

Chapter 17

Youth Participation in Local Environmental Action: An Avenue for Science and Civic Learning?

Tania M. Schusler¹ and Marianne E. Krasny²

Keywords environmental action, youth, participation, science education, civic engagement

17.1 Introduction

This chapter considers environmental action as an avenue for developing young people's capabilities for democratic participation as scientifically literate citizens. From the literature, we describe parallels between civic education conceptualised as civic engagement and science education approached as inquiry-based learning. We suggest six guiding principles for youth participation in local environmental action: *youth as contributors*, *genuine participation*, *deliberate action*, *inquiry*, *critical reflection*, and *positive youth development*. We illustrate these principles by applying them to local and national environmental programmes in the USA. The engagement of individual youth and the depth of their learning may vary widely even when programmes incorporate the guiding principles. We suggest future research directions around youth experiences, guiding principles, educator practices, participant characteristics, educational setting, impacts on adults and community, and culture. Such research will enhance understanding of environmental action and its contribution to science and civic learning.

17.2 Background

Environmental education practice in the USA often focuses on promoting personal responsibility and environmentally conscious individual lifestyle choices. However, it does not always adequately address the economic and political structures that limit

¹Department of Natural Resources, Cornell University, Fernow Hall, Ithaca, NY 14853–3001, USA, tms23@cornell.edu

²Department of Natural Resources, Cornell University, Ithaca, NY 14853, USA, mek2@cornell.edu

the freedom of individuals to make those choices. For example, one's freedom to buy local products or eat organic foods is restricted by the globalisation and industrialisation of agriculture – particularly if one cannot afford the luxury of paying more for environmentally responsible products. Environmental education in the USA could benefit from a political economy approach (Youngman 2000) that better addresses the political and economic structures within which individual actions take place. In this chapter, we consider how such an approach involving participation in local environmentally focused actions can integrate science education and civic engagement.

Emmons (1997:35) describes environmental action as 'a deliberate strategy that involves decisions, planning, implementation, and reflection by an individual or group. The action is also intended to achieve a specific positive environmental outcome, either small or large.' To improve access to locally produced fresh foods, for example, people might create a farmers' market, farm-to-school lunch programme, or community-supported agriculture. Participation in such local environmental action, which occurs at the intersection of ecological, economic, social, and political systems (Dryzek 1997), will also provide opportunities for integrating science and civic education, particularly if such efforts are based on both citizens' interests and sound science (e.g. a farm-to-school lunch programme that incorporates scientifically based nutritional guidelines). Such an approach is consistent with environmental education guidelines that emphasise knowledge and skills in both science and citizenship (NAAEE 2004). Youth grappling with environmental issues may develop understandings of environmental science and political processes, and skills in scientific inquiry and civic engagement, all of which are crucial to participation in a democratic society.

In this chapter, we illustrate examples of the extent to which science and civic education can operate in concert rather than conflict. Drawing on literature on civic engagement, science education, and youth development, we set out six guiding principles for youth participation in local environmental action. Following this, we apply the principles in a commentary on current environmental action programmes in the USA. The chapter concludes with suggestions for further research, the results of which, we suggest, could aid educators in the practice of engaging youth in action to improve their local environment and provide opportunities for science and civic learning.

17.3 Integrating Science and Civic Education

Civic education is a complex enterprise involving a variety of cognitive, conceptual, and attitudinal strands (Torney-Purta *et al.* 2001). Approaches to civic education vary immensely, in part reflecting fundamental differences in their conceptualisation of what it means to be a 'good' citizen (see, for example, Gibson 2001; Battistoni 2002; Youniss *et al.* 2002; Kirlin 2003). We conceive of civic education in relation to environmental action along the lines of a growing body of literature on youth civic engagement. Camino and Zeldin (2002:214) define civic engagement as 'being able to influence choices in collective action' and they recognise that citizen engagement – long a bedrock of democracy – is the purview of every citizen, not simply officials

and professionals. Skelton and colleagues (2002:9) offer a definition of *youth civic engagement* as 'young citizens developing civic skills and habits as they actively shape democratic society in collaboration with others'. Gibson (2001) suggests a broad conception of youth civic engagement that includes a wide range of indicators, such as: voting; knowledge and understanding of political processes; development of attitudes supporting democratic practices; critical thinking skills; ability to use information sources, including the news media; interaction and deliberation skills; and participation in civic activities like volunteering, service, or fund-raising for local causes (cf. Chapter 16 by Heck, this volume). Examples of pathways for youth civic engagement include public policy consultation on youth issues, community coalitions for youth development, youth infusion in organisational decision-making, youth organising, and school-based service learning (Camino and Zeldin 2002).

