Integrating Gardening into the Elementary School Curriculum

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SUMMARY. Gardening is increasing in use as the focus of interdisciplinary teaching units in the elementary school curriculum and as a stratagem for student therapeutic, recreational, and social experiences. Elementary school teachers, identified as experienced in using gardening as a teaching tool, were surveyed and interviewed to determine successful strategies for integration of gardening into elementary school curricula. The most important factors determined by these teachers for the successful use of gardening in the curriculum were 1) student and faculty ownership or commitment to integrating gardening in their curriculum, 2) availability of physical resources, and 3) faculty knowledge and skill in the application of gardening to enhance an interdisciplinary curriculum. Educators who incorporate school gardening into their curriculum report that school gardening is a somewhat successful (35.2%) or very successful (60.6%) teaching tool that enhances the learning of their students. Most (92%) teachers surveyed requested additional school gardening education for themselves.

Of Virginia elementary school teachers, 78% related a high level of interest in the use of horticulture and gardening as a classroom teaching tool (Dobbs

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et al., 1998). Many educators recognize and expound the value of gardening in an interdisciplinary curriculum in elementary schools (Braun et al., 1989; Gwynn, 1988; Hanscom and Leipzig, 1994; Monk, 1995; Nelson, 1988; Pivnick, 1994).

Current curricular trends are based on the acceptance of the constructivist learning theory, accentuating the belief that hands-on learning is an effective teaching strategy (Lumpe and Oliver, 1991; Martin, 1983; Mechling and Oliver, 1983). Gardening provides concrete experiences that contribute to the understanding of many topics within the standard, mandated curriculum. For example, teachers have used gardening to enhance studies on such diverse subjects as math and science (Jaffe and Appel, 1990; Pranis and Kohen, 1990), Native Americans (Marturano, 1995), multiculturalism (Thibault, 1994), Colonial America (Thompson and Marcoux, 1996), and nutrition (Canaris, 1995). Using standardized testing, Sheffield (1994) confirmed that the use of a garden-based curriculum was an effective way to increase learning and comprehension in underachieving elementary students. Planting a school garden also requires the development of decision-making and problem-solving skills (Jensen and Hughston, 1979).

Gardening provides students with opportunities to interact with nature on a personal level that promotes positive behavior changes. In caring for plants, children develop personal qualities such as individual responsibility and empathy toward other living things (Clark, 1977). In addition, gardening with other students fosters cooperation. While using gardening to teach disabled children, Sarver (1985) observed that "the children discovered that they prospered in an environment where others did well also. That is, they were successful in proportion to the success of others."

This study was conducted to determine those factors that promote the successful use of gardening within an elementary school curriculum from teachers who are experienced in its use. By identifying these factors, horticulturists and educators can focus their efforts in supporting and enhancing the use of gardening as a teaching tool. This research also sought to describe the current application of gardening by the study population.

Methods and materials

In 1996, a national school gardening survey (SGS) was developed and sent to 322 elementary schools that had received a Youth Gardening Grant from the National Gardening Association in the 1994–95 or 1995–96 academic years. The participating teachers from these schools were experienced in the use of school gardening. In addition, 28 elementary school teachers from the survey test population, located in Virginia, were interviewed concerning the use of school gardening. Both the survey and interview research instruments were comparable to a survey designed and tested by Sewing (1986) as an approach to define the barriers faced by teachers in the use of environmental education curricula. The SGS implementation followed Dillman's (1978) "Total Design Method" for survey research. The SGS and interview formats were pretested by teachers located in the Roanoke County and Montgomery County school districts in southwestern Virginia.

Survey respondents were asked to identify five of the 18 listed school gardening factors that were most essential to the successful use of gardening in the curricula. Teacher comments on the SGS provided 12 additional factors affecting the use of school gardening that were incorporated into the interviews. Interviewed teachers were asked to sort 30 cards (each labeled with an individual factor from the cumulative list of 30) into groups labeled "not important," "important," and "most important." Teachers were then asked to identify five factors from the most important group that were most essential to their use of school gardening within their curricula. Data were statistically analyzed by percentage, standard error, cluster analysis, and chi-square tests using the Statistical Analysis System (SAS Institute, Cary, N.C.).

Results and discussion

Of the 315 surveys mailed, 236 (74.9%) usable responses from 42 states were received. The results provided by the SGS and interviews are presented as response percentages. No significant correlations were identified in these data. Most SGS and interview questions allowed for more than one answer; therefore, many of the cited frequencies are not cumulative.

