Building an Outdoor Classroom

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Building an Outdoor Classroom for the Benefit of Hands On Science

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Building an Outdoor Classroom
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Abstract

A complete resource guide for building and using an outdoor classroom for the benefits of hands-on science activities and the enhancement of the science curriculum is compiled in one product for educators. The product is designed to take facilitators through all phases in the implementation of an outdoor classroom including designing, financing, and maintenance. A comprehensive listing of Internet sites, books, and additional resources are provided along with relevant lesson plans for environmental education. Scholarly articles and studies are offered in support of outdoor classrooms as a teaching tool and the advantages of hands-on science activities. The product is based on the actual inception and utilization of an outdoor classroom in a public school and can be used as a workable template for any outdoor learning center.
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Chapter I

Introduction
Environmental education has gained momentum during the past few years. Many schools are working with community and state organizations to train educators in the teaching of nature and the environment as a method for achieving science curriculum objectives. In order to offer quality nature and environmental science programs that meet established criteria for schools, it is important to create such programs that are consistently good and are interactive with hands-on activities. One tool that is being used for this means is the establishment and implementation of outdoor classrooms.

Outdoor classrooms can consist of many types of settings. They can be interactive gardens, weather stations, compost sites, natural habitats, water systems, or a simple schoolyard fieldtrip to observe nature. Educators decide how involved they want to become with their projects, given their constraints. What is important is that educators involve students in hands-on activities that incorporate sound science lessons and environmental issues. This allows students the opportunity to enjoy science, relate what they have learned to the world around them, and gain an appreciation for the environment and issues that face its preservation.

The main component of an outdoor classroom is the emphasis on hands-on activities and involvement of the students. Howard Gardner states that education must involve activities in which children investigate, question, and think (Gardner & Boix-Mansilla, 1994). An outdoor classroom allows such opportunities in a way that is fun and non-stressful. Rita Newman (1996) builds on this argument through a major study by Rivkin (1995) which emphasizes the importance of children spending time outdoors and having first hand experiences in the natural world. She explains that the natural world
provides content and materials for learning and that teachers can provide the language and ideas to extend those natural learning ideas.

Though success in all subject areas can be achieved, science is obviously the discipline that most lends itself to outdoor classrooms. Not only do students experiment and observe in a natural laboratory, they become aware of the importance of the environment merely by becoming a part of the living world. The 1997 National Report Card on Environmental Knowledge, Attitudes, and Behaviors gave the American public a failing grade (Motavalli, 1999). Actual knowledge of environmental issues was low across the board. The need to excite and motivate children in environmental issues is evident. Dr. Chris Myers, the editor of the environmental education magazine Dragonfly, states that “a lot of the times, it’s the kids who are coming home and getting their parents more active on environmental issues. It takes education to get kids going on a cause.” He continues saying that “if education is going to be transformative, then it has to actively engage the learner in a way that is relevant to their lives (Motavalli, 1999).”

Creating and using outdoor classrooms is “the way” to involve students in the kind of hands-on active learning that all educators want and seek. Lesson plans can be exciting and fun, not just for the students, but for the teacher as well. The outdoor classroom provides variety and change of pace for all those involved with the education of students. When learning becomes enjoyable and relative, success will follow. The interest and want for more knowledge that can be inspired in the student justifies the creation of outdoor classrooms.
Purpose

The purpose of this manuscript is to provide educators with a product that can be used in the conception, planning, building, and operation of an outdoor classroom. The manual offers a resource that will address the majority of the needs that will arise while formulating the actions an educator will take in establishing the outdoor classroom. Information on outdoor classrooms and nature programs is available in many different mediums. The problem that occurs is that the information is scattered and recovery of materials is time intensive. Many educators feel overwhelmed at the thought of where and how they should begin. Even when the commitment is made to creating an outdoor classroom, concerns such as how to finance the facility, implementation of the facility, and the maintenance of the new classroom can lead to a feeling of defeat and subsequent abandoning of the project.

This submitted product is different than other outdoor classroom “how-to” guides in the simple fact that it addresses all aspects of the creation and operation of an outdoor classroom. Though no manual or instructional resource is definitive or complete, this product is a “one-stop” source that will benefit educators in most outdoor programs. The research has been completed and presented in an easy to follow format with information for ideas, grants, types of classrooms, and lesson plans. Resource sites and materials are also offered to further enrich individual programs.

Another reason that this product is unique to other current outdoor classroom guides is the fact that it is not just information from varies sources combined in a package. This product was developed from the actual two and a half year creation and operation of a middle school outdoor classroom. The problems and difficulties that are a
part of such an undertaking are not assumed or hypothetically derived. They have been realized and overcome in an actual school setting. Possible mistakes and concerns involved in establishing a working outdoor classroom were made and their solutions are available to aid other educators.

This product attempts to remove such question as "Where do I turn to?" and "How do I do this?" with the answers "Here is how you do that!" For example: unlike many resources available for nature programs that suggest educators apply for a grant to finance an outdoor classroom, this product provides grant/financial contacts, examples of available grants, and completed grant applications to guide the users during the process. This product does not simply suggest that lesson plans can be written for the outdoor classroom. It provides numerous complete plans that can be immediately used and information on where additional curriculum is available.

This product has been developed so that anyone who is interested in starting an outdoor classroom, garden, or facility will have the means to do so in the convenience of one manual. It can be considered a "safety net" or "security blanket" that will be available to guide and assure the user so that productive energies are put into the creation of the learning center and not in the gathering of information from endless sources.
Definition of Terms

Educator – any person or group that teaches, trains, or informs others about ideas, programs, or in any way relays pertinent information about a subject or topic. This can be achieved through lessons, demonstrations, lectures, or experiments.

Environmental Education – learning process that uses the natural environment to promote the acquisition of science objectives. It also encompassing all aspects of the awareness and understanding of the earth and our ability to maintain a healthy, sustainable relationship with the natural world (Caduto, 1998).

Hands-on Active Learning – learning that takes place through the use of activities that allow the learner to observe, handle, manipulate, and interact with that which is being taught or investigated. It is learning through doing and relating.

Outdoor Classroom – an outdoor, natural setting constructed and used by educators or learners to achieve established learning objectives based on science or other stated disciplines. This may include, but is not limited to gardens, water areas, natural habitats, weather stations, compost sites, worm farms, and schoolyard observation sites. Outdoor classrooms are created as a teaching tool that incorporates hands-on active learning.
Chapter II

Review of Literature
Review of Literature

Most educators will agree that hands-on active learning is a preferred tool in teaching. This is especially true with science. By allowing students an opportunity to participate in an experiment or observe and gather information through first hand contact, success in achieving stated goals is more readily achieved. The use of hands-on activities with what Tom Good calls active teaching – teaching characterized by high levels of teacher explanation, demonstrations, and interaction with students (Woolfolk, 1998) – seems to be a winning combination for learning. However, the observation that the textbook is the primary tool utilized by teachers and students conflict with this suggestion. When textbooks are the dominate source for experiences, then learning becomes a passive activity (Shepherd & Ragan, 1992). Robert Rathom compared the results between the 1977 and the 1985 National Surveys of Science, Mathematics, and Social Studies Education and found a decline in the extent of hands-on activities, the number of rooms equipped for laboratories, and the background preparations for teachers (Shepherd & Ragan, 1992). Though this information is somewhat dated, it is arguable that this trend is still a present concern. Veteran science teachers will agree that though there is a benefit with hands-on learning, it is not always a priority in their lesson plans. This may be due to time constraints, preparation, or simply being uncomfortable having their students involved in these types of activities. Gene Shepherd and William Regan further comment on this situation by stating that it is left largely to the teacher to determine whether a child’s enthusiasm is suppressed by “teaching is telling” procedures, or is kindled by inquiry about the fascinating realm of exploration and invention. “If the teacher brings to the task an understanding of children, a broad understanding of (in this
case) science, and a willingness to let children observe, experiment, and act to find answers to their many questions, the science period can be a joyous quest, not only for the pupils, but for the teacher as well.”

It is clear that the benefit of hands-on activities is achieved through the benefits of experience. Students have a greater chance of retaining what they are to learn if they have observed and performed a task themselves. This is not something new. It also occurs in the “real world.” Life experiences become the lessons and guides of everyday life. Learning takes place through experiencing and then relating the new information to what is known or previously experienced. Ginger Gist (1998) observes that the adage “experience is the best teacher” has been part of common lore for 200 years. But, recently, she says, “Experience has been replaced with teacher-centered, subject-based learning, and the student has become a passive learner. It should be noted that knowledge used is better remembered; given the premise, problem-based learning results from understanding or resolution of a problem which in itself represents a brief segment of reality.

So, should this not be true in the classroom? Robert Brown (1998) continues the point writing that educators know the importance of personal involvement and the value of students operating directly on the raw data of experience. He points out: “Throughout the twentieth century, Dewey, Piaget, Bruner, and many others have built strong cases for this (personal experience) strategy. We advocate making the curriculum as non-scholastic and as personally and functionally relevant as possible. Still there is a need to devise methods for providing practical experiences to accompany classroom instruction.”
Teachers at Lake Park Elementary in Florida agree. The school began a three-year medicinal garden project that is a real-world educational experience. They (the teachers) believe that the walls of their classroom cannot and should not be the boundary for learning. Assignments should have “real-life application”, not just be curriculum or text directed. They feel that knowledge should be acquired for a purpose and a “real-live” audience (Camp, 1997). John Dewey (1916) was concerned about this in the early part of this century when he suggested: “There is a standing danger that the material of formal instruction will be merely the subject matter of the schools, isolated from the subject matter of life experience.”

Therefore, an argument has been made for hands-on learning and knowledge through experience. But, why create an outdoor classroom to meet this objective? Does environmental education lend itself to hands-on activities and experiences that will benefit students and bring mastery of science concepts being studied? The answer to the question is yes! Outdoor classrooms and environmental education is a powerful learning tool for teachers in almost all disciplines of science and in student development. Environmental study offers an opportunity to help children develop their critical thinking and decision making skills that will help them make wise choices (Sanera & Shaw, 1996).

Many schools are embracing the need to take their students outside. They see that the learning experience is enhanced through natural experiences. Natural lessons are, in many ways, the more primary modes of education. It is more central to “who we are as humans, and more closely aligned to our evolutionary history, than traditional methods. It’s becoming effective partly because we are rediscovering how we learn naturally. This
is a most powerful approach. It is the one that affects long-term change as children are asking questions of their own and investigating the issues for themselves (Motavalli, 1999).” The outdoor classrooms allow for this type of “natural” discovery. Dr. Mary Phillips (1997), environmentalist specialist and teacher of middle school gifted students, feels that through hands-on experiences and natural discovery, students practice their observation skills and recognize the need for living things as they learn to appreciate “the contributions of plant and animal life to the past and present of humankind.” The added benefit that Pam Toeppen observed using her schools outdoor classroom is that the students were actually teaching themselves. They were asking questions and finding solutions on their own to satisfy their curiosity (Elliot, 1994).

Outdoor classrooms and environmental education are affective with children for a number of reasons. One is that it addresses the many learning styles of students. In particular is the naturalist intelligence defined by Howard Gardner’s work on Multiple Intelligence. Gardner uncovered several different kinds of intelligence – not just one that can be measured and summed up like an I.Q. Intelligence. His theory offers a much broader view of intelligence and suggests that intelligence is a continuum that could be developed throughout life. Originally, Gardner identified seven types of intelligence. Recently, he has identified an eighth intelligence called the naturalist intelligence - thinking in reference to nature. This intelligence deals with one’s affinity with nature, being able to see connections and patterns in the natural world, and identify and interact with its process (DePorter, Reardon & Singer-Nourie, 1999).

Thomas Hoerr (1998) quotes Gardner as referring to naturalist as “the individual who is able to recognize flora and fauna, to make other consequential distinctions in the
natural world, and to use this ability productively.” With this in mind, Michael Caduto (1998) suggest that education is strongest when it occurs in a meaningful and relevant context in which to learn about the earth. The many forms of human intelligence are most actively and lastingly engaged in a learning environment rich in experiences and relevant patterns.

Hoerr comments that children have few opportunities to acquaint themselves with nature, to develop their naturalistic intelligence and make sense of the world of plants and animals. He says, “As we think about this intelligence and how we can reach those students who possess it, we should look for opportunities to let students use their abilities to identify and organize. Ideally we should provide a naturalistic setting for the naturalist intelligence.” Hoerr concludes his support of Gardner’s work by writing that the reason we bring the theory of multiple intelligences to our classroom is that it gives our students more avenues to succeed. The naturalist intelligence offers one more way to help students understand and learn.

Another reason that outdoor classrooms are effective with children is that, simply stated, they are fun and involve the world around them. If science (or any subject matter) is made fun and relevant, half the battle of teaching and learning is accomplished. Patricia Miller, a science teacher at Ferrum Elementary School in Virginia, believes in “engaging kids in what they’re curious about, and what they’re curious about is what’s around them (Grimes, 1995).” When students are in an outdoor classroom, their curiosity and learning can be enhanced through, what children perceive, as a sense of playfulness in the outdoors. Bixler and Floyd (1999) agree saying that playing and exploring in the outdoors
at an early age, with encouragement from adults, may be all that is necessary to promote a moderate view of dirt and insects and appreciation for the environment.

Playfulness, in a learning context, de-emphasizes the need to be perfect and therefore increases children’s self-esteem. Playful learning behaviors can allow a child to see the whole project or process, and understand why the project is important, and how it fits within a larger thematic context (Boyer, 1998). To this end, Brown (1998) refers to James Coleman, author of The Adolescent Society, who advocates educational games to bring the outside world into the classroom and to take the classroom into the outside world. Brown advocates the use of “Outdoor Learning Centers” for stimulation and educational games. He feels that using these learning centers makes both data gathering and problem solving possible within a convenient and controlled environment in a “fun” atmosphere. By providing opportunities for data collection and outside simulations through these centers, a teacher demonstrate that authentic, practical, and interesting learning occurs at school, both inside and out.

Valett (1983) incorporated the idea of playfulness as a tool for educators with the use of sensory exploration. He submits that educators increase students’ opportunity for sensory exploration. To maximize the benefits of such opportunities, students must be taught when and why to use their senses. He concludes that metacognition regarding the use of senses becomes a goal. “Ultimately, self-regulated metacognition, both sensory exploration and in later phases, is a tool for enhancing playfulness, which in turn is a tool for long-term, positive benefits throughout life.”

The very nature of hands-on activities is exciting for students of all ages, but especially for children. Children enjoy touching and observing what they are studying.
Rita Newman (1996) writes, “We all learn through direct experiences, especially involving our five senses. Children must be given frequent opportunities to experience the outdoors and the time to examine the differences in what they see around them.” She continues referring to Dighe (1993) who encourages adults to coach children to become aware of their surroundings by using their five senses to pay attention to small things. He states that adults can help children hone observation skills. Many things that are taken for granted, such as the colors of a leaf or the unusual shape of flowers, can be brought to a child’s attention through games of “detective” or “I Spy.”