Youth participation in local environmental action reflects civic education based in the traditions of participatory democracy, public work, and social justice (Battistoni 2002) because it includes youth directly in democratic processes. It can also involve collective action towards some public purpose (e.g. creating a community garden, changing local policy to protect water quality), and can address the root causes of problems. Through civic engagement young people can develop understanding of civic concepts and gain civic skills, including those related to political knowledge, critical thinking, communication, public problem solving, civic judgment, civic imagination and creativity, community/coalition building, and organisational analysis (Battistoni 2002). This learning, in turn, can increase young people's ability to exert influence in public affairs (Newmann 1975) through enabling them to play an informed and active role in the political systems of power and decision-making (Fien 1993), to make choices rather than accept the prescriptions of others (Freire 1973), to hold experts to account, and to insert their own knowledge into the public discourse (Fischer 2000).

To exert influence in contemporary, science-laden public policy discussions, however, also requires some familiarity with science. In public debates ranging from regulation of genetically modified organisms to attempts to mitigate global climate change, crucial normative assumptions are often buried in technical analyses with little opportunity to question or examine the science itself (Fischer 2000). Scientifically literate citizens may have the ability to assess the value of knowledge in a particular context and to participate in the social negotiations that produce knowledge (Roth and Désautels 2004). They may also be capable of critically evaluating the scientific evidence touted by politicians, corporations, or environmental organisations, and other interest groups. Scientific literacy can provide individuals with greater control over their lives by enabling them to make better-informed personal decisions (e.g. health care, nutrition, risk acceptance); the capacity to participate in science-laden policy debates at local (e.g. drinking water quality), national (e.g. regulation of genetically modified organisms), and international (e.g. global warming) scales; and the desire to realise broader economic and personally rewarding opportunities, through often well-compensated and stimulating scientific and technological careers. Scientific literacy is one form of knowledge among many that increases the resources (i.e. knowledge, skills, strategies, understandings) upon which one can draw to participate in public life.

In examining how science education can contribute to civic literacy, it becomes obvious that the scientifically literate citizen must understand more than just scientific concepts and facts. The science education reform movement in the USA emphasises the importance of inquiry-based learning to developing scientific literacy. According to the US *National Science Education Standards* (NRC 1996:2):

Inquiry is central to science learning. When engaging in inquiry, students describe objects and events, ask questions, construct explanations, test those explanations against current scientific knowledge, and communicate their ideas to others. They identify their assumptions, use critical and logical thinking, and consider alternative explanations.

This approach to science learning involves some of the same skills that are required for civic participation, including problem solving, planning, decision-making, and discussion with peers. While to participate in public debates on issues involving science, students also must have an understanding of the ‘Nature of Science’ – that science is tentative, empirically based, subjective, necessarily involves human inference, imagination, and creativity, and is socially and culturally embedded (Lederman 1998).

The extent to which science education is in concert or conflict with civic education depends to a large extent on how one conceptualises both. Conceiving science as a set body of facts to be assimilated and civic education as learning about governmental structure and the electoral process offers little opportunity for integration. In addition, science is often misleadingly portrayed as value-free and apolitical: characteristics counter to civic participation. Yet, scientific practice involves several characteristics of genuine civic engagement, including questioning assumptions, understanding cause and effect relationships, considering alternative explanations, and debating critically within a community. In short, both science and civic education emphasise critical thinking. Whether in discovering what factors affect the water quality of a stream, or analysing how racial discrimination affects educational and economic opportunities, the habit of asking critical questions is an essential dimension of both science and civic education.

In *Democracy and Education*, Dewey equated thinking with inquiry and explained, ‘We sometimes talk as if “original research” were a peculiar prerogative of scientists or at least of advanced students. But all thinking is research, and all research is native, original, with him who carries it on’ (Dewey 1916:148). Fortunately, the narrow conceptions of science as a body of facts and civics as fulfilling one’s obligation to vote do not reflect the potential for science and civic education to work together. An area of overlap exists between science and civic education; thus, programmes can be designed to foster both science and civic learning among youth.

17.4 Principles of Youth Environmental Action

In this chapter, we suggest six principles that might guide thinking and future research about youth participation in local environmental action that are consistent with providing opportunities for science and civic learning. These principles are:

youth as contributors, genuine participation, deliberate action, inquiry, critical reflection, and positive youth development.

Youth as contributors

Young people have both the right and responsibility to participate in decisions affecting their environment and are capable of making valuable contributions to their communities and society (Hart 1997; de Winter 1997; Eames-Sheavly 1999). Skelton and colleagues (2002:6) explained that young people are best seen not as future citizens but ‘as co-creators of a thriving democracy and of the healthy civic practices of the environments in which they live, work, play and learn’. Youth participation in environmental action reflects a fundamentally different relationship between young people and adults – one that requires a sharing of power, for example – than that typically prevalent in our schools, youth programmes, and communities. Youth participation may also influence adult perceptions of youth. Research conducted in the context of youth governance has demonstrated that youth voice in organisational decision-making can positively influence adults and organisations (Zeldin *et al.* 2000).