Survey factor selection was evaluated by cluster analysis resulting in the identification of three primary groupings that were further evaluated by standard error. Numerical assignment to factor groups listed in Tables 1 and 2 is based on the frequency of selection of the five most essential factors with respect to standard error (SE) estimates of the true frequencies. The overlap of SE ranges resulted in subjective decisions on factor groups made according to the strength of association between the factors. While actual factor relationships may be subject to debate, this rank order grouping provides a format for discussion of the teachers' perceptions of factor importance.

The top three groups of survey factors and the top two groups of interview factors were considered as "most essential" to the successful use of school gardening in the elementary school curriculum and are discussed here. In the top three groups of survey factors (Table 1), eight of the 18 factors were valued highest in importance by 27% or more of the teachers. With 30 factors to select from, interview responses were more diverse. In the top two groups of interview factors (Table 2), 11 of the 30 factors on the interview list were valued highest in importance by 21% or more of the teachers. In the interview groups, five of the eight factors valued in the top three SGS importance groups also ranked high in importance, along with six of the new factors. While all 18 factors on the SGS list and 27 of the 30 factors on the interview list were considered essential by at least one surveyed or interviewed teacher respectively, the lower selection frequencies suggest most teachers either easily accomplish these factors or cope reasonably well in their absence. Thus, the top-valued factors were evaluated more closely. They were observed to relate in three general areas: 1) student and faculty ownership or commitment to integrate gardening into the curriculum, 2) availability of physical resources, and 3) faculty knowledge and skill in using gardening as a method to enhance an interdisciplinary curriculum.

STUDENT AND FACULTY COMMITMENT. "A person with the responsibility for school gardening activities" was described in the SGS as one of the most essential factors for the successful use of school gardening (Table 1). A follow-up survey question (data not shown)

Table 1. Percentage of school gardening survey respondents indicating that a specific factor is essential for school gardening success when responding to the survey question “What are the five factors that are absolutely essential for school gardening success?” (N = 236).

Group ^z	Factor	Percentage	SE
1	Person with responsibility for school gardening activities	63.0	3.2
1	Availability of a site to grow plants	61.4	3.2
1	Availability of funding for supplies	60.6	3.2
2	Support of the principal	48.0	3.3
2	Availability of gardening equipment	47.7	3.3
3	Adequate amount of instructional time	32.8	3.1
3	Teachers' gardening knowledge	29.8	3.0
3	Availability of volunteer help	27.2	2.9
4	Management of student behavior	26.7	2.9
4	Availability of a summer garden maintenance program	24.2	2.8
5	Adequate amount of preparation time	20.0	2.6
6	Availability of outside, expert help	10.2	2.0
6	Availability of support materials	9.3	1.9
6	Small class size	8.9	1.9
6	Availability of storage for supplies	8.9	1.9
6	Addressing safety concerns	8.5	1.8
6	Availability of garden-based curriculum	6.8	1.7
7	Teachers' science knowledge	5.9	1.5

^zGroup = ranking based on SE.

Table 2. Percentage of interviewed teachers indicating that a specific factor is crucial for school gardening success when responding to the interview question “What are the five factors that are crucial for school gardening success?” (N = 28).

Group	Crucial factor	Percentage	SE
1 ^z	Student ownership of the gardening project	57	9.5
1 ^z	Integrating gardening with other subject matter	43	9.5
2	Availability of a site to grow plants	36	9.2
2 ^z	Availability of a water source	29	8.7
2	Person with responsibility for school gardening activities	25	8.3
2	Availability of gardening equipment	25	8.3
2	Support of the principal	25	8.3
2 ^z	Focus as to purpose of the gardening program	25	8.3
2 ^z	Faculty interest in school gardening	25	8.3
2	Adequate amount of instructional time	21	7.9
2 ^z	Teachers viewing the garden as a resource	21	7.9
3	Availability of volunteer help	18	7.4
3 ^z	Accessibility of the gardens to the students	18	7.4
3	Adequate amount of preparation time	14	6.7
3	Availability of support materials	14	6.7
3	Availability of outside, expert help	14	6.7
3 ^z	Long-range plan for the gardening program	14	6.7
3	Teachers' gardening knowledge	11	6.0
3	Addressing safety concerns	11	6.0
3	Availability of funding for supplies	11	6.0
3	Availability of summer garden maintenance program	7	5.0
3	Management of student behavior	7	5.0
3	Teachers' science knowledge	7	5.0
3 ^z	Pressure to meet other academic requirements	7	5.0
4	Availability of garden-based curriculum	4	3.6
4 ^z	Help from support staff for mowing, etc.	4	3.6
4 ^z	Support from the school district	4	3.6
5	Availability of storage for supplies	0	0.0
5	Small class size	0	0.0
5 ^z	Vandalism	0	0.0