Outdoor classrooms also provide a natural transition to environmental education that goes beyond the classroom. Students become aware of the world they live in and issues that are important to environmental preservation. As Holmes (1995) writes, “Everything the kids encounter can be turned into a science lesson they might use in the future. Their natural world supplies more than food and recreation. It will increasingly become the focus of political battles in the future.” Though this concept may be advanced for elementary students, it is important for young children to learn about their natural environment. The world outdoors is part of their lives. By helping students discover how nature works, and how they fit into the scheme of things, educators are providing a “gift” that students can build on for the rest of their lives (Spann, 1994).

Many educators and ecologist are in agreement. David Orr (1999) suggests that ecological education is the way of the future and will require the reintegration of experience into education, because experience is an indispensable ingredient in good thinking. He believes that one way to do this is to use school campuses as laboratories for the study of food, energy, materials, water and waste flow. Orr also recommends placing
knowledge in an ecological context, to engage all of the senses of the student and not just intellect, and to initiate a “romance” with the natural world. By doing this, students will learn to understand how the world works as a physical system and why this understanding is important for their lives.

If environmental education is going to be of real value to students, it must be taught in the environment. This seems a basic and trivial point, but the majority of such education is being presented within the confines of a walled classroom. Rarely will students be found in an outdoor laboratory for any meaningful amount of time. The kind of environmental education that is desperately, needed has little to do with showing more classroom nature videos, offering more “green” electives, or raising funds for computers so kids can “net-surf” for environmental links to Antarctica or the tropics. It entails routinely expelling classes – and teachers – into the natural world around them to learn directly from its workings and dysfunctions. The whole idea is to teach the traditional curriculum more effectively using the “connectedness” that is the very essence of natural systems to forge meaningful links in student’s learning (Horton, 1999).

Outdoor classrooms do not have to be huge horticultural facilities. They can be as small or large as the need requires. The purpose is to give students a real life experience that can relate to an objective or inquiry about the environment. Rudolph and Gunst (1996) insist that simple gardening offers countless opportunities to talk about the environment. From testing the make up of soil to weeding and neglect, issues arrive that end themselves to discussions that otherwise may not have taken place. Humphries and Rivkin (1998) note that simple things, such as being outside under a tree shedding its blossoms, often impress children greatly. That just being outside can make children feel
excited about nature. They believe that by experiencing and caring for outdoor
classrooms and learning centers, children develop an attitude of stewardship for the
environment in the wider world beyond the school.

“Stewardship” and “ownership” are terms and ideas that have been used in
education for quite some time. If students feel ownership in a class, they will show more
interest and be more likely to embrace the concepts being submitted. This idea has been
applied from the teaching of classroom subjects to affective classroom management
techniques. However, seldom is it applied to environmental teaching. It may be
mentioned in a lecture or video, suggested in a classroom report, or introduced by a
visiting environmental speaker, but students are not allowed to practice it in the
classroom. The outdoor classroom provides this opportunity.

Environmental stewardship is the most valuable lesson that students learn from
outdoor projects. Building and working in an outdoor classroom can have an impact on
students’ career choices as well as life choices (Kratch, 1997). Carol Browner (1995)
adds, “If we are to meet the environmental challenges of the next 25 years, we must
deepen environmental awareness among all Americans. Environmental education is
essential if Americans are to participate fully in solving environmental problems.
Expanding information and involvement: These are key to solving environmental
problems – problems as small as the contamination of the local creek and problems as
large as the ozone hole.”

There are other benefits to outdoor classrooms, learning centers and gardens.
They may not be directly related to a specific curriculum, but they still have value in a
student’s education and in their life. Gardening as therapy has ancient roots. Historians
say that Egyptian physicians advised mentally troubled patience to take long walks in a
garden. In the Middle Ages, according to the writings of St. Bernard, monks created
enclosed gardens in monastery courtyards to “solace the infirmities of the brethren.” But,
for most of the 20th century, the conviction that gardens could heal was buried under the
belief that medicine is strictly a science. Now, horticulture therapy, like other forms of
alternative medicine, is starting to flourish. Dozens of institutions – hospitals, seniors’
homes and even prisons – have installed green spaces designed to enhance the health and
well being of residents. Working with gardens and plants is restorative, not only to the
soul but also to the body and the mind. There is much literature over the past 25 years
that supports the case that people are restored by frequent contact with nature. (Driedger,
1996).

There is a real physical fitness value to working in nature. At a time when fitness
professionals are touting the advantages of regular moderate exercise, gardening is being
recognized as a healthy lifestyle habit that can provide significant benefits to people of all
ages. Studies show that 30 minutes a day of moderate activity, such as gardening,
decreases the risk of numerous chronic ailments, including heart disease, stroke, and type
II diabetes. Gardening is one of those rare activities that may people enjoy so much, they
do not even think of it as exercise. In general, gardening task like digging, raking, and
planting – all of which are done in an outdoor classroom – can be considered the
equivalent to sports such as snorkeling, volleyball, and brisk walking, with the added
advantage of interaction with the environment (Krucoff, 1995). Since physical education
is a part of most school’s curriculum, the outdoor classroom that inspires future gardeners
has accomplished a cross-discipline/curriculum objective.
Outdoor classrooms can also have benefits in multicultural education. Theme gardens containing varied plants and herbs from different cultures can be effective in building a science curriculum around activities that minority communities are familiar with and value. Teachers can use these elements to teach English and grade-level concepts while parents share traditional knowledge and primary language skills. For example, if a curriculum focuses on science themes that are familiar to minority families, such as weather and plants, parents can dialogue with their children about what they are studying. By expanding the study of plants that relate to one's heritage and possibly the creation of family-community gardens, the program now enables limited English speaking or minority parents (or any parent for that matter) to participate as teachers of gardening. Parents model expert gardening practices in their native languages and cultures, while teachers use the garden as a resource for science explorations and English language development (Merino & Hammond, 1998).

Outdoor classrooms provide hands-on activities and instill environmental awareness far greater than any traditional classroom can provide. As one educator put it, "they (outdoor classrooms) take science out of the text books and makes it really live for the students. It generates a sense of pride and enthusiasm within the school and the local community (Teaching children, 1999)." Chuck Atkins, superintendent of the Pike-Delta School District in Ohio contends, "If the kids can be actively involved in a hands-on activity, it has great impact. When they are back in the classroom studying different plants and searching the Internet for more information, they do it with much more enthusiasm and understanding (Chalfant, 1997)."
There is a word of caution. Outdoor classrooms take commitment and work. Once established, they must be maintained and used. If they are not used to their potential, or in the way they were intended to educate, then they become a burden. Educators must use them to enhance their curriculum and enrich their students. Hands-on has become a “buzz word” in science education. But even programs with hands-on projects will miss the mark if they are not related to some specific theme that engages participants’ attention and allows them to think, as well as create. The key is to clearly set goals and provide structure activities that allows students to work as a group within the stated limits (Lieberstein, 1997). This being said, Ginger Gist (1998) offers the following three issues to be addressed in the development of appropriate environmental education in an outdoor classroom:

- The basis of the program must be sound, unbiased science.
- Critical thinking must be the core of the learning experience to make it effective and lifelong.
- Environmental education must begin early.

These suggestions are not hard and fast rules but merely suggestions that should be considered when planning an outdoor classroom, or any environmental program.
Summary

If educators truly want their science curriculum to have an impact on their students, they must continue to find new and interesting ways to reach the young minds in their classrooms. One of the fastest, easiest, and most fulfilling ways to do this is to get them out of the traditional classroom setting and into some sort of outdoor classroom or environmental learning center. It may seem an overwhelming undertaking, but the rewards are well worth the effort. Outdoor classrooms address so many needs of students and are based on sound educational theories. The classrooms do not just limit themselves to science. They can play an important role in all academic disciplines. Therefore, outdoor classrooms should not be considered as merely a vehicle to improve science. Rather they are a means to improve the education value and experience of the school as a whole.
Chapter III

Product
BUILD IT, AND THEY WILL LEARN!

A COMPLETE RESOURCE GUIDE FOR BUILDING AND MAINTAINING AN OUTDOOR CLASSROOM

BY RICHARD E. KAHT
Many educators are looking for new and innovative ways to "jump-start" their science curriculum. They are searching for a way to involve the students and make science fun while still meeting the objectives of their course guidelines. Included in this quest is the need to present science concepts in such a way that students will retain the knowledge and demonstrate an application of what they have learned. There is no magic lamp that can easily solve this dilemma. However, there maybe an answer right outside the classroom window - an outdoor classroom.

Outdoor classrooms allow instructors to use hands-on science activities to teach their students science concepts that may not be as affective presented in the traditional classroom setting. Educators know that students learn better by doing. This is the benefit of hands-on activities in science. Students are not simply reading about a concept or taking notes on a topic, they are performing environmental experiments and solving problems on their own. In a 1990 study of hands-on science activities, California Achievement Test 85 standardized test scores in science were compared between two groups of fourth graders. One group, the experimental class, utilized hands-on science activities in an outdoor learning center while the other group, the control class, utilized the more traditional textbook based science program. The conclusion reached by the study revealed that the students in the experimental class had greater gains in the CAT 85 science scores than did the students in the control class.
The only difference that existed between the two classes was the science curriculum used. The study therefore concluded that that the difference in the CAT 85 scores can be attributed to the activity based science program used in the outdoor learning centers (Zwick & Miller, 1996). These are the types of benefits that teachers are looking for with their students.

Outdoor classrooms are hard work, but they can provide enjoyable learning experiences for the teacher as well as the students. The outdoor centers offer a change from the traditional routine of the classroom. Instructors can be creative in their lessons and use an outdoor setting to bring science concepts to life. The environmental awareness that is naturally a part of the learning experience is an added benefit to all participants.

Once the decision has been made to create an outdoor classroom, the question that arises is: "Where do I begin?" Building an outdoor classroom can seem overwhelming to educators due to the fact that most have never seen an outdoor classroom, much less built one. Building, financing, maintenance, and use of the facility are topics that have to be addressed. Information is available, but how do instructors obtain what they need to meet their particular situation? Are there examples to follow? Where can a teacher visit an outdoor classroom that is operational? All these are valid concerns and some represent the reason many educators lose interest in starting such a beneficial and worthwhile program.
Enter *Build It And They Will Learn*. This guidebook was created to take the worry and "leg work" out of starting an outdoor classroom. It will help take away thoughts of impossibilities and take instructors step by step through the possibilities. This manual addresses creative ideas, landscaping, financing, building, maintenance, lesson plans, and a multitude of references and resources for starting an outdoor classroom. It is real information that has been collected through the building and use of an outdoor classroom. The user will benefit from the mistakes and lessons learned of an instructor who facilitate an outdoor classroom for two and a half years. Through this experience, instructors will have a plan to guide them that is field tested and accurate.

As alluded to previously, almost all the information to start and maintain an outdoor classroom can be obtained through various sources. The problem with that is time and energy needed to research and retrieve that information. This is the point when many instructors "throw in the towel" and feel defeated. What is unique about this product is the fact that it is a "one-stop shop" for addressing the needs of someone planning to start or continue an outdoor classroom program. This resource is all an instructor will need to build an outdoor classroom. Once the project is started, the user may wish to use resource section to build on to their program and meet individual needs. Many times, all that is needed is an
example to follow or diagrams to remedy a problem. This guidebook offers such assistance.

The main purpose of this manual is to take away the fear and excuse for not starting an outdoor classroom that will benefit students, teachers, and schools. Whether a small compost site or a large interactive garden, a weather station or a butterfly garden, this guild will help prepare educators and assist them in reaching their goals.

Remember, build it- and they will learn!
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GETTING STARTED
Starting An Outdoor Classroom

You have decided to build an outdoor classroom. As you think about the major undertaking that lies ahead, you may feel a little anxious and overwhelmed. After all, this is a big responsibility. You probably have many ideas and thoughts in mind; things that you want accomplished with this project that you are about to embark upon. The main thing you might be asking yourself is: “Where do I begin?”

First, decide what type of outdoor classroom you want to have at your school. Many teachers choose some sort of a garden project. These can be simple to start and do not have to be too complicated. You can start small and add on as you feel more comfortable with the outdoor classroom. Natural habitats can be incorporated or be the main goal of your program. This maybe an easy transition for an outdoor classroom if a natural area is already present on your school grounds. Make certain that you have approval for all changes that you plan to make to the schoolyard.

When you have the idea of what you want to attempt, be clear about your goals. Collect information and ideas that relate to your specific project. Identify your labor force: students, teachers, parents, scouts, community. Make a master plan that outlines your intentions. Do not worry if it is a “rough draft.” You can modify it later. This will help you in presenting your proposal to administration and the rest of the staff. If you have support throughout the school, your job will be much easier.

It is important that you not try to do this alone. You will need to establish a committee or group to support, monitor, and maintain the classroom. They will also be able to provide ways that all subject areas can be incorporated in the outdoor classroom. Your committee should include as many of the following persons as possible:

- Principal
- Assistant principal
- Custodian/Building supervisor
- Community advisory council members: PTA or other interested people.
- Grade level chairpersons
- Physical education teachers
- Student council members or other student representatives
- Businesses relating to landscaping and plants – It does not hurt to have a sponsor.
Your outdoor classroom, and the programs developed from its use, should be student oriented. Not only should students reap the benefits of the outdoor classroom, they should be involved in all its stages. Root your project in student leadership. Let them pick activities and help plan the site. This builds pride and ownership. To have the utmost success, you want the students to buy into the project.

Let others know about your plans. Send letters home to parents and the community explaining the project and enlisting their support. This way you have involvement at the “ground floor level.” Once the outdoor classroom starts to take off, contact your local school board. School officials want to hear about these types of programs. It is good publicity and gives them an education program to be proud of – and brag about!

Goals

It was mentioned that clear goals and objectives are needed when beginning and maintaining an outdoor classroom. Having these will be essential in your presentation to your administration and also for justification in securing funds with donations and grants. Your goals should be realistic and obtainable. Though circumstances may change, you know your limitations and those of the outdoor classroom you are proposing.

Below are some examples of goals and objectives that are relevant to many different outdoor classrooms. These will not necessarily be yours or apply to your outdoor classroom, but may help you in establishing your own goals and objectives.

General Goals

- To provide habitats and water sources to attract wildlife.
- To plant a functioning garden for agriculture and related science studies.
- To develop a curriculum for outdoor study.
- To protect and enhance existing areas by planting trees, shrubs, and native plants.
- To provide shelters and feeding stations for animals such as bat houses, birdhouses, feeders, and natural cover for animals.
- To operate a weather station to study phases of meteorology and forecasting.
- To maintain grounds and an outdoor site in a suburban area.
• To provide a library of materials for teacher and student use for research and reference.

Student Objectives (Affective)

• To observe the environment and demonstrate responsible action toward the environment.
• To motivate and enhance classroom learning by investigation of natural surroundings.
• To develop appreciation of nature and promote a “caretaker” attitude toward the environment.
• To increase self-esteem by participation and planning environmental and agricultural activities.
• To plan and organize habitats to observe animals and plants.