Genuine participation

Participation in environmental action provides opportunities to experience democracy in authentic situations where youth can contribute and influence outcomes. People learn to participate in a democracy through the *exercise* of democracy, for that knowledge, as Freire (1973) stated, can only be assimilated experientially. At the heart of democratic processes, participation occurs in many forms with varying degrees of influence exerted by participants. Some seemingly participatory processes are deceptive. Decoration, tokenism, and manipulation do not meaningfully involve youth but rather advance predetermined adult agendas (Hart 1997). Genuine forms of participation, such as consultation and shared decision-making, are distinguished by honesty and clarity about the extent of young people’s power and the opportunity for youth to choose to participate to the maximum of their ability and interest (Hart 1997). Through participation, youth can learn civic concepts (such as decision-making structures) and skills (such as communicating and negotiating) that increase their ability to influence public affairs.

Deliberate action

Schnack (1994:190, in Simovska 2000:30) defines *action competence* as the ‘capability – based on critical thinking and incomplete knowledge – to involve

yourself as a person with other persons in responsible actions and counter-actions for a more humane world'. Two key distinctions between environmental action and activity are intentionality and targeting the root causes of a problem (Jensen and Schnack 1997). Of these, we find intentionality most important in distinguishing action from activity. For example, youth participation in an activity initiated and organised by adults, such as an environmental clean-up, while beneficial would not necessarily constitute action because it lacks deliberate choice or intent of the young people involved. Jensen and Schnack (1997) also argue that such a clean-up would not constitute action because it focuses on symptoms (e.g. removing trash and debris) rather than causes of environmental degradation. Actions that do not directly address root causes have the potential, however, to contribute indirectly to solving environmental problems (Bishop and Scott 1998). For example, a clean-up initiated by youth might draw public attention to the issue of littering or illegal dumping, which might lead a community to consider other actions to eliminate these sources of degradation. When youth take action to effect change, they can acquire skills related to planning, public speaking, fund-raising, and organising community support, as well as learn about civic-related concepts such as public purpose and power. Regardless of whether or not their efforts are successful, engaging in collective action enables youth to think critically about the kind of world they want to live in. It also can enhance their understanding of social, economic, and political systems as they identify opportunities for and obstacles to realising their vision.

Inquiry

Fusco and Barton (2001) and Roth and Lee (2004) view youth as potentially active producers and creators of scientific knowledge that contributes to community action in collaboration with peers, educators, and community members. Because it occurs at the interface of natural and social systems, young people's environmental research can involve a suite of quantitative and qualitative research methods ranging from water quality and soil analysis to interviews and participatory mapping (Doyle and Krasny 2003). Youth can engage in multiple aspects of the research process, including defining research questions, collecting and analysing data, interpreting results, and communicating conclusions. Thus, the research dimension can provide opportunities for youth to learn both science concepts (e.g. non-point source pollution, epidemiology of lead poisoning, changes in land use over time) and skills (e.g. aerial photo and map interpretation, Geographic Information Systems, interviewing, document analysis, synthesising, and communicating results) (Mordock and Krasny 2001).

Critical reflection

Reflection – thinking about what one is doing to more fully understand its meaning – is essential to both science and civic education. Lederman (1998) has demonstrated

that students do not implicitly learn about the Nature of Science and scientific inquiry simply by doing science. Such understanding is better facilitated through an 'explicit reflective approach' in which the educator explicitly points out aspects of the Nature of Science and scientific inquiry highlighted by students' experiences, and encouraging students to reflect on the implications that such aspects have for the way they view scientists, scientific knowledge, and the practice of science (Lederman 1998). Similarly, political knowledge and civic skills do not automatically develop from the experience of civic engagement or community service (Battistoni 2002). In this context, one particular approach for encouraging critical reflection on civic engagement to consider is 'conceptual organising'. This involves the explicit introduction of political ideas (e.g. citizenship, democracy, freedom, public life, power, self-interest, leadership, diversity, accountability) to challenge youth to reflect on and draw meaning from their actions, consider the broader implications of their work, and situate it in a larger public sphere (Boyte *et al.* 1999).

Positive youth development

Following a comprehensive review of existing studies, the National Research Council (NRC) in the USA compiled the characteristics of settings that promote positive youth development. These include physical and psychological safety, appropriate structure, supportive relationships, opportunities to belong, positive social norms, support for efficacy and mattering, opportunities for skill building, and integration of family, school, and community efforts. The NRC also identified 28 personal and social assets that facilitate positive physical, intellectual, emotional, and social development for youth. Participation in youth environmental action can foster many of these, including critical thinking and reasoning skills, good decision-making skills, confidence in one's personal efficacy, optimism coupled with realism, connectedness or perceived good relationships and trust with peers and adults, and commitment to civic engagement (Eccles and Gootman 2002).

