The National Environmental Literacy Project: A Baseline Study of Middle Grade Students in the United States

William McBeth

University of Wisconsin–Platteville, Platteville, Wisconsin, USA

Trudi L. Volk

Southern Illinois University–Carbondale, Carbondale, Illinois, USA

The authors discuss environmental literacy in the United States and present a brief summary of the results of a major national study designed to attain a baseline measure of environmental literacy among middle school students in the United States. The authors include events that led up to the study and describe future directions for environmental literacy assessment.

Keywords: environmental behavior, environmental education, environmental literacy, environmental sensitivity, middle school, national assessment

When we approach the discussion of environmental literacy in the United States, it is helpful to provide a context by stepping back to look at the development of environmental education (EE). As noted by Disinger (1983/2005), EE in the United States has been defined and described in several distinct ways since its emergence in the 1960s. Initially, during the 1960s and 1970s, several short, one- or two-sentence definitions of EE were published (e.g., Harvey, 1977; Schneider, 1977). Of these definitions, one of the most noteworthy and widely used in the United States was that offered by University of Michigan faculty and graduate students in 1969 (Stapp et al., 1969): “Environmental education is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution” (p. 31).

Eventually, two other types of definitional statements emerged. These were sets of goals and objectives (e.g., Harvey, 1977; Hungerford, Peyton, & Wilke, 1980; UNESCO, 1977) and sets of key characteristics and guiding principles (e.g., Hart, 1981; UNESCO, 1977, 1978a, 1978b). Perhaps the most widely recognized of these, both in the United States and internationally, were those agreed upon at UNESCO’s Tbilisi Intergovernmental Conference (UNESCO, 1978a, 1978b). The Tbilisi goals, objectives, and guiding principles provided the fundamental principles for proposals and recommendations that resulted from the historic United Nations Conference on Environment and Development (UNESCO, 1992) and subsequent international gatherings. The Tbilisi categories of objectives include awareness, knowledge, affect, skills, and participation.

Correspondence should be sent to William McBeth, PhD, College of Education, University of Wisconsin–Platteville, Doudna Hall, 1 University Plaza, Platteville, WI 53818, USA. E-mail: mcbeth@uwplatt.edu
As we (and others) have noted elsewhere, “When these categories of objectives are viewed in the context of the Tbilisi goals, they represent stepping stones to prepare and enable citizens, including students, to become actively involved in the prevention and resolution of environmental problems and issues” (McBeth, Hungerford, Marcinkowski, Volk, & Meyers, 2008. p. 2). The 1990s also witnessed a maturation of the field of EE with the formulation of frameworks for environmental literacy. Based on available reviews of EE research that had been conducted in the U.S. (e.g., Iozzi, 1984; Hines, Hungerford, & Tomera 1986/1987), the earlier sets of goals, objectives, and guiding principles were permuted into frameworks for environmental literacy (e.g., Roth, 1992; Simmons, 1995; Wilke, 1995). The framework developed by Simmons served as the basis for a review of research related to environmental literacy (Volk & McBeth, 1998) and guided NAAEE’s National Guidelines for Excellence Project (1999/2000). In turn, NAAEE’s Guidelines for Excellence were used to inform and guide national initiatives in EE, such as the development of state certification programs, NAAEE’s program to accredit state certification programs, and NCATE Standards. A second framework was developed by a team of researchers working on instruments to assess the environmental literacy of students and EE needs of teachers (Wilke, 1995).

Both frameworks for environmental literacy have two broad features in common: (a) they reflect at least four of the Tbilisi categories of objectives, namely knowledge, affect, skills, and participation (i.e., behavior); and (b) they address at least three major thematic emphases apparent across the history of EE within the United States (Stapp, 1974; Swan, 1975), namely the natural world, environmental problems and issues, and sustainable solutions to these problems and issues. These efforts tied the literature surrounding the EE goals and objectives (vision and rhetoric) and the reviews of EE research (a research base) to the NAAEE Guidelines and their application to materials, accreditation and certification, and assessment (practice).

