives, would be classified as a complex of activity, direct action and indirect action. From a curriculum or pedagogical perspective, some very obvious distinctions can be drawn between simple and quickly achieved actions (building nesting boxes or cleaning up a stream), those that require a sustained commitment over time (establishing and maintaining a fish hatchery or taking responsibility for managing a conservation area) and those that require a substantial level of political literacy (lobbying for policy changes, drafting legislation and filing law suits against those who violate existing codes and regulations). For these reasons, Wolff-Michael Roth (2010) is at some pains to distinguish among actions, activities and activism. In a more elaborate categorization, Paul Stern (2000) distinguishes among *environmental activism* (participation in activities organized by Greenpeace, Friends of the Earth, Sea Shepherd, etc.), *non-activist political behaviours* (voting, joining a community group), *consumer behaviours* (buying “green products”, recycling), *ecosystem behaviours* (installing nesting boxes, cleaning up a stream) and *behaviours specific to our expertise or workplace* (reducing both resource consumption and waste generation). Another useful distinction drawn by Stern (2000) is that between “private sphere” actions and “public sphere” actions, a distinction that Susanne Menzel and Susanne Bögeholz (2010) extend into *activism* (e.g., participating in public demonstrations), *non-activist public sphere actions* (e.g., signing petitions), *private sphere actions* (e.g., green purchasing) and *public sphere actions* (e.g., fostering recycling in the workforce).⁴ From a school perspective, there is also much value in distinguishing actions that are student initiated from those that are teacher initiated. Adapting the work of Sherry Arnstein (1969), Roger Hart (1992, 2008) outlines a “ladder of student participation”, ranging from actions that are assigned by the teacher, through those that are decided by teachers after consultation with students, initiated by teachers but negotiated with students, initiated and directed by students, to those initiated by students and carried out in collaboration with adults outside school.

In light of this discussion of direct and indirect action, activities and action, individual versus collective action and teacher-initiated versus student-initiated activities and actions, I would argue that a key part of preparing for action involves identifying action possibilities, assessing their feasibility and appropriateness, ascertaining constraints and barriers, resolving any disagreements among those who will be involved, looking closely at the actions taken by others (and the extent

⁴Schusler, Krasny, Peters and Decker (2009) identify five forms of (environmental) action: physical environmental improvements (e.g., restoring natural habitats); community education (e.g., organizing festivals and information fairs, producing newsletters and multimedia materials); inquiry (e.g., surveys and mapping, environmental monitoring, etc.); public issue analysis and advocacy for policy change (researching an issue and making recommendations); and products or services (e.g., growing food in community gardens, working in a food bank).

to which they have been successful) and establishing priorities in terms of what actions are most urgently needed (and can be undertaken fairly quickly) and what actions are needed in the longer term. It is essential, too, that all actions taken by students are critically evaluated and committed to an action database for use by others. From a teaching perspective, it is important that care is taken to ensure both the appropriateness of a set of actions for the particular students involved and the communities in which the actions will be situated, and the overall practicality of the project in terms of time and resources. An action-oriented curriculum can generate considerable controversy and may provoke opposition from other teachers, school administrators, parents and members of the local community. While recycling, cleaning up the beach, harvesting rainwater, building nesting boxes or working in the local food bank or shelter for the homeless are safe, benign and non-controversial, challenging local councils, staging demonstrations, conducting vigils and organizing boycotts may raise parental anxiety levels, offend the local community and lead to sustained opposition. Teachers need to be prepared for backlash and they need courage to fly in the face of this opposition. Implementing this kind of curriculum is not “an easy ride”.

Learning *about, through and from* Action

Milton McClaren and Bill Hammond (2005) draw distinctions among learning *about* action, learning *through* action and learning *from* action.