17.5 Applying Principles of Youth Environmental Action to Youth Programmes

A growing number of local projects and state or national programmes in the USA involve youth in action to enhance their local environment (Table 17.1). Many of these programmes also reflect the guiding principles described earlier. The programmes' goals are ambitious and their anecdotal success stories can be inspirational.

In the following section, the projects are considered in more detail in terms of how they relate to the six principles outlined above, starting with the *Earth Force* programme, and then the Seneca Falls Landfill Project and the Garden Mosaic Programme, whose approaches are compared in Table 17.2.

Table 17.1 Examples of environmental action programmes in the USA

Earth Force operates programmes in approximately 100 school and community-based organisations primarily in eight US metropolitan areas. It is a non-profit, national civic participation and service learning programme in environmental education, designed to teach middle-school-aged youth the knowledge, skills, and attitudes necessary to becoming active citizens influencing environmental decisions in their communities (www.earthforce.org).

Garden Mosaics is an informal science education and community action programme designed to connect youth and elders in investigating the mosaic of plants, people, and cultures in gardens, in learning about science concepts and practices, and in acting together to enhance their community. Operating in cities across the USA and several international sites, the programme involves youth aged 10–18 from diverse ethnic, cultural, and economic backgrounds in activities that take place in urban community gardens, as well as in home and school gardens. Participants conduct investigations and action projects and then share the results of their efforts on the programme web site (www.gardenmosaics.org). Garden Mosaics is funded by a grant from the National Science Foundation (NSF) Informal Science Education programme, to the Cornell University Department of Natural Resources in Ithaca, NY.

National Public Radio's weekly environmental news programme, *Living On Earth*, engages middle and high school students in science-based explorations of their local environment, and in production of original audio journalism about their findings that airs over local and national radio (www.loe.org/edu). Major funding for the Living On Earth Ecological Literacy Project is provided by the National Science Foundation and the Corporation for Public Broadcasting.

During the pilot phase of the *Project Wild Science and Civics: Sustaining Wildlife* programme, students planned and constructed school and community wildlife habitats, organised a cross-cultural water festival along the Rio Grande River, and studied the impact of airport expansion on wildlife (www.projectwild.org/ScienceandCivics.htm). Project WILD was established in 1983, and is administered by the Council for Environmental Education (CEE) and is co-sponsored by the Western Association of Fish and Wildlife Agencies (WAFWA).

High school students participating in *Shaw EcoVillage's Ecodesign Corps* in Washington, DC have developed a mural celebrating Shaw activists; protected and restored trees; identified grant opportunities for local businesses; educated workers about environmental safety; and created designs for neighbourhood development oriented around public transit (www.shawecovillage.org). Shaw EcoVillage, founded in 1998, is a 501(c)3 organisation whose mission is to develop youth leaders to be catalyst for sustainable change in our urban neighbourhoods.

Teenagers participating in *Urban Community Action Planning for Teenagers* in Worcester, MA, led planning, developed partnerships, and raised funds to renovate a neglected neighbourhood park. Another group engaged in research to document rubbish (from paper litter to sofas and car parts) in their neighbourhood, assessed people's perceptions of the problem, and proposed possible solutions (Ross and Coleman 2000) (www2.clarku.edu/departments/idce/cp/research/research.shtml). UCAP is a participatory, systematic community development approach, adapted from Participatory Rural Appraisal (PRA), developed by Ross and Coleman.

Earth Force

Evaluation results from the *Earth Force* programme (www.earthforce.org) lend evidence to the importance of several of the guiding principles. *Earth Force* incorporates a six-part problem-solving process that guides young people in assessing their local environment; selecting an issue for further study; analysing relevant public policy and community practices; identifying options for affecting change; and developing, implementing, and evaluating an action project. Pre- and post-surveys

Table 17.2 Examples of how principles of youth environmental action were applied in the Seneca Falls Landfill Project and Garden Mosaics programme