^zFactors added from prior survey results; group = ranking based on SE.

indicated that this person was, in most cases, the teacher. At 91% of the surveyed schools, an interested teacher, lead teacher, or teacher committee had responsibility for school gardening activities. Parent volunteers (7%) or an interested community volunteer (2%) administered the remaining school gardening programs. The interviews supported this finding by selecting "the person responsible for the school gardening activities" as a most essential factor (Table 2). The interviewed teachers also placed equal importance on "faculty interest in school gardening" and "teachers viewing the garden as a resource."

Involvement by other strategic personnel was stressed by the SGS and interviewed teachers. Both the SGS and interviews emphasized the support of the principal. In addition, the interviewed teachers indicated that "student ownership of the gardening project," a factor added by the surveyed teachers, was ranked as the highest of the most essential factors in school gardening success (Table 2). For school gardening to succeed as part of the curriculum, both teachers and school principals need to support its use, and students need to be personally invested in the gardening project.

AVAILABILITY OF PHYSICAL RESOURCES. Several key practical gardening features were identified by the survey as important to the successful use of school gardening (Table 1). The two most essential factors from the first group were the availability of a site to grow plants and the availability of funding for gardening supplies. Related to these two factors was the availability of gardening equipment. The interview results (Table 2) added the availability of a water source, as a most essential factor.

Accessing adequate volunteer help was selected by surveyed teachers as one of the third most essential factors. Additional survey questions indicated that volunteers were needed to provide an adequate adult to student ratio when students were engaged in school gardening activities, to provide gardening expertise, and to provide labor for garden maintenance.

FACULTY KNOWLEDGE OF THE APPLICATION OF GARDENING IN THE CURRICULUM. When selecting from the expanded list of 30 factors, interviewed teachers rated "the integration of school gardening into the curriculum" as one of the most essential factors. Interviewed teachers

placed importance on the "focus as to the purpose of the school gardening program" and "the availability of an adequate amount of instructional time" (Table 2). Interviewed teachers supported the selection of this latter factor by indicating in an open-ended question that finding the time to accomplish gardening activities during the school day was the most difficult part of school gardening.

Surveyed teachers selected "an adequate amount of instructional time" as an important factor influencing school gardening success. They selected their "gardening knowledge" as a factor that affected the successful use of school gardening. Teachers indicated significantly higher reliance on their gardening knowledge rather than on their science knowledge when using gardening in the curriculum (Table 1). This may suggest that teachers who are not "gardeners" may be less likely to use school gardening. In addition, 92% of the experienced, surveyed teachers expressed an interest in additional education for themselves to enhance their use of school gardening (DeMarco et al., 1998).

School gardening programs

Teachers' perceptions of what can be learned by gardening determine

how gardening will be used in the curriculum. School gardening was incorporated into most educational subject areas (Table 3); demonstrating the ability of teachers to use gardening across the curriculum. Survey responses indicated that gardening was used as a teaching tool with children in all age levels found in the elementary school environment (data not shown).

Teachers' perceptions of school gardening were reflected by their teaching goals when using gardening in the curriculum (Table 4), and comments written to clarify goals. The majority of the surveyed teachers (91.5%) indicated that they used gardening for students' academic learning. Teachers also indicated that they used gardening as a forum for expanding the students learning through social (83.1%), recreational (61.9%) and therapeutic (51.7%) experiences. Social development was enhanced by introducing students to such topics as community service, diversity in human culture, and environmental stewardship. Recreational uses included activities such as forming a gardening club, beautifying the school, and having fun. Therapeutic goals were reflected by comments about the motivational, emotional, and enriching qualities of gardening.

The SGS asked teachers to respond to a Likert-type scale (Smith

Table 3. Percentage of school gardening survey respondents indicating that a specific educational subject is taught in conjunction with school gardening (N = 236). Note: percentages are not cumulative; they reflect multiple category use.