Learning *about* action focuses on learning the skills and strategies of sociopolitical action using movies, biographies and autobiographies, case studies and simulations, role-play and dramatic reconstructions. Providing students with examples of successful action taking, preferably involving other students, fosters the belief that they can change things, too. It is here that an action database can be especially useful, particularly in helping to overcome what Anneleen Kenis and Erik Mathijs (2012) call “strategy skepticism” (doubts about the efficacy of particular interventions). Students can learn from the experiences of others, that is, listening to and/or reading the stories of those who have been intimately involved in such projects. As John Forester (2006) comments:

In fields of practical activity... we are likely to learn less from recipes or general rules for all times and places, and more from vivid examples of real work, exemplars of sensitive and astute practical-contextual judgement in families of messy and complex cases. Here we need not abstract lists of ‘what worked’ but specific stories of reconstructive action – not so much experimental results but experimental stories, not so much (or only) abstract rules (or principles alone) about ‘what to do’ as emotionally rich, morally entangled, contextually specified stories about ‘how they really did it.’ (p. 573)

What we need are detailed accounts of individual, group and community-based, action-oriented projects of varying degrees of complexity, sophistication and political involvement. We can learn a great deal from what Forester (2006) calls the “friction of actual practice”, that is, learning through “the eyes and ears and hopes and dreads

and difficulties and surprises of actual people, activists and ordinary – and often extraordinary – people who get up each morning and confront in messy detail the fears and distrust and scheming and self-interest and aggression of others that our abstractions otherwise so thinly render” (p. 569). Tania Schusler and colleagues (2009) provide much helpful advice on how researchers can go about gathering this kind of oral history by asking questions such as: What motivated or inspired you to engage in this kind of work? What were your goals, hopes and expectations? How did this project come about? At whose initiative? Who has been involved? What barriers and problems were encountered? How were they addressed? What successes have there been? What failures have there been? What have you learned? What surprised, delighted or disappointed you? What would you do differently if you were starting again? Would you do it again?

Learning *through* action comprises direct involvement in action-oriented projects outside the classroom that are likely to have tangible outcomes and consequences. While some projects may be chosen and organized by the teacher, especially in the early years, it is important to involve students as quickly as possible in selecting and planning for themselves the actions to be taken. It is important to involve students in local SSI-oriented research activities and support them in participating in community-based organizations that bring citizens together to grapple with serious local issues, particularly those issues often overlooked by government agencies. In confronting real local issues directly, students gain valuable first-hand experience of the ways in which competing social, political and economic interests impact on decision-making. Through participation in community-based activities, they gain access to ideas, experiences, people, institutions and sociopolitical structures that build both individual and collective capacity to address SSI and environmental issues in a responsible, thoughtful, critical and politically effective way, and build the commitment to engage in the struggle for greater freedom, equality and social justice. In other words, engaging in SSI-oriented actions builds a richer and deeper understanding of the issues, assists students in developing and refining their own views about them, and builds the capacity to engage productively in further actions. Sometimes a clear understanding of the scale and complexity of an issue, and clarification of one’s own position regarding it, is a consequence of engagement in action rather than an essential precursor to it.

By focusing on the community and the issues and problems that residents confront in their everyday lives, students come to recognize their own experiences as shared, social and political. It is through direct experience of confronting social and environmental problems in the immediate community that public issues acquire personal meaning for young people – for example, working in shelters for the homeless, participating in breakfast programmes, doing volunteer work in hospitals, drug rehabilitation centres, HIV-AIDS support groups and homes for the elderly, involvement in environmental clean-up projects, renovating dilapidated homes, replanting degraded areas, building and maintaining community gardens, creating parks and conservation areas, organizing community festivals and information fairs, producing a local newsletter or community blog. As Paolo Freire

(1973) observed, people learn democracy through the exercise of democracy, or as James Banks (2004) says: “democracy is best learned in a democratic setting where participation is encouraged, where views can be expressed openly and discussed, where there is freedom of expression for pupils and teachers, and where there is fairness and justice” (p. 13). By engaging in public issues at the local level, students see democratic processes in action and learn how to engage in and negotiate them. By working alongside others, they learn about the demands and difficulties of taking action and learn to develop effective coping strategies. Research suggests that participation in these kinds of activities in childhood and adolescence is associated with levels of civic participation, community service and political activism in adulthood up to four times higher than the norm (Chawla and Flanders Cushing 2007). Carlson (2005) reports an interesting venture in Hampton, Virginia, in which the City Council established part-time, paid positions for two high school students to conduct regular surveys of public opinion, facilitate focus group discussions with their peers about local issues of concern, keep other young people informed about opportunities for community engagement, and help to facilitate that engagement. By the time of the next City Council election, some 2 years later, the voting participation rate among eligible young adults was 29 % higher than the national average.