Principle	Related student (or adult as noted) activities	
	Seneca Falls Landfill Project	Garden Mosaics
Youth as contributors	<p>Creating opportunities for community learning through panel discussion</p> <p>Contributing to research results on student attitudes through presentations to community groups</p>	<p>Contributing to online databases used for educational, scientific, and community development purposes</p>
Genuine participation	<p>Debating and agreeing on a process for selecting a community-based research project</p> <p>Collectively developing a mission statement and timeline for achieving it</p> <p>Soliciting school board support for project and funding for field trips</p> <p>Working in teams to plan and conduct project tasks, such as preparing a press release, inviting guest speakers, and developing informative posters for display at panel discussion</p>	<p>Working with adults in the garden and community to define and carry out an action project (e.g. reclaiming a vacant lot to create a new community garden)</p>
Deliberate action	<p>Initiating ideas for action (e.g. panel discussion of community experts, survey of student attitudes) and bringing them to fruition</p>	<p>Initiating ideas for action (e.g. enhancing an existing garden through an art project, building a compost bin) and bringing them to fruition</p>
Inquiry	<p>Conducting library and online research about landfills</p> <p>Asking own questions of community experts</p> <p>Designing and implementing survey of students' attitudes</p> <p>Debating interpretations of survey results</p> <p>Presenting project to peers at a multi-school research congress</p> <p>Communicating results to community groups</p>	<p>Brainstorming research questions</p> <p>Conducting interviews and observations and taking measurements in gardens and neighbourhoods</p> <p>Compiling results into reports or on datasheets</p> <p>Discussing the implications of results</p>

(continued)

Table 17.2 (continued)

Principle	Related student (or adult as noted) activities	
	Seneca Falls Landfill Project	Garden Mosaics
Critical reflection	Participating in class discussions reflecting on what it means to be a community member and how social science affects people’s lives	Reporting results to online databases
		Participating in an international community of youth and adults conducting research about people and practices in community and urban gardens
Positive youth development	Writing in response to questions posed in journal assignments	Participating in discussions of what assets community gardens provide to communities and where else in their neighbourhood such assets can be found
	Educators provide:	Reflecting on the processes and outcomes of action projects
	Physical and psychological safety	Settings, programme materials, and educators, gardeners, and other adults provide:
	Appropriate structure	Physical and psychological safety
	Supportive relationships	Appropriate structure
	Opportunities to belong	Supportive relationships
	Positive social norms	Opportunities to belong
Support for efficacy and mat- tering	Positive social norms	
Opportunities for skill building	Support for efficacy and mat- tering	
Integration of school and com- munity efforts	Opportunities for skill building	
		Integration of school and com- munity efforts

used in the evaluation of the 2001–2002 programme found statistically significant increases in participants’ civic skills, including knowing where to find information, how to contact adults for information, what it takes to change rules and laws, how to work with others, and acting in ways to protect the environment over the long term. The evaluation also found statistically significant declines on several attitudinal measures, including:

- Belief that each person should do what he or she can to protect the environment
- Commitment to working on environmental issues now and later in life
- Belief that the participant personally can make a difference
- Belief that people working together can solve community problems

- Belief that it is important to listen to people on all sides of an issue
- Belief in the importance of finding long-term solutions
- Attention paid to environmental issues (Melchior and Bailis 2003)

A further examination of these results reveals that impacts differ according to whether or not participants had actually conducted an action project. Youth at sites that involved them in such projects showed more positive civic attitudes than those that did not. Furthermore, programme duration had a strong effect on results, with participants in longer duration programmes (lasting more than 18 weeks) showing substantially more positive impacts and almost none of the negative impacts appearing in the overall analysis. In contrast, participants in shorter-duration programmes showed declines on a wide range of measures and almost no positive impacts (Melchior and Bailis 2003). Long-duration programmes might provide participants with more time to participate genuinely, engage in deliberative action that is successful in creating change (or understand why their actions were unsuccessful and learn from that experience in a way that is empowering rather than demoralising), contribute in meaningful ways, and critically reflect on their experiences.

Seneca Falls Landfill Project

The *Seneca Falls Landfill Project* provides a second example of how the guiding principles can be applied to designing a youth environmental action project (Table 17.2). This project involved 60 high school biology students, aged 14–16 and of mixed academic abilities, in an upstate New York school classroom (Tompkins 2005). The students worked collectively in defining the following mission: ‘To learn and share how Seneca Meadows Landfill affects our community and others beyond it’. To realise their mission, students gathered information on environmental, economic, and social impacts of the landfill on their community, took a field trip to the landfill and to a National Wildlife Refuge downstream of the landfill, invited guest speakers into the classroom, and developed posters, fact sheets, and press releases to share with the community. The students also initiated and organised a panel discussion so that other students and community members could learn about the landfill. Panel members included a landfill representative, environmentalist, community educator, town supervisor, and engineer from the state regulatory agency. Finally, recognising that youth voices were largely absent from discussions around the future of the landfill, the students conducted a survey of their peers’ knowledge and opinions about the landfill and shared their results in public presentations to community groups.

Results from the Landfill Project show that even when one applies the principles of youth environmental action, the engagement of individual students and depth of their learning may vary widely. A selection of student responses to the question: ‘What did you learn by participating in this project?’ is illustrative:

In this project, I learned that young people *can* make a difference. We have really proved this in our project. I've also learned how poorly our society handles issues like garbage – more should be done to recycle.