Student Objectives (Cognitive)

• The learner will identify and give examples of plants and animals in the outdoor classroom.
• TLW manipulate materials to enhance habitat and maintain outdoor classroom grounds.
• TLW research and write about plants, animals, insects, habitats, and materials found in the outdoor classroom.
• TLW will prepare presentations about what they have learned.
• TLW demonstrate awareness of words related to environment/habitats and use the new vocabulary in speaking and writing.
• TLW discover what green plants need to survive and grow.
• TLW classify plants, seeds, and animals and recognize their requirements for life and growth.
• TLW establish feeding stations and analyze soil, water, and weather and relate information to the outdoor classroom.

Teacher Objectives

• The teacher will use a variety of teaching methods and bridge all academic disciplines in a whole language approach.
• TTW improve cooperative learning skills and social relationships between students, parents and the larger community.
• TTW increase the awareness of the interdependency of all living things.
• TTW reinforce classroom learning by improving visual, tactile, and motor skills through observation and investigation of the physical surroundings.
• TTW assess students through alternative methods such as performance-based assessment, behavior-oriented assessment, portfolios, and communication.
LANDSCAPING: PLANNING TO GROW
Landscaping: How do I Plan My Outdoor Garden Layout?

Now that you have decided to build an outdoor classroom, you have to decide on a landscape design that will fit both your needs and be appropriate for the available land you will use on your schoolyard. The area that you are going to start your garden and classroom dictates the constraints placed upon you. Take the time to do an evaluation of your site.

Begin by identifying existing resources:

- What are the food, water, and shelter situations for wildlife? (This is more a concern if you plan to do a natural habitat.)

- What are the dominate plant types in the area and do they figure in to your garden/outdoor classroom?

- What is the major soil type?

- How will this garden/outdoor classroom be used?

- Will this project conflict with existing uses of the schoolyard?

- Is there wheelchair access? Is this a high traffic area and will the outdoor classroom need paths?

- Where will tools and supplies be kept? Is there a water supply handy?

- What is the primary land use surrounding the schoolyard? How does the staff intend to use the garden? Is there room for expansion?

Once you have an idea of where you are going to build, you may want to visit other school gardens and outdoor classrooms in your area. This will give you an idea of what may be best suited for your site as well as motivate and lend encouragement for you to build an outdoor classroom. You will also be building a network of other educators who have been where you are now and have had mistakes and successes that they can share with you. If you are unable to locate schools in your area with gardens and outdoor classrooms, visit the E-Mail Pals Growing Network Web site (see Internet Sites in the Resource Section). At this site, Teachers involved in all types of outdoor classrooms and school gardens share their ideas and what they have learned.
Whether you are planning to build small or large, it is important to diagram the existing site and what you plan to build. In diagramming your site, you want to consider the following:

- Mark all property boundaries.
- Identify all existing structures.
- Add in driveways, walks, fences and playgrounds.
- Indicate any existing natural areas: trees, shrubs, fields, etc.
- Indicate areas of full or partial sun (remember that this changes over the year).
- Photograph the existing site. Document your progress throughout the project.
- Refer to a landscape architect (if feasible) for ideas.
- Obtain a copy of your schools layout.
- Make several copies of your diagram.
- Sketch in different possibilities of plantings, nesting boxes, weather stations and multiple layout designs.
- PLAN FOR DIVERSITY!!!

Your school administration will have to approve the plans and construction of the garden/outdoor classroom. You may have to submit a landscape plan in writing before you can begin. There is a copy of a Landscape Plan Form in the appendix that can be used or modified to meet your needs.
FUNDING
"SHOW ME THE MONEY!"
Funds and Materials for Building Your Outdoor Classroom - Where Do I Begin?

Once you have your plan approved and ideas in mind, you are ready to begin. There is one little problem. How are you going to pay for the project? First, you need to get a rough idea of how much money you will need to start the project. Shop around and find out how much materials cost. If you have an idea of what is going into the outdoor classroom (and you should if you diagramed a plan), price out what the materials, seeds, plants and soil will cost you. This will allow you to start a budget. Ask others who already have an outdoor classroom what it cost to start their program and what is the cost of maintenance. Remember, you are not just buying plants, seeds and fertilizer. Keep in mind that you might also need to purchase or acquire the following items:

- Tools such as shovels, rakes, hoes, tillers.
- Soil for your garden plots and organic material for existing soil.
- A hose and sprinkler for watering.
- Fencing to surround plots or other areas to keep out small pests (and people).
- Building materials for compost piles, weather stations, bird feeders and houses, landscape timbers, and growing containers.
- Training for your staff.

The first place to seek funding is in your own school. Most PTAs will offer some assistance to projects that benefit students through alternate learning situations. Check with the school’s science coordinator as well. There may be funds in the science budget to help with materials and training. School wide fundraisers may also be an option to raise money and have the students build ownership in their new outdoor classroom.

Make a “wish list” and have students bring them home. Often, parents will donate materials and time to worthwhile programs that help their child. They may also be able to raise funds, materials or volunteers through their workplace. You never know who will be able to help out until you let it be known that there is a need.
Along those same lines, do not overlook the community where the school is located. Many businesses (hardware stores, nurseries, grocery stores) are willing to get involved in school activities that enhance the school and its performance. By helping the school, they are ultimately helping themselves and the community. Plus, any donations are tax deductible.

GRANTS

Grants are a great way to get working capital for an outdoor classroom. There are many sources of grant money from local garden groups and businesses to state and national grant awards. Many school systems have a grant office to help educators with the process of writing grants and where to find the grants most applicable to the project. The National Garden Association has the Youth Gardening Grants program (see the Internet Sites section) which was created for this need. Your own state may have an outdoor classroom grant such as the Georgia Department of Education and the Georgia Department of Natural Resources Georgia Outdoor Classroom Grants Program which gives up to $500 in funds (20% of which must be matched by other sources). Check with your own school district for more information.

There are courses that you can take in writing grants. They are a little tricky the first time you attempt one. However, most grant applications ask the same type of information. So, once you write one, you will find it increasingly easier to write others. Dan Edmiston and Missy Slover presented the following guidelines for the first time grant writer at the 1997 NSTA Convention (1997) based on their experiences with their own outdoor classroom.

STEPS IN GRANT WRITING FOR THE NOVICE

1. Get administrator support and help.
2. Form a team with similar interest.
   A. Research journals/newsletters/Internet.
   B. Search the library for other sources
   C. Contact local businesses.
   D. Brainstorm ideas, objectives, activities and evaluation for each project.
   E. Designate a writer and an editor. List other jobs (budget developer, proofreader, coordinator, timekeeper, etc.).
3. Do your Homework!
   A. Describe the school area.
   B. Describe the community.
   C. List all businesses in the community.
D. Obtain ethnic percentages for the community.

4. Find a Grant – Only apply for grants that fit your agenda and are appropriate for your school. Look at the chances of receiving the grant. These are time consuming activities.

5. Establish a timeline. – Decide to have the grant completed two weeks prior to the due date. This saves on the last minute rush.

6. Present your package – Keep a hard copy and copies on a diskette to use for further grant writing activities.

7. Acknowledge the grant team. – Writing takes a lot of effort. A word of thanks is in order.

For further information, contact:

Education Grants Alert and Federal Grants and Contracts
Capitol Publications
P.O. Box 1453
Alexandria, VA 22313-2053

Education Funding News
Education Funding Research Council
4301 N. Fairfax Drive
Suite 875
Arlington, VA 22203

To give you further assistance, there are copies of actual grant applications in the Appendix. Be advised that the applications have been given as support and not to simply be copied. Your needs will obviously be different. Also, keep good records. Almost all grants require a follow-up report with detailed accounts of how the funds were spent and copies of receipts.
MAINTANANCE
Maintenance

Once your outdoor classroom has been built, you will want to maintain it in good working condition. It does not matter what type of classroom you have (garden, pond, habitat, etc.), it should stay neat, organized and clean so that all classes may use it at any time. You certainly do not want your outdoor classroom to be an eye sore. The classroom should enhance the schoolyard, not detract from it.

The key is to involve as many people as possible in the maintenance of the outdoor classroom. No one person can do it alone. Also, by giving ownership of the classroom to all students, you keep interest alive. Many times there is a lot of excitement when an outdoor classroom is first being built. However, without proper maintenance and involvement, the classroom can deteriorate and be a “one time wonder.” You do not want the enthusiasm lost! If the classroom is neat and clean and used regularly, the site can be as permanent a learning environment as any other classroom in the school.

Here are a few suggestions for maintaining your outdoor classroom.

- From the beginning, form a committee that will oversee the maintenance of the classroom. This group should plan regular workday events for students and volunteers to work in the outdoor classroom. This will include setting dates, procuring volunteers and equipment, providing refreshments, and setting the day’s agenda. They may solicit outside groups such as The Boys and Girl Scouts or garden clubs to help in maintenance as a community project. A great way to build ownership for the future is to invite student groups from schools that feed into yours. One day the outdoor classroom will be for their use and they will want it to be in its best condition. By helping to maintain the outdoor classroom now, they will ensure its readiness when it is their turn to experience it.

- Workdays should continue through out the summer - at least once or twice a month, if not more. You must stress to all concerned that part of the success of the outdoor classroom is keeping it in good shape. That does mean weeding, watering, pruning, preparing growing beds for winter and spring, and lawn maintenance. But, if you can help instill pride and ownership from the beginning, your maintenance tasks will be easier to conquer. The students and community will want to show-off all their hard work.

- Work with the custodial staff at the school. These support persons can be your greatest allies. You want to assure them that the outdoor classroom
is not meant to be extra work for them. However, let them know that you
do need their assistance, especially in the summer. Perhaps you could
offer them fresh fruits and vegetables in the summer - if you are growing
a garden. Express your appreciation for all they are doing for the
classroom and students - whether it's turning on the water sprinklers and
trimming the grass around your plots, or just being involved in one of the
lessons.

• Involve the administration. After all, a successful outdoor classroom
enhances the school and reflects well on them. If the leaders of the
school are involved with workdays and maintenance, it will relay the
message that the classroom is important and that all must do their share.

• Bring parents and other citizens of the school community into the
equation. Again, this shows students that the outdoor classroom is
important to everyone. Impress upon the fact that workdays can be a fun
family event and that it is quality time spent on their child's behalf.

• Get the word out and share the excitement of learning outdoors. Send
memos and perhaps a newsletter home to let parents and neighbors
know what is going on in the outdoor classroom. The more positive news
that gets out, the more people will want to be involved. You may want to
hold a picnic or an "Evening Under The Stars" after a spring or summer
workday. You may even want to create your school's own garden club.

• Work toward expanding the outdoor classroom. Part of maintenance is
growing and building on what is already in place. The complexity and
expansion of your outdoor classroom should be restricted only by what
you can reasonably accomplish, given physical and geographic
constraints. Think Big!
GARDEN IDEAS
Garden Ideas

This section gives a few ideas of projects you may want to include in your outdoor classroom/garden. The topics include butterfly gardens, compost sites, weather stations, and a sample garden. Each of these is covered in detail to assist you in the activities that they afford your students. Obviously, the information is not a definitive guide to these particular learning centers, nor should you limit yourself to these suggestions. They are offered as examples to assist you in starting or expanding your outdoor classroom. Build on them and incorporate your own ideas for what meets your needs.
BUTTERFLY GARDEN
Attracting Butterflies

Creating a habitat for butterflies is an exciting and rewarding endeavor. It is easy to invite butterflies to your area by gardening with their needs in mind. These beautiful insects will add bright colors and add to your student’s appreciation of nature. The U.S. Fish and Wildlife Service in conjunction with the Butterfly Center at Calloway Gardens suggest the following techniques in producing a successful butterfly garden.

Key Components of your butterfly garden are:

- **Sunny Areas** - Butterflies and most butterfly-attracting plants require bright sunshine.

- **Splashes of Color** - Butterflies are attracted to flowers by color. Groups of flowers are easier to locate than isolated plants.

- **Single Flowers** - The nectar of single flowers is more accessible and easier to extract than double flowering plants.

- **Host Plants** - Female butterflies lay their eggs only on certain host plants that will nourish the young caterpillars after they hatch. Grow those plants that will supply food for caterpillars.

- **Damp Areas** - Butterflies can not drink from open water. Wet sand, earth, or mud are the best watering holes.

- **Basking Stones** - Butterflies often bask in the sun. Basking raises their body temperature so that they are able to fly and remain active.

The most successful butterfly habitat includes plants which meet the needs of butterflies during all four stages of their life cycle: egg, caterpillar, chrysalis, and adult.

After mating, female butterflies search for a specific kind of “host plant” on which to lay eggs. For example, monarchs lay eggs on milkweed, black swallowtails on parsley, and tiger swallowtails on tulip trees or wild cherry. In a few days, caterpillars emerge from the eggs and begin to eat. It is interesting to note that caterpillars only feed on specific kinds of plants.
When the caterpillars are fully grown, they shed their skin and change into chrysalises. Often chrysalises are attached to plant stems and protected by surrounding vegetation. It is inside the chrysalis that the adult butterfly is formed. After emerging from the chrysalis, the adult butterfly begins to search for nectar-rich flowers to feed upon.

**HOST PLANTS FOR BUTTERFLIES:**

<table>
<thead>
<tr>
<th>Host Plant</th>
<th>Scientific Name</th>
<th>Butterflies attracted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butterflyweed</td>
<td><em>Asclepius tuberosa</em></td>
<td>Monarch</td>
</tr>
<tr>
<td>Parsley</td>
<td><em>Petroselinium crispum</em></td>
<td>Black Swallowtail</td>
</tr>
<tr>
<td>Dill</td>
<td><em>Anetham graveolens</em></td>
<td>Black Swallowtail</td>
</tr>
<tr>
<td>Fennel</td>
<td><em>Foeniculum vulgare</em></td>
<td>Black Swallowtail</td>
</tr>
<tr>
<td>Rue</td>
<td><em>Ruta graveolens</em></td>
<td>Black Swallowtail</td>
</tr>
<tr>
<td>Passion Flower</td>
<td><em>Passiflora incarnata</em></td>
<td>Gulf Fritillary</td>
</tr>
<tr>
<td>Spicebush</td>
<td><em>Lindera benzoin</em></td>
<td>Spicebush Swallowtail</td>
</tr>
<tr>
<td>Tulip Tree</td>
<td><em>Liriodendron tulipifera</em></td>
<td>Eastern Tiger Swallowtail</td>
</tr>
</tbody>
</table>

You can enhance your butterfly habitat by making personal observations and recordings with your class. Identify which butterflies occur in your community and the plants they are visiting. Butterflies are easy to identify with the use of a field guide.