We should make strenuous efforts to involve students in public hearings and town hall meetings, consensus conferences, study circles, focus groups, citizen juries/panels, negotiated rule-making forums, public/citizen advisory committees, and the like. It is through community-based activities that young people gain autonomy, a sense of worth, a sense of personal and civic identity, respect for other people’s views, negotiation skills, and so on. When engaged with real problems and issues, students encounter real barriers and obstacles; working with community members to overcome these barriers cultivates students’ competency and sense of competency. When people work together, there are opportunities for doing things that individuals would not even contemplate doing alone. By working on a sub-task within a group effort, individuals acquire a level of expertise that wouldn’t be achieved alone, at least not so quickly and so painlessly. They also come into contact with perspectives on issues and problems that differ from their own. Sharing experiences, action strategies and success stories, as well as building friendships, can be inspirational and highly motivating, and can lead to lifelong sociopolitical activism. These experiences are immensely valuable because they run counter to the twenty-first century trend of growing social isolation of individuals and individual families, and counter to the values that underpin the pervasive competition and conspicuous consumption of contemporary society.

Learning *from* action occurs when students evaluate the plans, strategies, processes and outcomes of their own action projects and those of others. Debriefing, as some would call it, entails compilation of a record of what happened or what the students perceive to have happened, an attempt to say why (or why not), and reflection by all parties on the significance of the action for themselves and for the community. It almost goes without saying that the process is facilitated by keeping careful logs and journals, consulting with others, sharing experiences and

feelings, and communicating with those who were not involved. There is value, too, in recruiting members of the community to act as critical reviewers.

Apprenticeship in Activism

Students can gain experience of action, and thereby learn *through* action and learn *from* action, via the familiar 3-phase apprenticeship approach.

- *Modelling* – the teacher demonstrates and explains the desired behaviour (in this case, social activism) and provides illustrative examples.
- *Guided practice* – students perform specified tasks within an overall action strategy with the help and support of the teacher.
- *Application* – students function independently of the teacher.

In short, it is assumed that students will become more expert in planning, executing and evaluating sociopolitical action by (i) observing teachers or other “experts” as they engage in action, (ii) practising the various sub-skills under controlled and supportive conditions, (iii) taking increasing levels of responsibility for planning and organizing the action, and (iv) engaging with critical evaluative feedback provided by the teacher and generated in inter-group criticism and discussion, and by means of intra-group reflection on the activity, both as it progresses and on completion. Initially, the teacher is responsible for planning the actions and directing the actions of students. However, if students are to achieve intellectual independence (Munby 1980), they must eventually take responsibility for their own learning and for planning, executing and reporting their own projects. In other words, learning as assisted performance must enable students, in time, to go beyond what they have learned and to use their knowledge and skills in creative ways for addressing different issues, solving novel problems and building new understanding. Consequently, alongside the modelled investigations, students should work through a carefully sequenced programme of exercises, during which the teacher’s role is to act as learning resource, facilitator, consultant and critic. Complex problems and interventions can sometimes be broken down into a series of smaller problems and suitable interventions, including relatively simple activities in which careful planning by the teacher can almost guarantee that students will succeed, while also creating opportunities for students to act independently of the teacher, thus building confidence and enhancing motivation for assuming greater autonomy. These exercises provide opportunities for students to learn through a cycle of practice and reflection, and to achieve, with the careful assistance and support of the teacher, and of each other, a level of sophistication and performance they could not achieve unaided. In this guided practice phase, teacher and students are *co-activists*, with both parties asking questions, contributing ideas, making criticisms and lending support. Thus, the teacher’s role shifts from instructor/demonstrator to director/facilitator. Clearly, such activities will only be productive if teachers and students are able to establish a learning community characterized by