In 1990, a panel of professional environmental educators and researchers identified the need for national measures of environmental literacy as part of a national research agenda for EE (Wilke, 1990). During the next decade, there was little movement toward a national assessment of environmental literacy other than that reported by Wilke (1995), McBeth (1997), and Volk and McBeth (1998). The need for a national measure of environmental literacy was again recognized by the National Environmental Education Advisory Council (NEEAC), the citizen advisory council to the U.S. Environmental Protection Agency, in its 2005 Report to Congress (NEEAC, 2005). The call for a national assessment remained unheeded until 2006 when a group of researchers, including the authors, sought and received funding to undertake the task.

In the remainder of the present article, we discuss the results of a research project undertaken to provide a baseline assessment of environmental literacy among U.S. middle school students. In this research, we wanted to learn what U.S. youngsters know about, think and feel about, and do in relation to the environment and environmental issues. With respect to baseline data, the results of this research provide the environmental education community with its first-ever glimpse of the level of environmental literacy across the United States at the middle school level.¹

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PRIOR LITERATURE AND RESEARCH RELATED TO ENVIRONMENTAL LITERACY

It appears that the earliest mention of environmental literacy was by Charles Roth (1968) in an article that appeared in *Massachusetts Audubon*. Some years later, Harvey (1977) identified environmental literacy as the expected outcome of EE, describing three levels of literacy—environmentally literate, environmentally competent, and environmentally dedicated. Roth, declaring that “we are still relatively vague about what it is we are trying to do through environmental education (1992, p. 8),” revisited his early definition and reviewed the efforts of a number of writers who had attempted to clarify and redefine the meaning of environmental literacy, including Rillo (1974), Hungerford and Tomera (1977), Roth (1984), and Volk, Hungerford, and Tomera (1984), McClaren (1989), Rockcastle (1989), and Marcinkowski (1991). Following his review and discussion, Roth operationalized the concept of environmental literacy and, disagreeing with those who regard literacy as binary (either you are literate or you are not), maintained that environmental literacy, as with any type of literacy, “represents a continuum from zero ability to advanced skills” (p. 25). In a fashion echoing Harvey, Roth identified a continuum of literacy: nominal environmental literacy, functional environmental literacy, and operational environmental literacy.

Reviews of research in EE within North America over the past 35 years also provide insight into environmental literacy and summarize evidence that is relevant to this project. These reviews include Iozzi’s (1984) narrative summaries of research for different EE goals or categories of objectives, Hines et al.’s (1986/1987) meta-analysis of studies of correlates of responsible environmental behavior, Volk and McBeth’s (1998) narrative summary and vote-count of studies of environmental literacy components, two narrative reviews of research pertaining to environmental sensitivity and significant life experiences (Chawla, 1998; Sward & Marcinkowski, 2005), and, to a lesser extent, Hart and Nolan’s (1999) and Rickinson’s (2001) narrative reviews of studies pertaining to sensitivity, knowledge, attitudes, and behavior.

These reviews, coupled with other studies and reviews (e.g., Marcinkowski, 1993, 2004; McBeth, 1997; Simmons, 1995; Wilke, 1995;), provide evidence to support the selection, definition, and measurement of the environmental literacy components included in the present study: environmental sensitivity, ecological knowledge, environmental emotion (attitudes), issue and action skills, verbal commitment (willingness to act), and actual commitment (behavior). In the research literature, we found studies with relatively small samples that explored some or many of these variables, and we found studies with large samples that explored one or two of these variables. However, the literature is very clear that there have been no studies with both of these characteristics (i.e., a large sample size and a broad set of environmental literacy components).

THE ENVIRONMENTAL LITERACY ASSESSMENT PROJECT

This national assessment of environmental literacy was a type of survey research (Frankel & Wallen, 2000) and was guided by two broad research questions that sought to ascertain the following: (a) the level of environmental literacy of sixth- and eighth-grade students across the United States on specific environmental literacy variables (i.e., ecological knowledge, verbal commitment, actual commitment, environmental sensitivity, general environmental feelings, and
environmental issue and action skills); and (b) the general level of environmental literacy of sixth- and eighth-grade students across the U.S. Data were collected in April, May, and June of 2007, by a cadre of professional environmental educators from across the United States. These individuals were recruited largely through NAAEE’s Research Commission and were prepared for their data collection responsibilities through mailed and online materials (McBeth et al., 2008).