I learned a lot about our town as a whole and how little or much they care. I got to see group work finally pay off. And specifics about landfills – leachate, et cetera.

During this project I learned many new things! I learned about how to research people's opinions and thoughts. Sometimes it was frustrating, but in the end I was very proud of what our class stuck through and accomplished.

This year, I've learned about the real scientific method. It takes a lot of work to be educated, but it's worth it. Now, I'm glad I know more about the environment and people of our community. I also learned that science is everything: social, biochemical, et cetera. This year was a great learning experience!

Not much. The reason why was because this project was boring.

It really didn't interest me. If I'm not interested, I don't pay attention.

I didn't learn anything.

What caused some students to participate enthusiastically and view the project as a valuable learning experience, while others chose to participate as little as possible and claimed to have learned little through the process? One explanation might lie in students' motivation for participation. Some students were genuinely interested in the project, while others participated reluctantly because it was a required part of their coursework. Thus, designing programmes that take into account student backgrounds and motivations can be key to programme success.

Garden Mosaics

Garden Mosaics (www.gardenmosaics.org) is a national (and increasingly international) programme that integrates civic action, multicultural understanding, and science learning (Table 17.2). Youth participating in *Garden Mosaics* conduct investigations focusing on the role of community gardens in their neighbourhood, the connection of gardeners' planting practices to their cultural heritage, and urban weed control. The youth then report the results of these investigations to online databases, which are used for a number of purposes. For example, results from the Community Garden Inventory are used by the American Community Gardening Association to build a case for the importance of these urban settings for community development and food security (Saldivar-Tanaka and Krasny 2004). Results from the Weed Watch investigation are used to help a Cornell University agronomist develop an environmentally sound urban weed control programme. Stories about gardeners' planting practices and cultures are posted online where they serve as an educational tool for web site visitors, including youth, gardeners, and others interested in plants and people. Through engaging youth in collecting data that are used for political, scientific, and educational purposes, *Garden Mosaics* incorporates inquiry, youth as contributors, and positive youth development principles.

In addition to posting the results of their investigations online, *Garden Mosaics* youth have also used their interviews and observations to help define an action

project that benefits the garden and wider community. To illustrate, in the process of talking with gardeners, youth in Sacramento, California learned that the available plots in a neighbouring community garden did not meet the demand for gardening space among community members. The youth worked with a landscape architecture student to design a community garden space adjacent to their school garden. Youth participating in *Garden Mosaics* write a report on their action projects, including a section on their reflections about the work they accomplished, and post them on the *Garden Mosaics* web site. Thus, the *Garden Mosaics* action projects address issues related to genuine participation, deliberate action, and critical reflection.

It should be noted that even though a programme addresses the guiding principles, its success may still be variable. Similar to what was observed in the Seneca Falls Landfill Project, youth in some *Garden Mosaics* projects never developed interest in the activities, whereas youth in other groups became very engaged and experienced significant outcomes in terms of developing positive relationships with elders, learning about gardens, plants, and gardeners, and conducting a project to benefit their community. Although educator skills and enthusiasm may explain some of this variability, even the same educator may have very different results depending on the group of youth. In describing a programme in Allentown, Pennsylvania that went well, the programme evaluator wrote:

The Master Gardener who led the programme was particularly enthusiastic about the youth-elder connections during the programme; he brought in 'expert' visitors on a weekly basis. The youth interviewed these visitors, documented what they learned through photographs and posters, and applied their knowledge to the care of the garden. Youth learned about planting practices, pest management, and water management, among other topics. ... At the end of the season, youth demonstrated their newly gained expertise during a game of 'Garden Jeopardy' (in which every question was correctly answered!) and through the creation of a summary poster of their experiences; they also took an observer on a successful Garden Tour and conversed easily about the garden. The evaluation team feels that the Allentown site illustrated the potential of the Garden Mosaics programme. When the programme is thoughtfully implemented with an appropriate audience, enthusiastic youth learn about numerous aspects of garden science through interactions with elders; youth are then able to apply that knowledge in a variety of ways (S. Thompson, unpublished Garden Mosaics project report).

17.6 Future Research

The three programmes, all of which incorporate principles of youth environmental action, illustrate that participating in local environmental action can contribute to positive learning experiences for some youth but not for others. Research can illuminate the additional forces (e.g. educator practices, youth motivation, curriculum, funding, institutional support) that influence the impact of youth environmental action on participants. We propose several areas for future research:

Science and civic education

How does participating in local environmental action influence young people's views of citizenship and civic engagement, themselves in relation to their community, and science and its relevance to their lives? What civic and scientific skills do youth gain, and through what experiences do they develop those skills?