respect for diversity, trust, willingness to engage in collaborative learning and eagerness to contribute to the learning of all members of the community. Eventually, as students gain experience and take on increasing control of decision-making, they can proceed independently: choosing their own topics, problems and situations, and approaching them in their own way. From this point on, students are responsible for the whole process, from initial problem identification to final evaluation. Students identify the issue or problem, collect, organize and analyse information, define the problem from a variety of perspectives, formulate and appraise alternative actions, choose which action to take, develop and carry out a plan of action, and evaluate the outcome and the entire undertaking. As a consequence, they experience both “the excitement of successes and the agony that arises from inadequate planning and bad decisions” (Brusic 1992, p. 49). Throughout these activities the teacher’s role is crucial: model activist, advisor, learning resource, facilitator, consultant, emotional support and critic. Also, because students are given the opportunity to experience failure as well as success, it is imperative that the class atmosphere is both forgiving and supportive.

Crucial to the notion of apprenticeship is a continuing dialogue about the way the activity is progressing, including frank discussion of problems encountered, avenues that prove fruitless, and barriers to progress that prove insurmountable. Crucial also, if the goal is for students to gain understanding of authentic sociopolitical action, is constant comparison between what students are doing in their project and what others have done (making use of an action database, as discussed above). By engaging in interventions and action-oriented projects alongside a trusted and skilled critic, students increase both their understanding of what constitutes sociopolitical action and their capacity to engage in it successfully. In other words, social activism is a reflexive activity: current knowledge and expertise informs and determines the conduct of the activity and, simultaneously, involvement in actions (and critical reflection on them) refines knowledge and sharpens expertise. In Carole Patemen’s (1970) words, “participation develops and fosters the very qualities necessary for it; the more individuals participate the better they become able to do so” (p. 42). Erin Sperling (2009) urges teachers to introduce students to the idea of SMART plans, that is, plans that are **s**pecific, **m**easurable, **a**ttainable, **r**ealistic and **t**imely. Good advice, certainly, but the reality is that the smartest plans in prospect may prove otherwise in practice. And coming to that realization, and seeking to ascertain why the plan proved less than ideal, is a crucial part of the learning experience. So, too, of course, is simply engaging in action. Even though an action may not solve a problem, reach a satisfactory conclusion or have significant environmental impact, it may still have great significance in terms of personal growth, fostering positive attitudes and building commitment.

As well as teaching students the need to be sufficiently resilient and determined to try again, experiences of failure may also impress upon them the need to mobilize others and to engage in collective action. Collective actions are often more effective than individual actions and, in some circumstances, may be the only means of bringing about change. Interestingly, Roth (2009a) reformulates the Vygotskian notion of zone of proximal development to refer to what can be achieved through

community-base collaborative efforts compared with what can be achieved by individuals. A key part of preparation for activism, then, is helping students to recognize, mobilize and coordinate the knowledge and skills that are distributed across communities. As Wolff-Michael Roth and Angela Calabrese Barton (2004) state:

Education needs to focus on the individual as an integral and constitutive part of the collective, and on the distributed nature of knowledge and skill. . . (and) we have to begin thinking about the modes by which individuals with different expertise coparticipate in resolving the complex problems that their communities, countries, and humanity as a whole face today. (p. 13)

It is highly unlikely that all students will be motivated by the same issues, problems, experiences or situations. Nor will all students be in a position to make substantial changes to their daily behaviour and routines, and more particularly in the context of education at the school level, effect changes in their family's behaviour and routines. Individuals can also vary quite substantially in their disposition to act (that is, in terms of differences in knowledge, self-esteem, values, commitment, emotional involvement, and so on). Clearly, these variations make it difficult to plan an action-oriented curriculum for all. But there is no reason why we should expect different students and groups of students to participate in the same project. Different views and different priorities could (and possibly *should*) lead to involvement in different projects. One final point: it is important that a particular action is not viewed as an end in itself. Students need opportunities to evaluate the action taken, reflect on its nature and impact, and possibly re-formulate the action. The simple point is that an *action orientation* or *action competence* (as Jensen 2004, calls it) are established over time and are rooted in reflective practice.