A few host plants have been listed. The list on the following page contains different types of flowers that you might want to consider in your butterfly garden.
PLANTS BUTTERFLIES LIKE

Plants selected from the following list will appeal to butterflies:

<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>SCIENTIFIC NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shrubs</td>
<td></td>
</tr>
<tr>
<td>Azalea</td>
<td><em>Rhododendron</em> <em>spp.</em></td>
</tr>
<tr>
<td>Butterfly Bush</td>
<td><em>Buddleia davidii</em></td>
</tr>
<tr>
<td>Lantana</td>
<td><em>Lantana camara</em></td>
</tr>
<tr>
<td>Hibiscus</td>
<td><em>Hibiscus rosa-sinensis</em></td>
</tr>
<tr>
<td>Annuals</td>
<td></td>
</tr>
<tr>
<td>Cosmos</td>
<td><em>Cosmos sulphureus</em></td>
</tr>
<tr>
<td>French Marigold</td>
<td><em>Tagetes patula</em></td>
</tr>
<tr>
<td>Heliotrope</td>
<td><em>Heliotrope arborescens</em></td>
</tr>
<tr>
<td>Impatiens</td>
<td><em>Impatiens w allerana</em></td>
</tr>
<tr>
<td>Mexican sunflower</td>
<td><em>Tithonia rotundifolia</em></td>
</tr>
<tr>
<td>Verbena</td>
<td><em>Verbena x hybrida</em></td>
</tr>
<tr>
<td>Zinnia</td>
<td><em>Zinnia elegans</em></td>
</tr>
<tr>
<td>Pentas</td>
<td><em>Pentas lanceolata</em></td>
</tr>
<tr>
<td>Perennials</td>
<td></td>
</tr>
<tr>
<td>Purple coneflower</td>
<td><em>Echinacea purpurea</em></td>
</tr>
<tr>
<td>Black-eyed susan</td>
<td><em>Rudbeckia</em> <em>spp.</em></td>
</tr>
<tr>
<td>Butterflyweed</td>
<td><em>Asclepias</em> <em>tuberosa</em></td>
</tr>
<tr>
<td>Coreopsis</td>
<td><em>Coreopsis</em> <em>spp.</em></td>
</tr>
<tr>
<td>Moss Verbena</td>
<td><em>Verbena</em> <em>tenvisecta</em></td>
</tr>
</tbody>
</table>
COMPOST
Composting: How and Why?

A feature that every outdoor classroom and garden should have is a compost pile. Composting is the natural recycling of organic materials. Best of all, it does not cost you a thing. Basically, a compost pile is an area where leaves, grass clippings, vegetable scraps and other organic materials are let to rot and turn into a rich type of soil. You can have your students bring things from home or, add to the pile from refuse around the school. The fact is that compost, the organic product of composting, helps your garden and container plants by improving the fertility and health of your soil. It also saves water by helping the soil hold moisture and reducing water runoff, and benefits the environment by recycling valuable organic resources (which extends the life of our landfills).

The following information on composting was offered by The Fernbank Science Center in Atlanta, Georgia. For further information, you can contact Fernbank at (404) 378-4314.

**WHAT CAN YOU COMPOST?**

<table>
<thead>
<tr>
<th>Do Compost</th>
<th>Do Not Compost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grass Clippings</td>
<td>Meat</td>
</tr>
<tr>
<td>Leaves</td>
<td>Bones</td>
</tr>
<tr>
<td>Chopped Pruning</td>
<td>Dairy Products</td>
</tr>
<tr>
<td>Wood Ash</td>
<td>Fish</td>
</tr>
<tr>
<td>Sawdust</td>
<td>Greasy Foods</td>
</tr>
<tr>
<td>Hair</td>
<td>Dog and Cat Feces</td>
</tr>
<tr>
<td>Flowers</td>
<td>Unchopped Woody Waste</td>
</tr>
<tr>
<td>Kitchen Peelings</td>
<td>Diseased Plants</td>
</tr>
</tbody>
</table>

Food wastes can easily be composted in worm boxes, rodent-proof buckets (with no holes bigger than % inch), or by burying small amounts at a time in the ground under at least one-foot of soil.
HOW TO USE COMPOST

Compost can be added to the soil anytime to help keep plants healthy. It improves soil structure, adds a wide variety of minerals needed for plant growth and holds moisture, plant nutrients and beneficial soil organisms. Here are the most common ways to use compost:

Soil Amending - is the natural thing to do with compost. Mix a 4"-6" layer of compost deep into newly reclaimed or poor soils. Dig 1"-3" of compost into annual garden beds at least once a year.

Mulching - is a way to use compost during the growing season. Spread compost 1"-3" thick over soil around plants. Do not pile it against plant stems. Compost used this way will add nutrients, protect the soil, save water and help deter weeds.

Potting Mix - can be made by mixing equal parts of compost and sand or soil. Be sure compost is fully decomposed and sifted before using. Compost amended potting mix will help you grow healthy seedlings but may lower germination rate slightly.

COMPOSTING “1-2-3” and RECIPES

The bugs, fungi, bacteria and worms in your yard or worm box do most of the composting for you. Whatever recipe you choose, it’s as easy as 1-2-3!

1. CHOP compostables. The more you chop, the faster the decomposition process will go.

2. MIX dry-woody materials with moist-green ones for a balance of nutrients, air and water.

3. MAINTAIN moisture level as damp as a wrung-out sponge. This helps break down compost and keeps it from becoming wet and smelly.
NO-FUSS COMPOST

This is the easiest way to compost yard wastes.

Ingredients:
Yard wastes, some water as needed

Directions:
In a heap, hoop or bin, layer your chopped yard waste as it accumulates. Water as needed so compost is kept as moist as a wrung-out sponge. In 12-18 months, the material at the bottom and center will be dark, crumbly compost. Sift, and use the uncomposted material to start a new batch.

BUCKET COMPOST

This is a small-scale food waste compost system.

Ingredients:
Food wastes, dry material (soil, sawdust, peat moss or finished compost.)

Directions:
Add dry matter with food wastes to keep the moisture level balanced. Chop and mix with a trowel each time you add materials. If compost is too wet or smells, stir in more dry materials. When bucket is half full, let stand 1-3 months, mixing once or twice a week. Harvest finished compost in 1-3 months.

FAST COMPOST

The fastest way to compost is to build a “hot” pile in a heap, hoop or bin. This requires frequent turning of the pile.

Ingredients:
Yard wastes and water as needed (Food wastes can also be used to supplement fresh green materials in a rodent-proof bin.)

Directions:
Layer and mix moist-green with dry-woody material until you have a cubic yard (3”x3”x3” - notice the math angle?). Keep pile as moist as a wrung-out sponge. Cover the pile with a lid, plastic film, or a piece of carpet. Turn the pile one to three times a week to give it the air it needs for clean, fast composting. If the pile is woody and not decomposing, mix in fresh green materials like grass clippings or an organic nitrogen fertilizer. Compost is
ready to use in 2-15 weeks. Sift, and use undecomposed material to start a new batch.

**WORM COMPOST**

Worm composting is a fun way to turn food wastes into a rich fertilizer and soil amendment.

**Ingredients:**
Food wastes, newspaper, red worms

**Directions:**
Shred and moisten old newspapers, and layer them 6” deep in the box; use black and white pages only. Add worms (can be bought at a live bait shop or through mail order). Feed them stale bread for two or three weeks, until worms feel at home. To the worm box, add fresh food waste as generated (no animal products) and shredded newspaper as needed. Worm compost is ready after 3-6 months.

**COMPOST TROUBLESHOOTING**

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Problems</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pile not Composting</td>
<td>A. too dry</td>
<td>moisten till slightly damp</td>
</tr>
<tr>
<td></td>
<td>B. too much</td>
<td></td>
</tr>
<tr>
<td></td>
<td>dry-woody material</td>
<td>turn, add fresh green materials or organic fertilizer</td>
</tr>
<tr>
<td>Pile smells rotten and/or attracts flies</td>
<td>A. too wet</td>
<td>turn, add dry-woody materials</td>
</tr>
<tr>
<td></td>
<td>B. non-compostables present</td>
<td>remove meat, grease, etc., and turn</td>
</tr>
<tr>
<td>Rodents in Pile</td>
<td>A. food waste in bin, holes &gt; than ¼ inch</td>
<td>turn compost, rodent-proof your bin.</td>
</tr>
<tr>
<td></td>
<td>B. non-compostables present</td>
<td>remove meat, grease, etc., and turn</td>
</tr>
</tbody>
</table>
COMPOST STRUCTURES

Hoops, bins, buckets, and worm boxes can help you fit your compost into small places. Choose a structure that is the right size, style, cost, and effort level for you. Remember to use recycled materials or containers whenever possible.

**Hoops** - are easy and fairly inexpensive to build, and help to keep your yard waste compost pile tidy. Secure the hoop with hooks or twists of wire. To speed composting, undo the hoop, set it up next to the pile, and turn the pile back into the cage in its new location.

![Diagram of hoop]

**Bins** - for yard waste compost and, when made rodent-proof, for food wastes. Home-built ones can be inexpensive and attractive. A removable front provides easy access to compost. Many styles are commercially available.

![Diagram of bin]

**Buckets** - can be used to compost small amounts of food wastes indoors or out. Compact 5-gallon buckets with sealable lids can be collected free from many grocery stores, restaurants, or even the school cafeteria. Be sure to fill your buckets only half full so you can easily stir the compost-sawdust (or compost-soil) mixture.
Worm Boxes - are excellent for composting food wastes indoors or out. They are very convenient for small spaces. Be sure there are holes in the bottom or small gaps between the boards (not larger than ¼ inch) to allow air to circulate. The box should be shallower than it is wide and have a secure lid to exclude flies, rodents and pets.

These are just a few compost structures. You can come up with many ideas that fit your needs. Many garden clubs and environmental groups give away (or offer at an extremely low cost) hoop type bins made of recycled plastic. You can also make a three-sided bin by fastening 3 truck pallets together. Use your imagination - or better yet, let your students use theirs.

For more information on compost structures, plans are available from the Fernbank Science Center Library. Contact them at:

Fernbank Science Center
156 Heaton Park Drive
Atlanta, GA 30307
WEATHER STATION
Weather Stations

A great addition to any outdoor classroom, be it a garden or habitat, is a weather station. This allows students to monitor temperature, barometric pressure, rainfall, wind speed or anything else related to weather conditions. Unfortunately, purchasing a pre-made weather station can cost a lot of money - around $300 to $400. And those prices generally do not include any data reading equipment such as thermometers, barometers or rain gauges. This type of expense can drain your precious budget in one purchase.

However, you can make your own weather station for around $100, depending on what you put into it. All you need is:

- A wooden mailbox post

- A standard redwood window flower box (Sizes may vary, but you want one that fits comfortably on the cross beam of the mailbox post.)

- 5-6 stainless steel carriage bolts with large washers - about 4” – 6” (or any other type of large bolt and washer set that you might have)

- A bag of quick drying cement - the kind that you add water, mix and pour.

⚠️ This project is simple to do and will take about 45 minutes to an hour. Make sure your students help with this assembly. They see results immediately in a project they helped build.

1. Place the flower box on its side so that you are looking into the opening. The side of the box will be the roof of the station and you will mount your equipment on what was once the bottom of the box. This box will fit on the crossbeam of the mailbox post.

2. Place the box on the mailbox post crossbeam so that it fits comfortably on the beam and determine the best place to bolt the box to the beams. Remove the box and drill 5-6 holes that will accommodate the bolts in the now bottom and side of the box.
3. Place the box on the beam and make drill guide marks where the bolts will go into the beams. Remove the box and drill pilot holes for the bolts. Remember, you will be attaching the box to both the upright beam and crossbeam.

4. While the holes are being drilled, have a posthole dug into the site where the weather station will be erected. Depending on the height of your mailbox post and how high you want your station, your hole should be at least 12 inches in the ground. When the hole is ready, mix the cement following directions on the bag (make sure you know how long you can work with the cement before it starts to set).

5. Place the bolts through the washers and then through the holes in the box, into the two beams. Tighten with wrench or screwdriver, depending on your bolts.

6. Once the box is secured to the mailbox post, have it placed in the hole and add cement. It will need to be propped up until the cement can set and dry.

7. When the post is secure in the ground, mount whatever equipment you like to the back of the box (thermometer, barometer, a rain gauge to the side of the upright post, etc.).

See the pictures on the next page to see how the station should look.
SAMPLE GARDEN
Sample Garden

Now that you have an understanding of how to start an outdoor classroom, it may be beneficial to see how one was actually started and built. The following photo journal was taken from an outdoor classroom at a middle school. The classroom was in the form of a garden and was started in the 1997-1998 school year. Grant funds were used to finance the first year and to expand the garden during the 1998-1999 school year. The garden classroom consists of a butterfly garden, a vegetable garden, compost station, weather station, and individual growing plots which any class could sponsor.

The vegetable garden had a theme each year. For the benefit of social studies, regional vegetables could be grown. Since the school is located in the southeast United States, southern produce was planted. Other ideas included growing plants to make dyes for the color unit in science and growing cotton for fibers, and demonstrating how difficult it is to harvest cotton. The cotton gin was also discussed during this project as well as inventors (As a side note, permission is needed from most southern states to grow cotton due to the threat of boll weevils- an insect that can cause great harm to crops.).

Many of the plants grown in the garden were started from seed. They were propagated in the classroom and transplanted when the plots were ready. It is important to note that not only did the students grow the crops and plants, but the building and maintenance of the garden was the responsibility of all that used the classroom. From checking soil pH to pulling weeds, student involvement was the driving force behind the garden's success. Even the weather station was constructed by a student team.

Many classes school wide used the outdoor classroom. The garden was open to all, not just science classes. Social studies, math (for measurement), special education, and even reading classes enjoyed the outdoor classroom facilities as an enhancement to their studies.

The original diagram is included to give you an idea of the mapping of the garden. The photographs start from the beginning of the project when the location was chosen and end with views of some of the successful outcomes the students realized.
ANYWHERE-USA MIDDLE SCHOOL
OUTDOOR CLASSROOM / GARDEN
THE GROUND-BREAKING YEAR

CLASSROOM
GROWING
PLOTS

VEGETABLE GARDEN

WEATHER STATION

BUTTERFLY

COMPOST
Future Site
Tilling the Soil
Classroom Propagation
Establishing Plots
Testing the Soil,
Planting the Seedlings
Compost Site
Butterfly Garden
1st Year
Completion of
The 1st Year
Butterfly Garden
2nd Year
Classroom Plots
Ready to Harvest!
LESSON PLANS

There are many resources for lesson plans that apply to outdoor classrooms. The resource section in this manual will help you locate plans that are appropriate to your needs. However, you know best what it is that you want from your outdoor classroom. Develop your own plans with this in mind. Maybe you want students to do plant cuttings or make slides of plant cells. You might want the students to make journals of the growth and development of a specific plant or insect - such as a butterfly. Whatever it is, find ways to use the outdoor classroom to enhance whatever you are teaching. And do not forget about those “teachable moments.” If a student comes up with a topic that is worth investigating, see what can be accomplished in the outdoor classroom to discover answers and solutions.

The following lesson plans are just a small example of activities that can be part of your outdoor classroom. Teachers submitted them from all over the country to the Columbia Education Center’s Web site. These were selected from hundreds of lesson plans as those that can be used directly or modified for the outdoor classroom. These activities have the advantage of being “classroom tested” and written to ensure your students the best opportunity for success. Use them to get started on your own outdoor curriculum. The benefits to your students will be immense and you will have started them on the “path” to the discovery of nature and their environment.