Subject area	Percentage
Science	92.4
Environmental education	83.1
Mathematics	68.6
Language arts	67.8
Art	65.7
Health and nutrition	58.9
Ethics	58.1
Social studies and history	51.3
Music	24.2
Physical education	19.9

Table 4. Percentage of School Gardening Survey respondents indicating their goals when using school gardening in elementary school curricula (N = 236). Note: percentages are not cumulative; they reflect multiple category use.

School gardening goal	Percentage
Academic	91.5
Social development	83.1
Recreational	61.9
Therapeutic	51.7

and Ragan, 1993) indicating how successful they felt school gardening was as a teaching tool. The respondents viewed school gardening as a somewhat successful (35.2%) or very successful (60.6%) teaching tool (Table 5). Although potentially biased by their positions as grant recipients, these responses indicated that teachers experienced in using gardening as part of their curriculum saw student learning enhanced through its use.

Recommendations

This study indicates that, for a teacher to be willing to make the commitment of time and energy to school gardening, he or she must recognize and believe that gardening is a valuable teaching tool that will enhance the education of the students. By genuinely understanding the value of learning through gardening, teachers may then effectively use it in the curriculum. To achieve this goal, teachers must first have opportunities to see gardening used successfully as a teaching tool.

The horticulture community can provide opportunities that promote teachers' understanding of school gardening and its adaptation into the curriculum. Arboreta and botanical gardens can provide school gardening demonstrations through on-site exhibits and visitations. Horticultural organizations can introduce school gardening to teachers through presentations and exhibits at education conferences and through in-service training sessions. Horticulturists can provide written articles on school gardening to educational periodicals and trade journals.

As commitment to gardening as a teaching tool develops, preservice and in-service teachers need the educational tools to effectively implement a garden-based curriculum. Instruction should include the interdisciplinary use of gardening, basic horticultural knowledge, and school gardening models

for local adaptation. Models can provide insight into maximizing student involvement and ownership of the school garden. To justify its use, teachers must be provided with specific activities geared to address state-mandated standards of learning. To assist teachers, the horticulture community can make available up-to-date, interdisciplinary, garden-based learning activities on the World Wide Web.

Teachers require courses that provide sound horticultural knowledge but are directed towards application in the elementary classroom. Educational formats for teachers could include courses at universities, colleges, and community colleges, as there is indication of strong demand for such classes (Dobbs et al., 1998). Cooperative extension master gardener training in school gardening can be developed specifically for teachers. Teacher in-service training in school gardening can be provided by Advanced Master Gardeners or by horticulture educational services, such as *Lifelab* (Life Lab Science Program, Inc.), and *Growlab* (National Gardening Association).

Principals need education and demonstration of the value of school gardening to understand and support teachers' use of this teaching tool. They can be reached not only by the opportunities presented for teachers, but also by exhibits at principals' conferences and school administration meetings. In addition, horticultural businesses and the cooperative extension service can assist principals and teachers in locating financial, horticultural, and educational resources that support school gardening programs.

To develop the physical resources needed, the school landscape should be promoted as an extension of the indoor classroom. School grounds are an ideal teaching lab that can provide more learning space at a very low cost. Gardening tools need to be made avail-

able through the horticulture industry at prices that cost-conscious schools can afford. Horticulture businesses should consider adopting a local school to provide school gardening support.

Volunteers with gardening knowledge effectively help teachers improve student learning by gardening. Specialized training of volunteers and parents to assist teachers in school gardening could be made available through the cooperative extension service and the master gardener Program.

To promote and support the use of school gardening by educators and educational institutions, it is imperative research be conducted that quantifies the student learning that occurs when gardening is used in the curriculum. Research tools and supporting documentation describing the cost effectiveness of school gardening needs to be developed.

Using gardening as a teaching tool within an elementary school curriculum is critical to the future of the horticulture industry. Exposing young children to gardening at school is an avenue for cultivating future generations of gardeners, as well as future generations of professional horticulturists. Arboreta and botanical gardens, horticultural organizations, horticulture trade associations, universities and colleges, and the cooperative extension service all have potential roles in increasing the visibility of school gardening and helping teachers understand its value as a teaching tool within an interdisciplinary curriculum.

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Table 5. Distribution of responses to the school gardening survey question describing the success of school gardening as a teaching tool (N = 236).

Rating	N	Percentage
Very successful	143	60.6
Somewhat successful	83	35.2
Neither successful nor unsuccessful	3	1.3
Somewhat unsuccessful	2	0.9
Very unsuccessful	2	0.9
No response	3	1.3

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