Further Considerations

It is important to note that young people are more likely to participate in community activities if a parent, some other family member or a close friend is already active and/or expresses approval and gives them lots of support (Pancer and Pratt 1999; Fletcher et al. 2000). The prevalence of references by young people to the influence of parents and other role models in forming their views and attitudes is sufficient testimony to the influence of the old on the young. It is also the case that adults are more likely to join activist groups if their children are already involved or have expressed a desire to be involved. Political power rests with adults, but children can influence the ways in which that power is exercised. Consumer power rests (ultimately) with adults, though children can and frequently do exert considerable influence on family consumption practices. Codes of behaviour, language patterns and tastes in music, fashion and movies adopted by young people frequently act, over time, to shift older people's views and behaviours in a similar direction. On a closely related theme, Roy Ballantyne, John Fien and Jan Packer (1998, 2001a, b)

have sought to exploit the ability of students to influence their parents or guardians, especially on environmental issues, by researching the elements in curricula that encourage students to talk with them (usually at mealtimes) about what they have been doing in school environmental education courses. Among the identified features that can easily be incorporated into recommendations for course design are: novel learning experiences, fieldwork, research-oriented homework assignments, discussion of easily-implemented pro-environmental behaviours (walking to school, taking shorter showers, turning off unneeded lights), student presentations at parents' evenings or public meetings, publicizing the programme in the local newspaper, conducting surveys and interviews in the community, and inviting local people to be guest speakers.

In short, effective sociopolitical action requires there to be a mutually supportive relationship between school and surrounding community. Traditional barriers between school and community need to be dissolved or rendered permeable, with community members present and active in the school, and students and teachers active and involved in the community. The difficulty of building such an atmosphere of interest, trust and shared responsibility and commitment should not be under-estimated. It requires strenuous effort on the part of teachers and students. As part of those efforts, we should be encouraging students to use their interest and skills in contemporary communications technology, especially social media such as *Facebook* and *Twitter*, to establish networks, express concerns, share thoughts and spread messages about the need for action. New forms of ICT enable forms of participation that were not previously possible and may engage significant numbers of people who would previously have been uninvolved. They have the potential to facilitate the building of a more inclusive, participatory, socially just and politically engaged community. Students should be encouraged and enabled to use aspects of youth culture, particularly music, chat rooms and other communications media, to spread a youth-oriented message concerning civic and environmental responsibility. Music, television and the Internet are important sites for identity construction and reinforcement, gaining a better understanding of one's own experiences and the experiences of others, raising political awareness, and building the solidarity and sense of community that can lead to activism. For many urban youth in the United States, the rap music of hip-hop culture can be a particularly powerful vehicle, enabling them to put their feelings, emotions, needs, aspirations, hopes, joys, fears, disappointments and anger into a form that is respectful of their immediate cultural experiences and will be readily understood by their peers.⁵ Shawn Ginwright and Julio Cammarota (2007), for example, describe how youth in Oakland (California) organized what they call "guerilla hip-hop" – impromptu mobile concerts with

⁵ Christopher Emdin (2010) provides an extended discussion of the ways in which a hip-hop based and hip-hop inspired science curriculum can play a key role in creating opportunities for marginalized and under-served youth to participate successfully in science education. I am proposing an extension to social activism.

music, rapping, distribution of leaflets and other forms of political education in local parks, shopping malls, street corners and other places where young people hang out.

Karim Remtulla (2008) identifies three categories of online political activity: (i) *awareness and advocacy* usage sees the Internet and other forms of ICT as a means of accessing independent and alternative sources of information that may be ignored or suppressed by mainstream media – for example, the Independent Media Center (www.indymedia.org) and Wikinews (en.wikinews.org); (ii) *community-oriented sites* seek to spread awareness, share experiences and ideas and build networks within communities; and (iii) *action groups* endeavour to raise public support for actions related to specific issues (local, regional, national and international). We need to be aware, however, that social inequities and differential access to technological resources can restrict opportunities for those who are already marginalized, unheard or disregarded. They can be further disadvantaged, silenced or excluded from participation in addressing the very problems that most affect them. Massive efforts will be needed to ensure that online spaces, and the communities that use them, are open to everyone. Kelly Garrett (2006) discusses these and related matters in an extensive review of some key literature in sociology, political science and communications studies. Space precludes any further comment here, save to note that Garrett frames the discussion in terms of three interrelated factors: *mobilizing structures* (the mechanisms that enable individuals to organize and engage in collective action), *opportunity structures* (the conditions that facilitate or constrain activist behaviour), and *framing processes* (the ways in which messages are framed, contested or promoted, and disseminated).