Principles of youth environmental action

How are the guiding principles exhibited in youth environmental action programmes occurring in diverse contexts? What additional principles apply? How does each of the guiding principles relate to programme success?

Educator practices

How do specific educator practices create opportunities for youth participation in local environmental action? Some educators seem to be 'naturals' in developing ownership, empowerment, and leadership skills among youth but little systematic analysis has addressed how they do so. Researchers can contribute to building and transmitting an accepted body of knowledge about practice by investigating what educators who successfully facilitate youth participation in environmental action actually do, and how they are trained and supported in doing it (P/PV 2000).

Participant characteristics

How do youth background, motivation, and demographics interact with programme design, educator characteristics, and other factors to determine impacts for individual youth?

Educational setting

How does the educational setting (e.g. formal classroom vs. non-formal community, computer resources available) in which youth environmental action occurs influence young people's learning experience?

Impacts on adults and community

How does youth environmental action benefit communities (e.g. through new green spaces or new policies)? How does it specifically impact adults and other members of the community (e.g. through adults changing their attitudes about youth)?

Culture

To what extent is youth participation in local environmental action relevant in different cultures? How are the guiding principles applied in programmes from different countries? How does multicultural education inform the theory and practice of youth participation in local environmental action?

Opportunities for integrating science and civic education differ significantly in countries throughout the world. For example, with its tradition of local participatory decision-making, Denmark has been at the forefront of research and practice focusing on the value and efficacy of ‘action competence’ and related civic action approaches to science education (see Svedbom 1994). Further afield, educators from many countries are currently developing concerted efforts under the banner of the UN *Decade of Education for Sustainable Development* (2005–2014), part of which focuses on environmental sciences education within a social action and equity context. Collaboration with international colleagues can help address the research questions outlined above, fostering learning with and from each other, and the creation of youth programmes that cross national borders. Such international collaboration will provide us with a broader perspective on the principles of youth environmental action, how to improve the practice of engaging young people in action to enhance their environment, and how participation in local environmental action contributes to science and civic learning that enhances one’s ability to participate in democratic society.

References

- Battistoni, R. (2002) *Civic Engagement Across the Curriculum: A Resource Book for Service-learning Faculty in All Disciplines*. Campus Compact. Providence, RI: Brown University.
- Bishop, K. and Scott, W. (1998) Deconstructing action competence: developing a case for a more scientifically attentive environmental education. *Public Understanding of Science*, 7, 3: 225–236.
- Boyte, H.C., Kari, N.N., Lewis, J., Skelton, N., and O’Donoghue, J. (1999) *Creating the Commonwealth*. Dayton, OH: Kettering Foundation.
- Camino, L. and Zeldin, S. (2002) From periphery to centre: pathways for youth civic engagement in the day-to-day life of communities. *Applied Developmental Science*, 6, 4: 213–220.
- de Winter, M. (1997) *Children and Fellow Citizens: Participation and Commitment*. Oxford: Radcliffe Medical Press.