For more information on the Columbia Education Center and the multidisciplinary lessons that they offer, visit their site at:

http://www.coe-ed.org/

Or you can contact them at:

Executive Office
Columbia Education Center
11325 Southeast Lexington
Portland, OR 97266-5927
Phone: (503) 760-2346
Fax: (503) 760-5592

Project Office
Columbia Education Center
171 Northeast 102nd Avenue
Portland, OR 9720-4169
Phone: (503) 252-4999
Fax: (503) 252-4866
TITLE: CATERPILLARS TO BUTTERFLIES

AUTHOR: Elaine Wilson, Anchorage, Alaska

GRADE LEVEL/SUBJECT: Kindergarten. The activity involves language, science, math, and art - it is a cross-curriculum project. This unit encompasses four learning modalities: language, visual, auditory, and fine motor.

OVERVIEW: This unit involves setting up a science activity that allows students to observe the development of a caterpillar into a butterfly.

PURPOSE: The purpose is to give children an appreciation of nature by teaching them about the life cycle of the butterfly.

OBJECTIVES: My objectives are:
1. to develop language
2. to learn sequencing skills
3. to learn graphing and other math skills
4. to experience art in a different light
5. to learn about balance in nature, using the life cycle of the butterfly as an example
6. to compare and contrast butterflies and moths

RESOURCES/MATERIALS: I ordered my butterfly kit from:
Insect Lore Products, Inc., P.O.Box 1535, Shafer, California 93263

Our district has these films: Butterfly, Caterpillars Grow and Change, Bugs and Butterflies

Book list:
The Life Cycle of the Painted Lady Butterfly, by Barbara Murray
The Very Hungry Caterpillar, by Eric Carle
A Moth is Born, Rand McNally Publishers
Now I Know...A Butterfly, by Troll
Amazing World of Butterflies and Moths, by Louis Sabin and Jean Helmer
Mysteries and Marvels of Insect Life, by Dr. Jennifer Owen
The Life Cycle of the Butterfly, By Paula Hogan
Hope for the Flowers, by Trina Paulus
ACTIVITIES AND PROCEDURES: I first ordered a butterfly kit. The kit contained caterpillars in a small plastic cup with food, a garden box to view the butterflies, and the rest of the supplies needed. In coming years I will order just a replacement larva kit of caterpillars and food.

Start the month of May with a calendar of the days written on butterflies of different colors. Follow a pattern according to color. Read to the students from list above.

Compare different kinds of butterflies: monarch, red admiral, tiger swallowtail, common sulphur, and painted lady. Color each of these kinds.

Do a graphing lesson on a favorite kind of butterfly. Learn the difference between butterflies and moths.

Estimate the number of days from the caterpillar to chrysalis stage. Estimate the number of days from the chrysalis to butterfly stage. Learn and label the six parts of a butterfly.

Do a sequencing lesson on the life cycle of a butterfly beginning with eggs on a leaf, caterpillar stage, pupa or chrysalis stage to adult butterfly.

Observe the growth of the caterpillar in the cup. As the caterpillar got bigger, it was easier to see the segments of the caterpillar. We tried to distinguish all 12 segments.

Make a paper caterpillar, including the 12 segments plus the head and tail.

Make a construction paper caterpillar which opens up to be a butterfly. After making these, learn the poem:

_Caterpillar_

Fuzzy, wuzzy, creepy crawly
Caterpillar funny
You will be a butterfly
When the days are sunny.

Wigging, flinging, dancing, springing
Butterfly so yellow,
You were once a caterpillar,
Wiggly, wiggly, fellow.

by Lillian Vabada

Learn The Caterpillar poem by Christina G. Rossetti.
Make caterpillar books. They could be in the shape of a
caterpillar. Students use their knowledge to write a story of what happens to a caterpillar from the caterpillar’s point of view.

As the chrysalis starts to turn black and transparent, predict which of the chrysalis will become a butterfly first.

Students observe the chrysalis and butterflies. They help feed the butterflies with sugar water. We also added real flowers in our flower garden box.

TYING IT ALL TOGETHER: When the unit was completed, we reflected back to the very beginning and remembered what the caterpillars looked like and what they developed into. We talked about the changes, and how this happens every year, year after year. We then sang a special goodby song to our butterflies that we sang together as a class daily. We then released the butterflies to their natural habitat.
TITLE: Plants and Seeds

AUTHOR: Carolyn Sheppard, Sequoyah Elem., OK

GRADE LEVEL/SUBJECT: 1-3, science

OVERVIEW: For many students science has no real meaning if material is covered by the read and discuss method. A hands on approach is a wonderful way to teach a concept.

PURPOSE: Flowering plants produce seeds encased in fruit. Three kinds of fruits are berries, drupes, and pomes. Oranges, grapes, and tomatoes are berries. Their seeds are embedded in the flesh of the fruit. Peaches and plums are drupes. Drupes have one seed enclosed in a hard case surrounded by flesh. Apples and pears are pomes. Pomes have several seeds enclosed in a core surrounded by flesh.

OBJECTIVES: Different kinds of plants form different amounts of seeds. Some plants form only a few seeds, while others form many seeds. The fruit is the part of a flowering plant that contains seeds.

RESOURCES/MATERIALS: oranges, tomatoes, peaches, plums, pears, apples, sturdy plastic knives, pieces of plastic

ACTIVITIES AND PROCEDURES:
1. Demonstration - show your students a one-half piece of each of the fruits. Help them observe and identify the placement of the seeds in each piece of fruit. Then have students group the fruits according to how the seeds are enclosed. You may wish to introduce the words berry, drupe, and pome to your students. If so, explain that many fruits commonly called berries are not berries according to the scientific definition.

2. Exploration - Give each group three pieces of fruit (one berry, one drupe, and one pome), a plastic knife, and a piece of plastic. It may be helpful to precut the fruit for your students. Have students cut their fruit apart on the plastic, count the number of seeds in each piece, and record their observations on a worksheet.
TITLE: Plant Systems

AUTHOR: Allen T. Schauerhamer, New Ruth School, Ruth, Nevada

GRADE LEVEL: 2

OBJECTIVE(s): The learner will be able to:
1. Identify root and leaf systems (as well as measure length and width.)
2. Trace these systems on grid graph paper.
3. Integrate other curriculum areas: such as music; art, P.E., social studies and math.
4. Build a Terrarium and integrate math concepts by: measuring, comparing, graphing, recording data and observing plant growth.
5. Discuss and explain uses of plants, such as: For food, shelter, clothing, fuel; and medicines.
6. With the use of various seeds integrate math concepts such as: Estimating, counting, sorting, graphing etc.
7. Be able to identify seed parts.

RESOURCES/MATERIALS:
Graph paper; colored construction paper; crayons; scissors; scotch tape, glue; baggies; seeds of all sorts; ruler in CM; sponge; and mustard seeds.
Also materials to build terrarium (2-liter plastic bottle, potting soil and pebbles).

ACTIVITIES AND PROCEDURES:
Day 1:
Skill: Root System Study
1. Students will collect leaf and root systems from outside.
2. Students will fill out an (integrated math) worksheet on identifying root systems and measuring their length and widths.
3. Each student will draw their own root system. (Art integration).

Day 2:
Skill: Leaf System Study
1. Identify leaf and where it was found.
2. Measure length and width and trace on graph paper.
(Math integration)
3. For music integration students will sing the songs: "It's Spring Again" and "Plant a Little Tree".

Day 3:
Skill: Making a Terrarium
1. Handout sheet on building instructions for the terrarium.
2. Explain procedures for measuring; comparing; recording data and observing what takes place (cause and effect relationships). (Math integration)
3. If time, read the poem "The Little Brown Seed". (Language Arts integration)
4. Compile pages for the "Little Brown Seed" booklet also paste on brown seed.

Day 4:
Skill: Learn of Plant uses
1. Discuss and explain from handout, the uses of plants: Oxygen, food, shelter, fuel and medicine. (Social Science integration)
2. Have students graph their favorite plant and then make a costume of it and put on a verbal play telling the audience how they grow as well as what oppositions they encountered. (Drama, speech and self-expression integration)

Day 5:
Skill: Awareness of locations where seeds get planted geographically
1. With the use of different colored construction paper, the student will make a booklet on geographical locations where seeds get planted. (Social Science integration)
2. Each student will get a baggie and tape on various seeds and a paper wetted towel to show rate of seed growth.
3. For experimentation the learner will plant mustard seeds in a sponge, place it within a baggie; wet it down and place by a lighted window to observe plant growth.

TYING IT ALL TOGETHER:
This science unit worked well and was a success! The
students in the second grade were excited about the hands-on-activities and are anticipating more integrated units. One student commented, "Wow, I didn't know learning math could be so fun!"
TITLE: Bark Casts

AUTHOR: Darrell Spendlove, Lewiston Elementary School, Lewiston, Utah

GRADE LEVEL: Appropriate for grades 2-4

OVERVIEW:
When students look at a tree they often see only the leaves. This activity will give them the opportunity to make careful observations of the bark as well as learn to use bark to classify and identify trees.

OBJECTIVE(s):
1. Make a plaster cast of tree bark.
2. Use plaster casts of tree bark to make a simple classification system.
3. Use plaster casts of tree bark to identify individual trees.

MATERIALS:
Modeling clay, plaster-of-paris, pieces of poster board, pins, an area with a variety of trees.

ACTIVITIES AND PROCEDURES:
(Note, this activity can be done by individual students, or as groups of two, three, or four.)

1. Cast Making: Prepare by flattening out a stick of modeling clay so that it forms a rectangle about half and inch thick. Press the flattened clay hard into the bark of a tree. (Make sure that students push on the back of the clay as hard as they can.) Carefully peel the clay off the bark and roll the sides into a long U shape. Use pieces of poster board pinned into the clay to close off the ends to form a bowl. Mix plaster-of-paris and pour into the bowl. Let it set. When hard remove clay.

2. Have students group the casts according to similarities and explain why they grouped them the way they did.

3. Have the students or groups exchange casts and see if they can locate the tree that the cast was made from.
TYING IT ALL TOGETHER:
Discuss with students the importance of making careful observations. You may want to have the students paint the casts to make them look like the bark. Be sure that they try to make there colors match the bark and not just paint it brown.
TITLE: Salad Party

AUTHOR: Beckianne Kilkenny, Cornelius Elem., OR

GRADE LEVEL/SUBJECT: 3-4; science, health

OVERVIEW: This is a great activity to help students realize how important plants are in our diets and in our world. It improves classifying skills, increases knowledge of plant parts, provides a cooperative learning experience, and takes the place of an "all sugar treats" party. It also involves home and parents in our studies.

PURPOSE: The purpose of this activity is to provide a positive experience with "vegies" while practicing basic skills of observation, classification, and cooperation. It also provides a model for healthy eating.

OBJECTIVES:
1. Students will recognize which part of a plant a specific vegetable comes from.
2. Students will be able to sort and classify vegetable according to various characteristics.
3. Students will investigate vegetables which are new to them and classify each according to established guidelines.
4. Students will create a super salad and share in its consumption.

RESOURCES/MATERIALS: plant parts poster, ziploc baggies (all sizes), marking pen, peelers, knives (dull for kids), serving containers, serving utensils (preferable tongs), plates, forks, salt, pepper, herb vinegar
Extensions materials: tempera paint, butcher paper, potting soil, cups, "Earth Tunes" cassette tape by Mary Miche

ACTIVITIES AND PROCEDURES:
1. Several days prior to the party the students are given the task in their learning groups to choose one group member to bring each type of vegetable. Each student in the group must bring a different plant part.
   Students may choose a vegetable that is a flower (such as broccoli, cauliflower, or artichoke), a fruit (tomato, cucumber, peppers, zucchini, peas, etc.), a
leaf (lettuce, cabbage, spinach, greens), a stem 
(celery, asparagus, chives, or sprouts), or a root or 
bend (carrot, onion, garlic, jicama, radish, etc.). 
Remind the "fruit" bringers that their contributions 
should be vegetables that are the fruit of the plant so 
bananas, peaches, etc. are not appropriate. I also 
encourage them not to spend over one dollar.

2. The day before the party everyone brings their 
vegetables. Each student's contribution is put in a 
ziploc baggie with their name on it.

3. We start classifying by first having everyone who 
brought a bulb or a root bring it to the table in the 
front of the room. We discuss characteristics of a 
root or bulb, determine if all items truly fit this 
category, and divide them into sub-categories putting 
the roots in one group and the bulbs in another. On 
the board behind the classifying table is a large 
diagram of a plant with its parts labeled. Setting 
aside the roots and bulbs we do the same activity with 
each plant section proceeding upward to stems, leaves, 
flowers, and fruits.

4. Next I ask the students to develop a different way to 
classify the vegetables. The consult as a group and 
decide what new characteristic will be used as a basis 
for grouping the "vegies". Groups then share their 
system of classification with the class and demonstrate 
by regrouping the vegetables. They might chose to 
classify by size, color, shape, weight, taste, texture, 
peeled or unpeeled, whatever they wish, but they must 
agree within their group on the basic rule of their 
classification system.

5. The I give each group an unfamiliar "vegie" and ask 
them to determine which plant part it is. I have used 
artichokes, jicama, mushrooms (not quite fair, but 
interesting to discuss!) celeriac, bok choy, raddicio, 
sugar peas, leeks, tomatillos, basil, olives, and 
dandelion greens.

6. The day of the party we take over the cafeteria right 
after morning recess. I have four parents come to help 
with salad preparation. Each parent works with one 
plant part and the students who brought those e.g. 
stems (celery, asparagus, chives, and sprouts). I work 
with the other group. We prepare all the vegetables, 
i.e. peel and slice and put them in separate serving
dishes with a serving utensil (tongs work best) and set it up like a great salad bar. Only parent helpers use sharp knives to slice and dice! We don't use dressing by have salt, pepper, and herbal vinegars available. Everyone eats! What a treat!

ADDITIONAL ACTIVITIES:
1. Use leftovers and ends to do vegetable prints with tempera on butcher paper.
2. Learn the song "Dirt Made My Lunch" by Steve Van Zandt (available on cassette Earthy Tunes by Mary Miche)
3. Use all peelings and organic waste to feed the worm farm!
4. Save seeds from the fruits and plant them!

TYING IT ALL TOGETHER:
1. Homework - Following the party students have an assignment to check out their own kitchen and find five foods not used at the party but which are plants. They list the foods and identify which part of the plant it came from.
2. The day after the party we write thank you notes to the parent helpers. Each note must contain some statement of one thing each student in the group learned that was new to them.
3. Evaluation - Using grocery food ads from the newspaper, students cut and paste ten plant foods and identify plant part. This works well when done in teams of two.
TITLE: EARTHWORMS
AUTHOR: Lydia Flynn, St. John's Catholic School; Yukon, OK

GRADE LEVEL: Appropriate for grades 3-4.

OVERVIEW: This activity with earthworms will show students an organism that lives in a dark, cool, wet place and how this organism has special body parts which enable it to live in its environment.

OBJECTIVE(s): Student will be able to:
1. Describe the activities of an earthworm.
2. Describe the body parts of the earthworm.
3. Explain how the body parts of the earthworm enable it to live in soil.