In public meetings, ordinary people (“ordinary” in the sense of being non-experts) and students can sometimes feel intimidated or excluded by scientists and engineers (and by politicians and lawyers, too) who use overly technical language and present opinions as fact and options as restricted. This is where Chantal Pouliot’s (2008) advice to teach very explicitly about three models of citizen involvement (*deficit*, *public debate* and *citizen involvement*) can be very helpful:

The purpose of using the deficit, public debate and co-production models is not to augment the consensual character of discussions concerning SSI... it is to encourage citizen participation in the sociotechnical issues confronting society... it is to encourage students to develop a point of view concerning citizens’ attitudes, interests and capacities (discursive and interpretative) that moves away from the deficit model; it is to prompt students to articulate representations that accord legitimacy to the statements and experience-based knowledge of citizens and to the collaboration of citizens in the process of producing scientific knowledge. (p. 68)

Even so, strenuous efforts will need to be made if all constituencies are to be represented and all voices heard. In many societies, it is the urban or rural poor, women and members of minority racial, cultural, ethnic and religious groups who are most likely to be excluded from public representation, and to have their needs, interests, views, attitudes, values and aspirations marginalized or ignored. We would do well to heed Gayatri Spivak’s (1988) warning that the space for dialogue

is invariably structured in exclusionary terms that prescribe who can speak, what they can speak about and how they will be heard. Within any group of participants, however carefully and sensitively recruited, there is unlikely to be a level playing field within which fully autonomous speakers can express their views. There is the ever-present danger that systemic inequalities will be activated and create opportunities for what Lisa Taylor (2008) calls “selective silencing”. Even the venue for a public meeting can impact the demographics of the gathering, with location in a church hall, school hall, local RSA,⁶ health centre, university lecture theatre or local council debating chamber playing a role in inclusion/exclusion and determining whose voices are heard. For example, on a Māori *marae* gender will be a key determinant of who speaks; in a community hall in Toronto, ethnicity will be influential in positioning the debate; in a village hall in the English countryside, it is likely to be social class that fixes the agenda. Participants need to be constantly vigilant lest activities undertaken in the name of participation result in patronizing tokenism rather than effective representation and participation of diverse groups; lest they reinforce social hierarchies, reflect the dominant hegemonic agenda, and distract attention from key issues of contention by insisting on early consensus. Despite good intentions and efforts to establish open and democratic processes, there is a danger that dominant individuals can (consciously or unconsciously) impose an agenda that supports particular versions of what is appropriate thought, behaviour and action. It is significant that following the large-scale national debate in the United Kingdom about the commercial growing of GM crops, involving a large number of local, regional and national events during the summer of 2003, the establishment of a Website that received 2.9 million hits and the return of 37,000 feedback forms (Irwin 2008), the final report concluded: “It is profoundly regrettable that the open part of the process, far from being a ‘public debate’, instead became a dialogue mainly restricted to people of a particular social and academic background” (House of Commons Committee 2003, p. 15). It is also the case that community-based groups can fracture around differences in gender, race-ethnicity, sexuality, age and class-based identities. Much skilful and sensitive work is needed to keep diverse groups working well. As Jeppe Laessøe (2010) comments, it is not simply a case of “top-down is bad, bottom-up is good”. Rather, it is a case of struggling for the most appropriate and effective balance of experts and non-experts in any particular situation, and for procedures that ensure all views and voices are heard and given consideration.

Common sense tells us that not all community-based SSI-oriented activities will be successful in promoting, developing and sustaining an activist stance. There is an ever-present danger that actions reflect the teacher’s agenda rather than the interests and concerns of the students and a danger that students merely “go through the motions” of engaging in action without any real commitment or sense of empowerment, simply to satisfy course requirements or meet the expectations of the

⁶In New Zealand, the Returned Serviceman’s Association (RSA) is the equivalent of the RSL (Returned Serviceman’s League) in Australia and the British Legion in the UK.