We used a nationally stratified random sample of sixth- and eighth-grade classrooms, identified by GfK Roper. Data were collected in schools from 48 counties in the United States, using four different instruments: A School Information Form (completed by school administrators) identified demographic characteristics of the school; a Program Information Form (completed by teachers of the classes that were surveyed) solicited a range of information about the school’s curriculum, including environmental aspects; a Teacher Information Form (also completed by teachers of the classes that were surveyed) gathered teacher demographics and solicited their views on the environment and environmental education; and the Middle School Environmental Literacy Survey (administered to students in sixth- and eighth-grade classes) that collected information pertinent to environmental literacy.

The Middle School Environmental Literacy Survey (Hungerford, Volk, McBeth, & Bluhm, 2006)—also known as the MSELS—is based on the Middle School Environmental Literacy Instrument (MSELI), developed and field-tested by Bluhm, Hungerford, McBeth, and Volk in 1995. The earlier instrument was refined and expanded by the original developers for use in the National Environmental Literacy Assessment Project, with input from Marcinkowski and Meyers. The MSELS included items from the MSELI, along with additional or modified items, tests, and subtests drawn from Cheak (1999), Leeming, Dwyer, and Bracken (1995), Meyers (2002), Peterson (1982), Quale (1993), Tanner (1980). The instrument includes several demographic items and measures of the following environmental literacy components: ecological knowledge; verbal commitment; actual commitment, or environmental behavior; environmental sensitivity; general environmental feelings; issue identification and issue analysis skills; and action planning. As such, the MSELS includes measures in four of the five domains commonly regarded as critical to environmental literacy: knowledge, affect, cognitive skills, and behavior. The MSELS contains 75 multiple choice and Likert-type items, and was designed to be administered within a traditional 50-minute class period.

The initial validity assessment of the MSELS was based on a comparison of elements of the instrument and the body of EE research literature, and construct validity was established using an expert panel. A field test of the instrument provided further measures of construct validity using contrasted groups comparison for the scales that focused on knowledge and skills. Construct validity was established for the noncognitive scales (i.e., affective measures and self-reported data) through factor analyses using the data from the sixth- and eighth-grade samples in this study. The results of the factor analyses for these scales of the MSLES revealed that the one-factor model for each scale was the best fit, confirming that each scale was unidimensional. Reliability estimates using Cronbach’s alpha were obtained from the field test of the MSELS; alpha coefficients ranged from .389 to .869 for the different parts of the instrument. Additional reliability analyses using the sixth- and eighth-grade data from this national baseline study yielded alpha coefficients ranging from .717 to .847.

A total of 2,004 usable student responses were received and included in data analyses (1,042 sixth-grade students, and 962 eighth-grade students). The sixth-grade sample was nearly evenly divided between females (51%) and males (49%); the eighth-grade sample included more
females (52%) than males (47%). The majority of students were White, Non-Hispanic (65% of sixth-grade students and 64% of eighth-grade students). In the sixth-grade sample, 15% of the students identified themselves as Hispanic and 10% indicated that they were Black, Non-Hispanic. In the eighth-grade sample, these proportions were roughly reversed, with 13% identifying themselves as Hispanic and 15% indicating they were Black, Non-Hispanic. In all, 5% of the sixth-grade students and 4% of the eighth-grade students indicated that they were Asian/Pacific Islander, and 3% of both sixth- and eighth-grade students identified themselves as American Indian/Alaska Native.

Because we were concerned that this study’s multistage design might reduce the extent to which the study sample reflected the national population of sixth- and eighth-grade students, we took steps to ensure that the study sample would represent the national profile of sixth- and eighth-grade students by enlisting the assistance of personnel at the University of Connecticut’s Center for Survey Research and Analysis (CSRA) to weight the data set in a manner that was consistent with this kind of sampling design. We applied these weights to the data set and analyses of aggregate data for the sixth- and eighth-grade students presented in the following section. In this way, the results reported for the study sample reflect the national population, at least on geographic or demographic parameters, and permits us to answer the first research question, addressing the levels of environmental literacy with respect to eight literacy variables.