MATERIALS:
Teacher Materials: Earthworms, jars, dirt, chart paper, and magnifying glasses. Earthworms can be obtained from a local bait shop, ordered from a biological supply house, or dug from the ground.
Student Materials: Pencil and paper.

ACTIVITIES AND PROCEDURES:
1. Divide students into groups of three or four.
2. Each group should be provided with several earthworms to hold and observe. Students should be encouraged to hold earthworms and observe their many sections, muscles, stiff hairs, and their thick wet skin.
3. Students should record their observations.
4. Place dirt and worms in glass jars so that students can observe the movement and activities of the earthworms.

TYING IT TOGETHER: Each group of students will prepare a chart illustrating the body parts of the earthworm. The students will also record their observations of the earthworms' activities.
TITLE: Convening, Creating, and Conventioneering

AUTHOR: Barbara Clark, Marshall Elem., Checotah, OK

GRADE LEVEL/SUBJECT: K-5, science

OVERVIEW: Research shows most students have developed negative responses to scientific vocations by the time they have reached third grade. Science is taught too as supplemental ready, or dwelling on memorization and vocabulary. Students seldom see science as a vital creative discipline that they use each day cleaning house, riding to school, controlling pests, etc.

PURPOSE: This project is an attempt to incorporate the creative domain with science education using the study of coelenterates, worms, and arthropods.

OBJECTIVES: As a result of this activity the students will:
1. Identify the life processes that an organism must perform to be classified as living. (Getting energy and nutrients, using energy, reproducing its own kind, growing, removing waste, reacting to outside changes)
2. Study characteristics of coelenterates, worms, and arthropods.
3. Create a creature from each of these groups.
4. Write a story explaining how their creature performs the life processes.
5. Participate in a convention for their animal.

ACTIVITIES AND PROCEDURES:
After in depth study of coelenterates, students develop a creative story about their creature explaining how it performs the life processes. On a designated day, students bring their creations to school for a convention name the "Sting Thing". Students introduce their delegate and read its vita. The convention is concluded with a flotilla in the class aquarium.

A similar convention is held after students celebrated worms (The Worm Squirm). The students must identify the life processes in their delegates story, and must classify the worm as segmented, round, or flat.
The Arthropod Assemble uses the information required by former conventioneers, plus emphasis on niche and habitat.

TYING IT ALL TOGETHER:
1. Each student's creature and story is evaluated during the convention. The emphasis is on the understanding of the life processes.
2. All students are encouraged to participate in this activity and are given credit for doing so.
3. This activity is used for three animal groups, but could be used for others as students study them.

* This activity was a 1990 winner of the Business Week Innovative Teaching Award.
TITLE:  Buggy Diner

AUTHOR:  Rosina L. Phillips, Sierra Vista Elementary,  
Las Vegas, New Mexico

GRADE LEVEL:  3-5

OVERVIEW: Not all insects eat the same foods. Some like to  
eat the leafy parts of vegetables and some like the roots.  
Some insects prefer other insects! In this activity  
students will construct an insect diner and serve food  
samples to the invited insects.

PURPOSE: Because of existing environmental conditions and  
pesticides being used, it is important that students learn  
that there is a natural way to control insects in a garden.

OBJECTIVE(s)  Students will be able to:  
1. Identify 10 common garden insects.  
2. Identify 3 garden plant leaves.  
3. Identify 3 garden plant roots.  
4. Demonstrate the feeding preferences of some common  
garden insects.  
5. Identify insects they would encourage or discourage to  
be in their garden.

RESOURCES/MATERIALS:  
1. 10 plastic petri dish covers.  
2. 10 garden insects.  
3. 3 plant leaves from garden.  
4. 3 plant stems from garden.  
5. Journals.  
6. Jar with air holes.

ACTIVITIES AND PROCEDURES:  
1. Collect a variety of plant leaves and roots from the  
garden.  
2. The day before activity, collect a variety of common  
garden insects, place in a jar with air holes.  
   DO NOT FEED  
3. Turn each of the petri dishes upside down. Place 3  
leaf and 3 root samples around the edge of each dish.  
It is important that they be the same size in order to  
get accurate results. Label the samples.
4. The "diner" is now open for lunch. Choose one of the insects from the jar. Place the insect in the petri dish. Observe the insect every 2-3 hours to see what the insect is munching. Record the results in your journal.

5. Repeat the activity with other insects. Record the results in your journal.

6. Students may also place two insects in each petri dish to observe if preference in "diner" may be another insect.

TYING IT ALL TOGETHER: If insects eat the same plants that we eat, we wouldn't want them in the garden eating our food. If they did not like a plant, could you use it to protect the plants we eat? Were there insects that ate plants we do not want in the garden? If there are insects that eat other troublesome insects, can we find a way to encourage them to stay in the garden?
TITLE: LETTUCE US BE DIFFERENT

AUTHOR: Glenda Lazenby, Casady School, Oklahoma City, OK

OVERVIEW: Students compare their own similarities and differences. They then grow and compare several varieties of lettuce plants to explore variations within the same type of plant.

GRADE LEVEL/SUBJECT: Appropriate for grades K-5. Life Science lesson with some social studies applications.

PURPOSE: A healthy, resilient ecosystem results from the complex web of roles played by a diversity of organisms.

OBJECTIVE(s): To recognize that different qualities make each human unique and to appreciate variations within species by growing and comparing different types of lettuce plants.

RESOURCES/MATERIALS: It will be necessary to acquire three cups or pots for each child, fill the cups with potting soil and purchase three different varieties of lettuce seeds. Most importantly, however, this lesson and many, many more wonderful lessons are available from the National Gardening Association. Their publication is "Grow Lab: Activities for Growing Minds." Call (802) 863-1308 or write 180 Flynn Avenue Burlington, Vermont 05401.

ACTIVITIES AND PROCEDURES:
Play the game "I Like My Neighbor Who". Sit in a circle with and "it" in the middle. The "it" says, "I like my neighbor who (complete the sentence with a personal characteristic such as has brown eyes or wears white tennies). Everyone who fits that description must quickly change places around the circle. "It" becomes the last person standing. Have students play the "Let Us Be Different Game" as a conclusion to the first game. Have one student share a way s/he is different from the person to her/his right side and
continue around the circle. Teacher question: "If humans are alike in many ways but still have many differences, is the same true of plants?"

Give students three different types of lettuce seed to plant in separate pots. As the plants grow, have students make and record regular observations in their plant journal.

At the end of four weeks the students complete a worksheet titled "Lettuce Be Different". Questions include:
What do the seeds look like (color, shape, size)?
What color are the leaves?
How do the leaves feel?
How tall is the plant? How does it taste?
What else do you notice about the lettuce?
TYING IT ALL TOGETHER: Discuss what the title "Lettuce Be Different" means to you. Count the number of varieties of apples, tomatoes, or other vegetables and fruits might have, using seed catalogs for reference. Conduct a supermarket survey to see what varieties are available locally. Graph results. Make collages highlighting variations of any one particular trait. Write a haiku poem (five, seven, and five syllables) about each variety of lettuce.
TITLE: Mountain Building

AUTHOR: Tom Walker, White City Intermediate, White City, OR

GRADE LEVEL: Grades 4 and up

OVERVIEW: This activity was a part of a series of lessons in a continuing study of Change. It was designed to give the students hands-on experience manipulating and controlling some of the variables in one type of Change, soil erosion.

OBJECTIVES:
1) The learners will identify variables that influence rates of change.
2) The learners will, through group consensus and using the assigned materials, design and build what they believe to be the strongest mountain possible.

RESOURCES/MATERIALS: dish pans, potting soil, rocks, sand, water, watering can, building plan sheets.

ACTIVITIES AND PROCEDURES:
The teacher will begin by dividing the class into seven groups. (For the sake of saving time the terrarium study groups may be used.) The teacher will explain to the class as a whole that their task will be to build a mountain in their dish pan that can withstand the effects of having a watering can emptied out on it. Two groups must use sand as their building medium, two groups must use potting soil as their building medium, two groups must use rocks as their building medium and the last group will be allowed to use any combination of materials that they see fit. All the groups may use creative extras to complete their mountains but the main structure must be made from their assigned materials.

The groups should be allowed 10-15 minutes to come up with a building plan before they begin.

When all groups are finished they will gather with their mountains and under go the erosion test. The teacher will fill a watering can and pour it over each
mountain in turn. During the erosion testing each group should share their building strategies and theories with the rest of the class.

The activity will end with a discussion and group planning session to design the ultimate, ever-lasting mountain.

Questions to think about: "Why did some of the mountains erode more than others?" "What are the variables involved in the structure of a mountain?" "How can these variables affect the rate of mountain erosion?" "Can people change the erosion rate of a real mountain?" "How?" "How did our mountains change during the erosion?" "What ways did they stay the same?"
TITLE: Guidebook

AUTHOR: Geralene Richard, Eastside Elem., WY

GRADE LEVEL/SUBJECT: 4-6, environmental awareness

OVERVIEW: Environmental education is stressed in all grade levels. Often children perceive "outdoor education" to mean the national forests or any land that is outside the urban area. I use this lesson to make children that "outdoor education" encompasses all land.

PURPOSE: Students will develop an understanding and appreciation of the environment around them through the research and publishing of a guidebook.

RESOURCES/MATERIALS: plant books, science teachers, county extension agents, Forest Service, BLM, or any knowledgeable person; drawing paper, pencils, computer, printer; optional - binder, increment borer (for aging at least one deciduous tree)

ACTIVITIES AND PROCEDURES:
1. Students list all they know about any plants found on the school grounds.
2. Working in pairs or small groups, students identify certain plants.
3. The groups research the plant and discover any benefits to man, any diseases, history, whether it is native to the area, etc. (This list should be student generated with some guidance from you.)
4. Students learn how to age deciduous trees and conifers.
5. Each group writes a narrative and draw or find pictures about their plant.
6. Students publish their book and make several copies.
7. Students give guided tours of the school area to other classes, parents, and any interested community groups.

TYING IT ALL TOGETHER: The culmination of this unit would be giving guided tours using their published guidebook.

ADDITIONAL ACTIVITIES: Include insects and other animal life. Plant another tree or bush of a species not found on
the playground. TALENTS UNLIMITED is good to use with this.
TITLE: School Yard Park/Ecosystem

AUTHOR: Linda Smith, Shedeck Elementary School; Yukon, OK

GRADE LEVEL/SUBJECT: Used at 5th grade Science level. (Can be adapted to any level), measurement can apply to math.

OVERVIEW: I am extremely fortunate to teach in a school directly across from a city park complete with a spring fed pond. We have used this setting to expand the Life Science Unit of our 5th grade Addison-Wesley Series, the Small Friends Community Unit and Ecosystems Unit from Gr. 5, HOES. You can also use your own school yard for variation.

PURPOSE: To acquaint students with a better appreciation for nature.

OBJECTIVE(s):
1. To be able to classify animals in their different families
2. To be able to classify plants according to their different families
3. To learn the complex interactions that take place in nature
4. To observe changes that occur in nature

RESOURCES/MATERIALS:
Insect nets (made from pantyhose and clothes hangers)
Egg cartons for collecting (items)
Hand Lens
Collection jars
Plant and Animal Field Guides

ACTIVITIES AND PROCEDURES: These units are started at the beginning of the school year.

1. Begin unit with a mapping session where students plot the park/school yard placing in all necessary details.
2. Next conduct a classifying session. This can be
done by doing bark and leaf rubbings. (Stress importance of not disturbing/destroying nature).

3. We then personalize the activity by assigning each student/study group their own "plot of land" (size to be determined by teacher).

4. Because this unit is taught at the beginning of school, we continue our observations throughout the year (making a "visit" every two weeks) noting any changes such as plant growth, different animal sightings, temperature, moisture etc.

TYING IT ALL TOGETHER: Culminating activity is the completion of each student/study group's "diary" notebook.
TITLE: Discovering the Earth's Journey Around the Sun

AUTHOR: Mark Whitener, DKL Elementary
         Arkansas City, Kansas

GRADE LEVEL: 5

OVERVIEW: The revolution of the earth around the sun is a phenomenon that is hard for students to deal with concretely. The following lesson will help students to more fully understand our planet's relationship to the sun.

OBJECTIVE(s): Students will observe the following about shadows:
1. The length of a shadow changes from week to week.
2. The angle of the sun's rays to the earth changes from week to week.

ACTIVITIES AND PROCEDURES:
On the school grounds find a shadow cast by a fence post or a piece of playground equipment. Have students observe the length and position of the shadow. Students may then make predictions about any changes that occur in the length and direction of the shadow throughout the day. Allow students to observe the shadow throughout the day.

Students should then make predictions about the shadow's length and angle of the ray to the earth if it is measured at the same time every day. Students should then measure the shadow each day and graph the results. (12:00 noon is an ideal time)

At the end of each week find the average length of the shadow and angle of the sun's rays to the earth. Students will see a change in the shadow's length and the angle of the sun's rays.

TYING IT ALL TOGETHER:
Students should conclude from their data that the position of the earth to the sun changes with the seasons. Hence in spring the shadow will show that the angle between the rays and earth has grown bigger and the sun is more directly overhead thus producing warmer temperatures.
TITLE: Everybody Needs a Rock

AUTHOR: Leslie S. Gordon, Badger Road School,
Fairbanks, AK

GRADE LEVEL/SUBJECT: 2-8 science, math, language arts
TALENTS UNLIMITED LESSON

OVERVIEW/PURPOSE: It seems that all children love rocks, so
this was a perfect medium for integrating Talents across the
curriculum. I'm also always looking for realistic situations
in which my students have to measure using metrics.

OBJECTIVES: The student will be able to:
1. Use his or her Decision Making Talent and the
   worksheet provided to select a rock.
2. Use his or her Communication Talent #1 to list
   all the many, varied words to describe the rock.
3. Estimate the mass of all the rocks in
   his or her group and rank them accordingly.
4. Use his or her Planning Talent to check the
   estimations of mass using only a balance without gram
   masses.
5. Find the volume of his or her rock using water
   displacement
6. Use Communication Talent #5 to write a story about
   his or her rock based on what he/she learned during
   the activities above.
7. Use Productive Thinking Talent to list 'mvu'
   strategies for grouping/classifying the rocks of
   his or her group.

RESOURCES/MATERIALS:
"Everybody Needs A Rock" by Byrd Baylor
Decision Making worksheet
rocks
blind folds
balances
gram masses
graduated cylinders or jars
water

ACTIVITIES AND PROCEDURES:
1. Read "Everybody Needs a Rock" by Byrd Baylor.
2. Ask the children to use their Decision Making Talent and the worksheet to help them decide what criteria they will use to help them pick their rock.

3. Next have everyone get into groups of five or more. Each person should observe his/her rock and use Communication Talent #1 to record all the many, varied words that describe his/her own rock.

4. Next put everyone's rock in the center of the table and add at least five more rocks. Have each child find his/her rock. Give them three minutes to feel their rocks, then repeat the activity blindfolded. If the children are good at this, you might want to put all the rocks for the entire class together and challenge each student to find his/her own.