- Dewey, J. (1916) *Democracy and Education: An Introduction to the Philosophy of Education*. Toronto, ON: Collier-Macmillan.
- Doyle, R. and Krasny, M. (2003) Participatory rural appraisal as an approach to environmental education in urban community gardens. *Environmental Education Research*, 9, 1: 91–115.
- Dryzek, J.S. (1997) *The Politics of the Earth: Environmental Discourses*. Cambridge: Oxford University Press.
- Eames-Sheavly, M.L. (1999) *Children and the Environmental Aspects of Community Development*. Project report. Ithaca, NY: Cornell University.
- Eccles, J. and Gootman, J.A. (eds) (2002) *Community Programs to Promote Youth Development*. Committee on Community-level Programs for Youth, Board on Children, Youth, and Families, Division of Behavioral and Social Sciences and Education, National Research Council and Institute of Medicine. Washington, DC: National Academy Press.
- Emmons, K.M. (1997) Perspectives on environmental action: reflection and revision through practical experience. *Journal of Environmental Education*, 29, 1: 34–44.
- Fien, J. (1993) *Education for the Environment: Critical Curriculum Theorising and Environmental Education*. Geelong, Victoria: Deakin University Press.
- Fischer, F. (2000) *Citizens, Experts, and the Environment: The Politics of Local Knowledge*. Durham, NC: Duke University Press.
- Freire, P. (1973) *Education for Critical Consciousness*. New York: Continuum.
- Fusco, D. and Barton, A. (2001) Creating relevant science through urban planning and gardening. *Journal of Research in Science Teaching*, 38, 8: 860–877.
- Gibson, C. 2001. *From Inspiration to Participation: A Review of Perspectives on Youth Civic Engagement*. Berkeley, CA: The Grantmaker Forum on Community and National Service.
- Hart, R.A. (1997) *Children's Participation: The Theory and Practice of Involving Young Citizens in Community Development and Environmental Care*. London: Earthscan.
- Jensen, B.B. and Schnack, K. (1997) The action competence approach in environmental education. *Environmental Education Research*, 3, 2: 163–178.
- Kirlin, M. (2003) *The Role of Civic Skills in Fostering Civic Engagement*. College Park, MD: CIRCLE (Center for Information and Research on Civic Learning and Engagement), University of Maryland School of Public Affairs.
- Lederman, N.G. (1998) The state of science education: subject matter without context. *Electronic Journal of Science Education*, 3, 2. Reno, NV: University of Nevada. <http://unr.edu/homepage/jcannon/ejse/lederman.html>.
- Melchior, A. and Bailis, L.N. (2003) *2001–2002 Earth Force Evaluation: Programme Implementation and Impacts*. Waltham, MA: Center for Youth and Communities, Heller Graduate School, Brandeis University.
- Mordock, K. and Krasny, M.E. (2001) Participatory action research: a theoretical and practical framework for environmental education. *Journal of Environmental Education*, 32, 3: 15–20.
- NAAEE (North American Association for Environmental Education) (2004) *Excellence in Environmental Education Guidelines for Learning (K-12)*. Washington, DC: NAAEE. http://naaee.org/pages/npeee/learner_guidelines.html.
- NRC (National Research Council) (1996) *National Science Education Standards*. Washington, DC: National Academy Press.
- Newmann, F.M. (1975) *Education for Citizen Action: Challenge for Secondary Curriculum*. Berkeley, CA: McCutchan Publishing.
- P/PV (Public/Private Ventures) (2000) *Youth Development: Issues, Challenges and Directions*. Philadelphia, PA: P/PV.
- Ross, L. and Coleman, M. (2000) Urban youth as community planners and leaders: exploring their potential with Urban Community Action Planning for Teenagers (UCAPT). *PLA Notes*, 38: 25–28.
- Roth, W.M. and Désautels, J. (2004) Educating for citizenship: reappraising the role of science education. *Canadian Journal for Science, Mathematics and Technology Education*, 4, 2: 149–168.

- Roth, W.M. and Lee, S. (2004) Science education as/for participation in the community. *Science Education*, 88: 263–291.
- Saldívar-Tanaka, L. and Krasny, M.E. (2004) The role of NYC Latino community gardens in community development, open space, and civic agriculture. *Agriculture and Human Values*, 21: 399–412.
- Schnack, K. (1994) Some further comments on the action competence debate. In: Jensen B.B. and Schnack K. (eds), *Action and Action Competence as Key Concepts in Critical Pedagogy*. Didaktiske studier, Studies in Educational Theory and Curriculum, Volume 12, Copenhagen: Royal Danish School of Educational Studies, pp. 185–190.
- Skelton, N., Boyte, H.C., and Leonard, L.S. (2002) *Youth Civic Engagement: Reflections on an Emerging Public Idea*. Minneapolis, MN: Center for Democracy and Citizenship, Hubert H. Humphrey Institute of Public Affairs, University of Minnesota.
- Simovska, V. (2000) Exploring student participation within health education and health promoting schools. In: Jensen, B.B., Schnack, K., and Simovska V. (eds), *Critical Environmental and Health Education: Research Issues and Challenges*. Research Centre for Environmental and Health Education, The Danish University of Education, pp. 29–43.
- Svedbom, J. (1994) Science knowledge – an important part of action competence. In: Jensen B.B. and Schnack K. (eds), *Action and Action Competence as Key Concepts in Critical Pedagogy*. Didaktiske studier, Studies in Educational Theory and Curriculum, Volume 12, Copenhagen: Royal Danish School of Educational Studies, pp. 59–72.
- Tompkins, L.J. (2005) A case for community-based education: students form partnerships to tackle local environmental issues. *The Science Teacher*, 72, 4: 34–36.
- Torney-Purta, J., Lehmann, R., Oswald, H., and Schulz, W. (2001) *Executive Summary: Citizenship and Education in Twenty-eight Countries: Civic Knowledge and Engagement at Age Fourteen*. Amsterdam: International Association for the Evaluation of Educational Achievement (IEA).
- Youngman, F. (2000) *The Political Economy of Adult Education and Development*. London: Zed Books.
- Youniss, J., Bales, S., Christmas-Best, V., Diversi, M., McLaughlin, M., Silbereisen, R. (2002) Youth civic engagement in the twenty-first century. *Journal of Research on Adolescence*, 12, 1: 121–148.
- Zeldin, S. et al. (2000) *Youth in Decision-Making: A Study on the Impacts of Youth on Adults and Organizations*. National 4-H Council. Madison, WI: University of Wisconsin.