Using the means derived for eight environmental literacy variables, we also prepared composite scores for the major conceptual variables associated with environmental literacy (cognitive knowledge, affect, cognitive skills, and behavior). We used sixth- and eighth-grade means to prepare grand means for each scale of the instrument. The grand means for the scale or scales related to each of four conceptual variables associated with environmental literacy (cognitive knowledge, affect, cognitive skills, and behavior) were combined and multiplied by a weighting factor to yield a maximum possible adjusted score of 60 for each conceptual variable. In turn, these four weighted scores were summed to yield a maximum possible total or composite score of 240. These weighted scores enabled us to describe the general level of environmental literacy among sixth- and eighth-grade students, as specified in the second research question.

RESULTS AND DISCUSSION

Levels of Environmental Literacy on Specific Variables

The first research question sought to describe the level of environmental literacy of sixth- and eighth-grade students across the United States on specific environmental literacy variables: ecological knowledge; verbal commitment; actual commitment; environmental sensitivity; general environmental feelings; and environmental issue and action skills. The results of the analyses of the aggregated sixth- and eighth-grade students’ scores related to these variables are summarized in Table 1.

Table 1 presents means, standard deviations, and percentage of points possible for the sixth- and eighth-grade samples, for each literacy variable included on the MSELS. It also includes information on the number of items used to measure each variable and on the range of points possible for each variable. Because there were variations across the numbers of items and across
TABLE 1
Descriptive Statistics for Weighted 6th and 8th Grade Data for Each Environmental Literacy Variable

<table>
<thead>
<tr>
<th>Environmental Literacy Variable</th>
<th>No. Items</th>
<th>Range</th>
<th>Grade</th>
<th>Sample Size n</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Percentage of Possible Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecological Knowledge</td>
<td>17 Items</td>
<td>0–17</td>
<td>6</td>
<td>934</td>
<td>11.24</td>
<td>3.26</td>
<td>66%</td>
</tr>
<tr>
<td>Verbal Commitment (Intention to Act)</td>
<td>12 Items</td>
<td>12–60</td>
<td>8</td>
<td>921</td>
<td>11.62</td>
<td>3.32</td>
<td>68%</td>
</tr>
<tr>
<td>Environmental Sensitivity</td>
<td>11 Items</td>
<td>11–55</td>
<td>8</td>
<td>978</td>
<td>32.54</td>
<td>7.47</td>
<td>59%</td>
</tr>
<tr>
<td>General Environmental Feelings</td>
<td>2 Items</td>
<td>2–10</td>
<td>6</td>
<td>987</td>
<td>8.14</td>
<td>2.00</td>
<td>81%</td>
</tr>
<tr>
<td>Issue Identification</td>
<td>3 Items</td>
<td>0–3</td>
<td>8</td>
<td>902</td>
<td>1.31</td>
<td>0.93</td>
<td>44%</td>
</tr>
<tr>
<td>Issue Analysis</td>
<td>6 Items</td>
<td>0–6</td>
<td>8</td>
<td>905</td>
<td>2.75</td>
<td>1.89</td>
<td>46%</td>
</tr>
<tr>
<td>Action Planning</td>
<td>8 Items</td>
<td>0–20</td>
<td>6</td>
<td>874</td>
<td>7.25</td>
<td>5.44</td>
<td>36%</td>
</tr>
<tr>
<td>Actual Commitment (Pro-Environmental Behavior)</td>
<td>12 Items</td>
<td>12–60</td>
<td>8</td>
<td>921</td>
<td>35.14</td>
<td>9.39</td>
<td>58.5%</td>
</tr>
</tbody>
</table>

the range of points possible, the discussion below will focus on how students performed in regards to their percentage of possible points for each section of the instrument.