5. Ask the students to use their Productive Thinking Talent to find as many strategies as possible for classifying their rocks. You might want to suggest a particular genre such as dichotomous keys or Venn Diagrams to give the assignment some structure.

6. Next have students work in their groups to rank the ten rocks in their group by estimating their mass using feel only. After this is done, they can use their Planning Talent to determine a plan for checking their estimations with only one balance per group and no gram masses. Finally, have them check their ranking using gram masses.

7. When students have found the mass of their rocks, challenge them to use their Productive Thinking Talent to think of many strategies to find the volume of their rocks in cubic centimeters. They may need the hint that one gram of water equals one cubic centimeter equals one milliliter.

TYING IT ALL TOGETHER:
Ask the students to use all the things they learned about what makes a rock great and their Communication Talent #5 to write their own book using many, varied complete thoughts on how to select a rock.
TITLE: Solar Energy Experiment

AUTHOR: Beatrice Ortiz, Ann Parish Elem., NM

GRADE LEVEL/SUBJECT: 3-8, science

PURPOSE: The purpose of the following experiment is to demonstrate that energy from the sun can be collected and stored in many ways.

RESOURCES/MATERIALS: one plastic bottle painted white, one plastic bottle painted black, several small balloons

ACTIVITIES AND PROCEDURES: General information -

Our sun is an average sized star and it has been burning for about 4.5 billion years. Few people think of the sun as a nuclear furnace and fewer realize this is a source of nuclear energy that does not pollute. About four million tons of the sun's matter turns into energy every second and only one-billionth of the sun's light ever strikes the Earth.

At the equator the Earth receives about one kilowatt per square meter of solar energy. A kilowatt is 1000 watts or the amount of energy needed to light 10 one-hundred watt bulbs. If man could make full use of solar energy, almost every house in the world could be energy independent. Only a few households would have to be dependent on the electric company and this would reduce the pollution problem greatly. The consumption of gas, oil, or coal would be reduced and this would also help reduce the level of pollution. The automobile could be powered by the sunlight during the day and use battery power at night. This would also reduce pollution and help prevent global warming.

Turning solar energy directly into electricity today is not very efficient; however, solar energy can be best collected as heat. The following experiment will teach young people how to collect and store the sun's energy in the form of heat.

The teacher will notice the experiment demonstrates a method to collect and store solar energy and has been designed for grade one through six. It is possible for young students to expand the concepts of these experiments
into local science fair projects.

The Black and White Bottle Experiment

The experiment is performed with the two plastic bottles. The teacher will note one bottle is painted black and the other is painted white. Place the open end of one small balloon on the mouth of the white bottle and do the same for the black bottle. Make sure the balloon forms an air tight seal. Now place both bottles in bright sunlight. Within a few minutes, the students will notice the balloon on the black bottle will start to expand. The balloon of the white bottle will remain limp. Have a student touch the black bottle to notice that it is warm. Then have the same student touch the white bottle to notice that it is much cooler than the black bottle.

Questions -
1. Why do you think the balloon on the black bottle expanded?
2. Does heat make air expand?
3. Does a black object get warmer in the sunlight than a white object?
4. What would be a good color to paint your car if you wanted to stay cool in the summer?

Explanation -
The black bottle will absorb the sun's energy much better. The white bottle reflects away most of the sun's energy. As the bottle absorbs energy, the air inside the bottle warms up and expands making the balloon full with air.
TITLE:  Fruits and Vegetables

AUTHOR:  Robert D. Willis, Arapahoe Middle School, Arapahoe, WY

OVERVIEW: Plant reproduction and response helps students understand the difference between plants with seeds and seedless plants. In this activity students are surprised to learn that many of the items commonly called vegetables or nuts are really fruits.

GRADE LEVEL:  Appropriate for grades 5 - 8

PURPOSE: The purpose of this activity is to help students understand that some plants produce fruits and some produce vegetables.

OBJECTIVES: Students will be able to:
1. Define - in their own words a definition for fruits and vegetables and be able to differentiate between fruits and vegetables.
2. Compare - based on color, size, shape, taste, seeds, and plant parts, the differences between a fruit and a vegetable.
3. Identify - fifteen to twenty common fruits and vegetables.

RESOURCES/MATERIALS:
A wide variety of both fruits and vegetables obtained from your local grocer. Quantities should be varied according to class size.

Reference materials to help in classifying the specimens.


ACTIVITIES AND PROCEDURES:
1. Begin by having the students write the definitions of each, a fruit and a vegetable on a sheet of paper. Discuss some of the various answers students have
2. Display a wide variety of fruits and vegetables, as many of each as possible, around the classroom.

3. Divide the students into groups of 3 or 4 and ask them to list each item and classify it as either a fruit or a vegetable using the definitions of each given at the beginning of class.

4. Allow students to sample and taste the different specimens while classifying them. Depending upon the age of the student discretion should be used whether to allow students to use knives or use precut samples.

5. Have students share their lists and give reasons for their choices.

TYING IT ALL TOGETHER:

1. Follow this up by giving feedback to the students by listing all the specimens in their correct classes.

2. Use this activity to introduce the first unit or lesson for plant reproduction and response.

3. Return student list with no negative comments.

4. Give a simple identification quiz using some of the specimens in order to evaluate what the students have learned.
TITLE: Photosynthesis and Transpiration

AUTHOR: Nelida Boreale, Mountain View Elementary, AZ

GRADE LEVEL: 6-8

OVERVIEW: Many students are not interested in science at all. They often think that the concepts taught in science are irrelevant to their needs. They think that science is boring and hard. Until children experience science in a fun way, their attitude toward science won't change.

PURPOSE: The purpose of this lesson is to help students experience science in a different way. To change students negative attitudes toward science into positive.

OBJECTIVES:
1. To observe the effect of light on plants. Illustrate the exchange of gases between the atmosphere and the plant.
2. To understand how green plants use the sun's energy to produce food through photosynthesis.
3. To see that plants are part of many natural cycles.

RESOURCES/MATERIALS: Two or more six inch pots, fifty or more pea seeds, vermiculture soil mix (or potting soil) a sprinkler (a jar with holes in the lid), a dark area (a large cardboard box) or a cabinet A glass bottle or jar, paper, pencils, crayons

INTRO: Plants provide a renewable source of food energy for many forms of life. Green plants utilize the sun's energy and the gases in the atmosphere to produce food through photosynthesis and exchange gases in the atmosphere in the associated process of transpiration.

ACTIVITIES AND PROCEDURES:
1) Have the class divide into small groups (if not conducting this experiment as a demo.) Have each student make an illustrated log of events for germination of the seedings to the end of the experiment.
2) Germinate pea seeds by placing them onto damp paper towels in a tray or shallow dish and covering them with
warm tap water. Keep covering them with warm tap water. Keep covered with warm water and in a indirectly lit place. A "hook" should appear in two to three days. After the "hook" appears, the seeds are ready to be planted in the pots.

3) Prepare two pots by placing paper towels as a lining for each pot. Fill with the vermiculite soil mixture up to 2 1/2 inches from the top.

4) Place the seeds carefully on top of mixture. Cover with 1/4 to 1/2 inches of soil mix.

5) Sprinkle water over the top of the soil until the soil is well saturated.

6) Place one of the pots in a well lit place.

7) Place the other pot in the designated dark area and leave it completely in the dark for one week to ten days.

8) At the end of one week or ten days, remove the pot from the designated dark area and compare it with the pot of seedlings that were grown in the light.

9) Have the class discuss the differences and make a drawing to illustrate the differences between the two sets of seedlings.

10) Leave the pot that was in the dark in the light for a few days, and compare the results.

11) Remove one seedling from each pot and compare the root structure of the dark grown seedlings and the light grown seedlings.

12) Place a glass bottle over one of the seedlings, and place it in the sunlight.

13) Notice the condensation that occurs on the inside of the bottle. The condensation is water vapor being given off by the plant when it exchanges oxygen for carbon dioxide. (transpiration)

EXTENSIONS
1) Take the class out to a grassy area on the school grounds. Dig up a shovelful of grass covered soil.
   Have the class examine the depth of the roots and their structure.
   How do they differ from the pea seedling roots? How does grass differ physiologically from the pea seedlings? (stems leaves, etc.) Do they have the same photosynthetic process?

2) Take the class to a treed or forested area. Compare
the effect of light on identical seedlings growing in the shade of a tree and seedlings growing in sunlight.
TITLE: pH

AUTHOR: JIM L. TORGERTON, NORTH SEVIER MIDDLE SCHOOL, SALINA, UTAH

GRADE LEVEL: Appropriate for grades 6-8.

OVERVIEW: The students will be able show how pH affects their lives.

PURPOSE: Students will learn how to test for pH and understand its relationships to them and their environment.

OBJECTIVE(s): STUDENTS WILL BE ABLE TO:
1. Tell what pH is.
2. Draw and label a pH scale.
3. Tell what the pH of different items is.
4. Explain why its important to understand pH.
   (Dangers, etc.)

BACKGROUND INFORMATION AND MATERIALS:
pH is the symbol for the degree of acidity or alkalinity (base) of a substance. pH also refers to the potential of hydrogen in a substance. Have students draw and label the pH scale as you discuss it.

   pH scale
   |---------------------|---------------------|
   0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
   Acid (H3O+)  Neutral  Alkaline
   (Base, OH-)

As the hydronium ion H3O+ concentration increases the acid concentration increases. For example: a pH reading of 1 is a stronger acid than a pH reading of 6. As the hydroxide ion (OH-) concentration increases the alkalinity increases. For example: a pH reading of 12 is a stronger base than a pH reading of 8.5. pH reading of 7 is neutral. The reaction of an acid with a base produces salt and water. In neutralization, the properties of the acid and base are lost as two neutral substances water and a salt are formed.
You will need the following materials:
1. beakers
2. litmus paper (I would recommend litmus paper that tests 1-12 and litmus paper to test specific ranges- i.e. 1-3, 4-6, 6-8, 8-12).
3. paper towels
4. substance you would like to test.
   (i.e.: lemons, apples, vinegar, shampoo, bananas, water, eggs, ocean water[if available], milk of magnesia, soap, ammonia, etc.

IT IS VERY IMPORTANT THAT STUDENTS DO NOT BRING OR WORK WITH ANY SUBSTANCES THAT COULD HARM THEM, SUCH AS BATTERY ACIDS, DRAIN CLEANERS, ETC. REMEMBER A STRONG BASE WILL BURN YOU JUST AS FAST AS A STRONG ACID. PLEASE, PROTECT YOUR STUDENTS.

5. paper and pencil for notes.

RESOURCES:
PHYSICAL SCIENCE TEXT BOOK, CHEMISTRY TEXT BOOK, ENCYCLOPEDIA, ANY OTHER RESOURCES THAT RELATE TO pH THAT ARE AVAILABLE.

ACTIVITIES AND PROCEDURES:
Give each student several pieces of litmus paper that will test pH 1-12. Also, several pieces of litmus paper that will test pH 6-8. The other specific testing pH paper use under you direct supervision. Each group of students should also have access to a pH color bar to compare their exposed paper to after exposure.

Following is a list of substances that are easy to test in the class room. Feel free to test any other substance you like as long as it is safe to the students. Have students expose the material to the litmus paper and take notes.

<table>
<thead>
<tr>
<th>Substance</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>lemons</td>
<td>2.4</td>
</tr>
<tr>
<td>vinegar</td>
<td>2.9</td>
</tr>
</tbody>
</table>
3. apples  3.4
4. bananas  5.2
5. shampoo  5.7 (some shampoo differ from this)
6. water  6.8-7.2
7. eggs  7.8
8. ocean water  8.5 (If you have any)
9. soap  10
10. milk of magnesia  10.4
11. ammonia  11.2
12. etc.  etc.

Have students do their tests and compare their results with book charts that show pH. Discuss why there are some differences. Students really have fun with this activity if you give them a little freedom to test all different types of things.

MAKE SURE ALL SUBSTANCES BEING TESTED ARE SAFE FOR STUDENTS TO HANDLE BEFORE THEY COME IN CONTACT WITH THEM.

I have had students test everything from saliva to underarm sweat. They really enjoy this part of the activity. It is really important to discuss the possible dangers of exposure to strong acids or strong base substances.

TYING IT ALL TOGETHER:
CROSS-CURRICULUM IDEAS:
Math: Have students graph the pH of several different substances.

English: Have students write an essay of how pH is used in their everyday lives.

History: Check to see if there has been any accidents in the area regarding strong acids or strong bases.

* You can test the pH of soil by making a slur of distilled water and soil samples from an outdoor classroom. Mix the two well and test the slur for a pH reading. Commercial kits can also be purchased inexpensively for testing.
TITLE: WEATHER FORECASTING

AUTHOR: JIM L. TORGERSON, NORTH SEVIER MIDDLE SCHOOL, SALINA, UTAH

GRADE LEVEL: Appropriate for grades 6-8.

OVERVIEW: The students will be able to forecast the weather up to 48 hours.

PURPOSE: By gaining an understanding of how to forecast weather, the students will be able use weather reports for their personal benefit.

OBJECTIVE(s): STUDENTS WILL BE ABLE TO:
1. Tell what weather is.
2. Read barometer, anemometer, wind vane, hygrometer, (psychrometer) and thermometer.
3. Understand basic cloud formations relationship to weather.
4. Forecast the weather for two days.

RESOURCES/MATERIALS:
You will need the following materials:
1. thermometer
2. barometer (recording barometer would be the best type)
3. weather vane
4. anemometer
5. weather charts
6. hygrometer
7. paper and pencil for notes.

Make sure students have had experience labeling weather maps before starting this activity.

Resources:
EARTH SCIENCE TEXT BOOK, WEATHER AND CLIMATE TEXT BOOKS, ENCYCLOPEDIA, ANY COMMUNICATION RESOURCES (i.e. National Weather Service, Local weather service, TV and radio stations) THAT RELATE TO WEATHER THAT ARE AVAILABLE.

BACKGROUND INFORMATION:
Students will need to have covered basic weather topics such as fronts, high and low pressure areas, use of meteorological instruments, etc. before beginning this activity. You can do this by having students watch TV or newspaper or National Weather Service weather reports daily. Using this information along with the demonstration reading from the instruments in your school the students can make weather charts of cold and warm fronts, high and low pressure systems, etc. Also you need to cover the cloud types with pictures and actual viewing.

ACTIVITIES AND PROCEDURES:

Each day, for two or three weeks have students use a thermometer, barometer, wind vane, anemometer, and hygrometer to take measurements of the current weather conditions.
MAKE SURE STUDENTS KNOW HOW TO USE EACH OF THE WEATHER GATHERING INSTRUMENTS.

Because of the lack of instruments, you may have to rotate the weather report assignment so each student has an opportunity to participate. Use these measurements to make a current weather map each day. Using their weather maps and view of clouds, have students forecast the weather for the next two days. Have students do this for one week and check their own accuracy. Discuss how knowing what the weather will be doing can save lives and/or make people more comfortable.