teacher. At the extreme, teachers may be led to compile a list of approved, scripted and “politically safe” actions in which to involve successive groups of students without ever engaging them in the critical debate that should precede and determine action. Cheryl Lousley’s (1999) research on the activities of four urban secondary school environment clubs, established to focus attention on such endeavours as naturalizing the school grounds, planting trees, recycling and organizing an Earth Week Festival, shows that students are frequently directed towards uncontroversial issues, guided away from conflict, dissuaded from political debate and censored when their proposals seem likely to challenge school practices, local government policies or the interests of local businesses. In short, she says, “the hidden ‘curriculum’ of surveillance, regulation, and interrogation which structured the club experience taught the students not to rock the boat and it hints that the liberal-humanist offer of tangible, ‘empowering’ results – results which do not alter the relations of power and authority within the school and do not take up controversial and challenging issues – amounts to a false perception of ‘making a difference’ and an education in naïve conformism” (p. 297). In making a similar point, Venka Simovska (2008) distinguishes between *token* participation and *genuine* participation in terms of “focus” (specified content versus knowledge building through critique and reflection), “outcomes” (acceptance of a particular set of beliefs, values and behaviours versus student autonomy, critical consciousness and ability to address novel and complex issues) and “target of change” (individuals and their specific lifestyle versus individuals in context, taking account of inter-personal relations, sociocultural factors, moral-ethical dimensions and existing organizational structures). The same concerns run through Roth’s (2009b) urging of teachers not to subordinate experience of activism to the more general aims of schooling.

Thus far, the choice of most teachers seems to have been to reflect (if not actively promote) the values, attitudes, ways of thinking and social structures that have fostered the economic, social and political systems responsible for current social and environmental crises. It is a matter of considerable urgency that we change the way we think, and change the science and technology education that has for too long maintained a particular way of thinking. For example, all the teachers interviewed by Randy McGinnis and Patricia Simmons (1999) felt so intimidated by the prevailing social climate that they expressed support for an SSI orientation but avoided controversial topics, especially those that might challenge religious views of a fundamental nature or the practices of local industries. Similarly and equally regrettably, Ali Sammel and David Zandvliet (2003) note that most approaches to SSI in school are conducted within teachers’ perceptions of “politically acceptable limits”.

In contrast, the primary thrust of the politicized science education being advocated here entails being critical of industrial, business, military and wider social practices, and where considered necessary, seeking change. Causing surprise, discomfort or offence to one or two parents, school officials, local residents or business interests is simply the price we have to pay in the struggle to create and sustain a better world and a more just, equitable and honourable society. It is imperative that teachers find the courage, enlist the support of others and mobilize

the resources to be much more challenging, critical and politicized in their approach. From my point of view, it is enormously encouraging that the Qualifications and Curriculum Authority in the United Kingdom regard teachers as having a *duty* to prepare students to deal with controversial issues.

Education should not attempt to shelter our nation's children from even the harsher controversies of adult life, but should prepare them to deal with such controversies knowledgeably, sensibly, tolerantly and morally. (QCA 1998, p. 56)

Avoiding controversial issues, especially those with very significant political dimensions, is regarded by many teachers as taking a neutral view. In reality, it is not neutral. Because it fails to confront and challenge the underlying sociopolitical causes of environmental problems, for example, it implicitly supports current social practices, current institutions and current values. Thus, it has to be regarded as education for social reproduction.⁷ There is no such thing as political non-involvement. Non-involvement is, in itself, a form of involvement by default and constitutes implicit support for the dominant ideology. Avoiding political matters is, in effect, leaving it for others to decide. There is no doubt that teachers who promote sociopolitical involvement and develop students' action skills and competencies are riding a tiger, but it is a tiger that may well have to be ridden if we really mean what we say about education for civic participation. I do not seek to minimize the difficulties that teachers face in deciding a course of action. All I can do is urge teachers and students to be critical, reflective, robust in argument and sensitive to diverse values and beliefs, and above all to have the courage and strength of will to do what they believe is right and good and just. In the words of Alberto Rodriguez (2001), we need the courage to "expand our gaze. . . and rise to the challenge of becoming cultural warriors for social change" (p. 290).

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⁷ There are, of course, many with a vested interest in social reproduction; there are many more who do not recognize that social reproduction is the outcome of most current educational practice.

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