When we observed the cognitive variables, we noted that at both sixth- and eighth-grade levels, the percentage of possible points was higher for the ecological knowledge section of the MSELS (66% of possible points for the sixth grade and 68% for the eighth grade) than for the cognitive skills sections of issue identification (44% and 40%), issue analysis (46% and 48%), and action planning (36% and 39%). We also noticed that student scores were higher for verbal commitment—intention to act (73% and 68.5%) than for actual commitment—proenvironmental behavior (64% and 58.5%). Neither of these patterns is surprising in light of past evidence about student performance on outcome measures in environmental education (Bogan & Kromrey, 1996; Leeming et al., 1995; Volk & McBeth, 1998). In general, knowledge application is less difficult than skill application, and the prevalence of verbal commitment (intention to act) over actual commitment (proenvironmental behavior) is well documented in the research surrounding responsible environmental behavior. We also noticed that students scored higher for general environmental feelings (81% and 78%) than they did for the more specifically worded verbal commitment—intention to act (73% and 68.5%).

We were curious about what we might find regarding environmental sensitivity measures, since into the 1990s, relatively few studies had measured environmental sensitivity among youth (e.g., McBeth, 1997) as opposed to among adults (Chawla, 1998; Marcinkowski & Sward, 2005). Student scores were noticeably lower for environmental sensitivity, than for the other affective variables (59% and 55% for environmental sensitivity, as opposed to 73% and 68.5% for intention, and 81% and 78% for general environmental feelings). In fact, the scores that most nearly resembled those of environmental sensitivity were those for actual commitment—proenvironmental
behavior (64% and 58.5%). Again, prior research would support this relationship because environmental sensitivity has long been considered a key predictor of responsible environmental behavior (Lierman, 1995; Marcinkowski, 2005; Sia, Hungerford, & Tomera, 1985/1986; Sivek & Hungerford, 1989/1990).

Simple comparisons between the sixth- and eighth-grade results indicated that, in general, eighth-grade students tended to slightly outscore sixth-grade students on the measures of knowledge and cognitive skills. As noted by Leeming et al. (1995), it would be expected that “older children would have more knowledge and earn higher scores on [a knowledge] instrument than would younger children” (p.24). We would have similar expectations in the cognitive skills area, as well.

On the other hand, sixth-grade students tended to outscore eighth-grade students on both the affectively oriented sensitivity, and general environmental feelings measures and on the more action-oriented intention and behavior measures. Again, we would not necessarily expect to observe age progression for an attitude scale because “attitudes change as a function of specific exposure and experiences, rather than as a result of increasing age,” (Leeming et al., 1995). Although the former differences are relatively small, suggesting that eighth-grade students are not that much more knowledgeable or skilled than sixth-grade students, the latter differences are clearer and more pronounced, suggesting that sixth-grade students hold moderately stronger affective ties to the environment than do eighth-grade students.

General Levels of Environmental Literacy

The second research question sought to identify the general level of environmental literacy of sixth- and eighth-grade students across the United States. In this portion of the study, we hoped to gain a broad view of environmental literacy among middle school students. However, there is a dearth of research evidence concerning environmental literacy, and there exists no benchmark against which the results of this study can be compared (e.g., there exists no quantitative standards or norms for environmental literacy). If it were possible to compare the results of this particular study to those of an earlier study, we could assess the relative rise, fall, or stability of environmental literacy within this developmental level. However, since there exists no such study, we would anticipate that the results of this research would become the basis against which future assessments might be compared.

The results for the prior research question were reported for each of the distinct sections of the MSELS. In response to the second research question, a more holistic approach to the concept of environmental literacy was needed. Thus, we derived composite scores for the major components or conceptual variables of environmental literacy, so that interpretations might be made across them. As previously described, we considered those major components to be environmental
knowledge, environmental affect, cognitive skills, and behavior. Table 2 presents information on the components of environmental literacy and composite scores. The first column presents four environmental literacy components, along with specific variables within each component—as measured on the MSELS. The means for each component are then reported by grade and as a combined grand mean for both grades. Finally, the table reports total scores or environmental literacy composite scores (the sum of the literacy component means) by grade, and for combined grades (6th and 8th).

The combined component means for Ecological Knowledge were 39.67 for sixth-grade students, 41.01 for eighth-grade students and 40.34 for the grand mean combined of sixth- and eighth-grade students. The combined component means for Environmental Affect (verbal commitment—intention to act, environmental sensitivity, general environmental feelings), for sixth- and eighth-grade students were 40.73 and 38.06, respectively, and the grand mean combined was 39.40. For Cognitive Skills, the combined component means were 25.15 and 25.98 and the grand mean combined was 25.56. The Behavior combined component means were 38.44 and 35.14, its the grand mean combined was 36.84. Finally, the Environmental Literacy composite scores (the combined means of all environmental literacy components for the sixth grade, the eighth grade, and the sixth and eighth grades combined) were 143.99, 140.19, and 142.14, respectively.

Of the four environmental literacy components, the highest scores (combined sixth- and eighth-grade adjusted grand mean) were attained in Ecological Knowledge (40.34), with slightly lower
scores in Environmental Affect and Behavior (39.40 and 36.84, respectively). The lowest scores were observed in the component of Cognitive Skills (25.56). In the components that focused on performance (i.e., which asked students to demonstrate knowledge or skills), the eighth-grade students out-scored the sixth-grade students. This might be expected due to developmental differences between the two age groups. In the components that relied on self-reports (affect and behavior), the sixth-grade students outscored the eighth-grade students.

Overall, what might we say about the general level of environmental literacy among U.S. sixth- and eighth-grade students, as measured by the instrument used in this study? The results of this research suggest that, as a group, they are moderate to high in their ecological understandings. Their attitudes also appear to be moderately positive, especially in terms of positive feelings toward the environment and willingness to take positive actions toward the environment. Although the older students appear to be more knowledgeable and more skilled in a cognitive sense than the younger students, the younger students appear to have more positive feelings about the environment, a greater willingness to take positive actions toward the environment, and a higher level of participation in pro-environmental behaviors.

However, for all students, in a pattern echoing that of adults, their report of undertaking actual behaviors to remediate environmental conditions falls short of their verbal commitment and feelings. Lower still is their grasp of critical thinking and decision-making skills that might be useful in helping to resolve environmental issues in their own communities and in society at large.

CLOSING

The development of environmental literacy is complex and can take many forms. In the present study, we have described a baseline, which, in itself, may be the most significant
aspect of the study as it provides us with a benchmark against which to measure current and future efforts. Our research team anticipates additional research efforts that will purposively seek out and collect data from middle school settings where environmental education is in place. This would permit us to compare measures on environmental literacy variables across the representative sample of middle school classrooms from this study and that purposive sample to determine if EE efforts can indeed make a difference in environmental literacy. It will also permit us to observe the relative effectiveness of diverse environmental education programs and curriculums with respect to environmental literacy, in general, and with respect to the four components of environmental literacy addressed by the MSELS.

Further analyses of the additional data collected in this study (in particular with respect to the classroom and teacher information) might shed light on the impacts of environmental education efforts, where it was present in these classrooms. In general, these data provide us with a glimpse into the incorporation of EE into our nation’s schools and, as such, warrant serious attention.

We believe that it is time for the field to take a close look at our efforts to achieve an environmental literacy citizenry. As the field has grown, we have seen the defining of environmental literacy, the development of research-based frameworks for literacy, and efforts to develop sound educational practices toward the development of literacy. What is lacking is regular and systematic measurement to help us view our progress. The findings of the present study provide a basis against which future measures can be examined. However, that examination will only be meaningful if the instruments of measurement are the same (or at least comparable) across studies. Therefore, we suggest the use of the MSELS by others so that there is some basis for comparing findings related to the environmental literacy of various populations and samples.

We also envision the development of additional environmental literacy instruments comparable to the MSELS but designed for students younger than the middle grades, for high school students, for tertiary level students, and for adults. In other words, we see the MSELS as the first in a series of instruments, and the Middle School Environmental Literacy Assessment project as the first in a series of literacy assessments that may help us understand where we stand with respect to environmental literacy in the United States.

NOTE

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