CROSS-CURRICULUM IDEAS:
Math: Have students keep track of high and low temperature in both F degrees and C degrees for one week. Graph those temperatures and figure the mean average for the week.

English: Do a narrative of the life of a cloud.

Art: Draw and color different types of clouds.

History: Keep track of location and damage of all significant storms in the next three months.
TITLE: BUILDING A PSYCHROMETER

AUTHOR: John Cowens; Greenwood Elementary, La Grande, OR 97850

GRADE LEVEL/SUBJECT: Appropriate for Grades 3-12

OVERVIEW:
Humidity is moisture in the air. When air feels damp, the humidity is high. When air feels dry, the humidity is low. The amount of water the air can hold is determined by the temperature. Warm air can hold much more moisture than cold air. (See Relative Humidity Table for specific examples.)

When air can hold more moisture at a given temperature it is said to be saturated. Relative humidity is the percentage of saturation. A psychrometer is one tool for measuring relative humidity. The bulb, or rounded end of one thermometer is covered with a wet cloth. After the thermometers are fanned the wet bulb temperature will usually be lower than the dry bulb. The water evaporating from the cloths lowers the temperature of the wet bulb because evaporation is a cooling process. The relative humidity can then be read from the chart (provided at the end of this lesson).

OBJECTIVES:
Students will demonstrate their knowledge of the atmosphere and humidity by building and using their own psychrometer.

MATERIALS/RESOURCES NEEDED:
Tape, water, 2 identical thermometer, gauze (2" X 2"), rubberband, piece of cardboard (8" X 11"), Relative Humidity Table

ACTIVITIES AND PROCEDURES:
1. Wrap the gauze around one of the bulbs and tie it firmly in place with a rubber band.
2. Wet the gauze.
3. Place the thermometers side by side with the two bulbs just hanging over the edge of a desk or table.
4. Use the cardboard to fan the thermometers. (Be careful not to bump or hit the thermometer while they are taped down, or they could break).
5. Fan vigorously until the temperature of the thermometer with the wet bulb stops going down.
6. Record the temperature readings on both thermometer.
7. Subtract the wet bulb temperature from the dry bulb temperature and record the difference.
   Note: With the more advanced classes use Fahrenheit thermometers and require them to convert from Fahrenheit to Celsius and then find the difference.
8. Look at the Relative Humidity Table. The numbers in the left hand column represent the dry bulb reading. The numbers across the top represent the difference between the wet and dry bulb readings. This is the answer you obtained from step #7. Follow your dry bulb temperature across and follow your difference column down until they intersect. Record the number at this point. The number you have recorded is the relative humidity of your room.

Extension:
1. Find the Relative Humidity of another room (i.e. an empty classroom). Any difference? Why?
2. Find the Relative Humidity outdoors
RELATIVE HUMIDITY TABLE
(SHOWN IN %)

<table>
<thead>
<tr>
<th>DRY BULB</th>
<th>DIFFERENCE BETWEEN WET AND DRY BULB READINGS IN CELSIUS DEGREES</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
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<td>----------</td>
<td>----------------------------------------------------------------</td>
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<tr>
<td>10</td>
<td>88 77 66 55 44 34 24 15 6</td>
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<td>11</td>
<td>89 78 67 56 46 36 27 18 9</td>
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<td>89 78 68 58 48 39 29 21 12</td>
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<td>89 79 69 59 50 41 32 22 15 7</td>
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<td>90 79 70 60 51 42 34 2 18 10</td>
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<td>90 80 71 61 53 44 36 27 20 13</td>
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<td>90 81 71 63 54 46 38 3 2 15</td>
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<td>90 81 72 64 55 47 40 32 25 18</td>
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<td>18</td>
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<td>21</td>
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<td>92 84 77 69 62 56 49 43 37 31</td>
</tr>
<tr>
<td>25</td>
<td>92 84 77 70 63 57 50 44 39 33</td>
</tr>
</tbody>
</table>
TITLE: The Importance of Trees in the Rural Area: Planting a Snowfence

AUTHOR: Wilma Jean Lunt, Parkview Elem., Lamar, CO

GRADE LEVEL/SUBJECT: 5@12, science

OVERVIEW: Trees can play an important role in rural areas. As a living snowfence, trees can protect roads and highways as well as provide habitat cover for wildlife and protection for livestock. This activity gives students hands-on experience in planting trees as well as being involved in area projects.

PURPOSE: The purpose of this activity is to demonstrate the importance of trees in rural areas through the planting of a living snowfence.

OBJECTIVES: Students will be able to:
1. Explain the importance of a living snowfence in a rural setting.
2. Sequence the steps in planting trees for a living snowfence.
3. Exhibit the ability to work in a group.
4. Demonstrate the proper way to plant a living snowfence.

RESOURCE/MATERIALS: "The Living Tree" brochure from Colorado State University Cooperative Extension, "Project Learning Tree Activity Guide", county extension agent or forest service personnel, slides from county extension agent, materials for planting trees

ACTIVITIES AND PROCEDURES:
1. Have the students brainstorm ways trees can be useful in rural areas.
2. Invite an extension agent or person from the forest service to talk about the importance of trees in rural areas.
3. Use slides to illustrate the use of trees as a living snowfence.
4. Use math activities to figure how many trees it will take for the project. Figure how far from the highway the trees will need to be planted to keep the snow off
the road. Predict the percentage of trees that will survive.

5. Take a class field trip to the area that the living snowfence is to be planted. Using the team approach actually plant the trees. (We have planted two snowfences along a highway for ranchers and have also planted trees for the new county landfill.)

6. After returning to the classroom, use writing activities to highlight the experience.

TYING IT ALL TOGETHER: This activity has sparked interest in the students as to how trees can be of importance to our school playground. It has been an excellent way to work with area ranchers and county officials. One student developed an interest in what it takes to become a "tree city USA."
TITLE: Measuring the Earth

AUTHOR: Jane Rich, Shawnee High School, Shawnee, OK

GRADE LEVEL/SUBJECT: (9-12)

OVERVIEW: Many students have little understanding or appreciation for the process of science. I like to get my students involved in doing science, taking measurements, collecting data at the very beginning of the school year. So, I usually start this activity during the first week and call the local newspaper to come out and take pictures of the students.

Eratosthenes, a Greek mathematician, was the first to measure the circumference of the earth. He based his measurement of the earth on the assumptions that the earth was round and the sun's rays are parallel. He knew that at noon on the day of the summer solstice in Alexandria, Egypt, a vertical post casts a shadow. At the same time in Syene, a town directly to the south, a vertical post casts no shadow. Eratosthenes used Euclidean geometry to determine that the angle formed by the post and an imaginary line from the end of the shadow to the top of the post equals an angle at the earth's center formed by imaginary lines from the two towns. He calculated the earth's circumference by measuring the distance between Alexandria and Syene, and multiplying it by the number of times the angle at the earth's center is contained in 360 degrees.

PURPOSE: The purpose of this activity is to get students interested and involved in doing science, give them a reason to use some of the math they have learned, and develop a feeling of cooperation in working with people from other schools.

OBJECTIVE(s): As a result of this activity, the students will:
1. Work effectively in a small group to take accurate measurements at a specific time.
2. Use their knowledge of geometry and trig. to determine the measure of an angle.
3. Use significant digits in their reports.
4. Calculate percent error.
5. Use their research skills to determine accepted values.
6. Understand the value of cooperation in achieving a common goal.

RESOURCES/MATERIALS: The students will need a meter stick or measuring tape and a scientific calculator. I like to video tape the students doing the activity and send it to the other school. Your geography teacher may have some good maps to get the distance between schools.

ACTIVITIES AND PROCEDURES:
1. Contact a class directly north or south of you (in a different state if possible) and set a specific date and time to take the measurements.
2. Divide the class into groups and practice at least once before the day of the activity. They are to measure the height of an object (a pole is good) and the length of its shadow at a specific time. I have them start 15 minutes before the stated time.
3. Assign several people to research the circumference of the earth and others to find several ways to determine the distance from your school to the other group's school (maps, auto clubs, etc.). Eratosthenes had a slave to pace off the distance between the two cities and report back to him.
4. The measure of the angle is found by dividing the length of the shadow by the height of the object on your scientific calculator and then push 2nd function tangent. However, this is not the central angle. The angle from the other school must be subtracted from your angle and the absolute value of this difference is the central angle. The circumference of the earth can then be calculated by setting up a ratio and solving for the circumference.

\[
\text{central angle} = \frac{\text{distance from schools}}{360 \text{ degrees}} = \frac{\text{circumference}}{\text{circumference}}
\]

5. The students will have to decide how many significant digits to use in their results and then calculate the percent error from the value they found in their research.
TYING IT ALL TOGETHER:
1. Discuss the sources of error and the fact that your results depend on other people making accurate measurements.
2. I like to show the first tape of the "Cosmos" which tells about Eratosthenes.
3. The next activity might be to indirectly measure the height of our flagpole.
TITLE: MEASURING THE DIAMETER OF THE SUN

AUTHOR: JANE RICH, Shawnee High School, Shawnee, OK

OVERVIEW:
The earth is approximately 150,000,000 km from the sun. This distance varies somewhat with the seasons because of Earth's elliptical orbit. Yet, a simple instrument can be constructed which will provide measurement data that permits a relatively accurate measurement of the sun's diameter.

The relationship that will be used is:

\[
\text{diameter of sun (km)} = \frac{\text{diameter of sun's image (mm)}}{\text{distance to sun (km)}} \cdot \frac{\text{distance between cards (mm)}}{\text{dist. between cards}}
\]

From this relationship we can derive a formula:

\[
\text{Dia. of sun (km)} = \frac{\text{dia. of sun's image} \cdot \text{dist. to sun}}{\text{dist. between cards}}
\]

MATERIALS/RESOURCES:
2 small cardboard boxes--size not critical but should be ridged enough to hold their shape well
2 pieces stiff cardboard 10 cm X 20 cm (perhaps from a shoebox)
meter stick
single edged razor blade or sharp knife
masking tape
small piece of aluminum foil

ACTIVITIES AND PROCEDURES:
1. Tape the lids of the boxes shut securely. Cut slits in opposite sides of each box, directly opposite each other. Make each slit in the form of a capitol "I" and of a size that will fit the meter stick snugly when the box is pushed on to the meter stick. If measurements and cuts are made carefully the face of the box will be perpendicular to the meter stick. This is
important. Tape one box securely near one end of the meter stick but leave the other box free to slide.

2. Cut a 5 cm x 5 cm hole near one end of one piece of cardboard and cover with the aluminum foil. Tape the foil in place. Punch a very small hole near the center of the foil with a sharpened pencil lead or a pin.

3. Tape this card to the box that has been secured to the meter stick.

4. Draw two parallel lines exactly 8.0 mm apart near the center of the remaining cardboard.

5. Tape the card with the parallel lines to the face of the sliding box. Note: Be certain both cards are as nearly perpendicular to the meter stick as is reasonably possible. The lines are perpendicular to the meter stick.

6. Point the end of the meter stick that holds the foil-covered card toward the sun. CAUTION: Do not look at the sun! Move the meter stick around until the shadow of the foil-covered card falls on the other card. A bright image of the sun will appear on the sliding card. Move the sliding card until the bright image of the sun exactly fills the distance between the parallel lines. Measure the distance between the cards on the meter stick. Distance between the two cards = mm.

7. Use the formula from the theory section to calculate the diameter of the sun. Use 150,000,000 km as the distance from Earth to the sun.

Calculation A:

8. Find the percent difference between your measurement of the sun’s diameter and the accepted actual diameter of the sun which is 1,391,000 km.

CONCLUSIONS:
List factors which could account for the difference between your measurement and the accepted diameter of the sun.
The calculation you made in step 8 was a test of measurement ACCURACY. What could you do to test the PRECISION of your meter stick instrument?

FOR FURTHER STUDY: The actual distance between the earth and sun varies from a minimum of 147,097,000 km to a maximum of 152,086,000 km.

1. Recalculate the diameter of the sun using your distance between cards measurement and the minimum distance between the earth and sun in the formula. Calculation B:

2. Again, recalculate the diameter of the sun using your distance between cards measurement and the maximum distance between the earth and sun in the formula. Calculation C:

3. Does the accepted actual diameter of the sun fall between your calculations B and C? How do calculations B and C affect your estimation of the accuracy of your measurement as opposed to the percent difference you calculated in step B above?

EXPANSION:
Refer to the relationships described in the theory of this lab and derive a formula for calculation the distance from the earth to the sun. Use the measurements you can obtain from your meter stick instrument to calculate this distance. Obtain an astronomy reference which gives the actual distance between the earth and sun on a given day or week to check the accuracy of your instrument.

What changes or refinements would you make in your meter stick instrument if you were to plan to chart the
earth-sun distance through the remainder of the school year? How could you present the results of such a charting project in a meaningful way?
RESOURCES
Resources

This section on resources may be the most helpful to you as you start, or even maintain, an outdoor classroom. Much of the information comes from the Outdoor Classroom Council through the DeKalb County Cooperative Extension Service in Georgia. This organization helps train educators in building outdoor classrooms. This is mentioned so that you will realize that the enclosed information has been carefully researched and tried in outdoor classrooms to ensure success when you are creating your own classroom.

Read through the information and find what is relevant to you and your needs. From butterflies to bugs, from soil to sun, from one tree to a forest, even grants and funds—this section will help you get underway in building the best outdoor classroom possible. Know that by no means is this an exhausted list. You will find many other resources and sources of information as you become involved with the outdoor classroom. This information is to help get you started or, even to “fill in a few holes” in your current program. Whatever the case may be, use these resources as they can help you!
Information, Ideas and Training

There are a number of places that offer educators ideas, materials and assistance with the operation of an outdoor classroom. Local botanical gardens, nature centers, nurseries, environmental groups and science centers can assist you with many of your needs. Many offer nonformal education courses related to outdoor classrooms as well as staff development, student field trips, hands-on curriculum, lesson plans and expert advice. Do not overlook the resources in the school’s community. Many residences have knowledge of gardening and would be thrilled to share what they know with your students. This also gives a sense of ownership of the outdoor classroom with those who live in the school’s district. Listed below are a few places that can be contacted to assist your outdoor endeavors.

Callaway Gardens
(770) 663-2281
Contact: Education Department

National Wildlife Federation
www.nwf.org

Project Learning Tree
www.nceet.snprg.umich.edu/plt.html
Established in 1973, PLT uses the forest as a “window on the world” to increase students’ understanding of our complex environment. The goals are to stimulate critical and creative thinking, develop the ability to make informed decisions on environmental issues, and to instill confidence and commitment to take responsible action on behalf of the environment. PLT is a nationally recognized, comprehensive K-8 environmental education curriculum.

Project WET
www.montana.edu:80/wwwwet

*Water Education for Teachers* is designed to facilitate and promote the awareness, appreciation, knowledge and stewardship of water resources through the development and dissemination of classroom-ready teaching aids and the establishment of state and internationally sponsored Project WET programs. A teacher’s guide is available from Project WET. For information on the national “River of Words” competition sponsored by Project WET, visit their web site at www.iron.org.

Project WILD
www.geolink.umich.edu/wild/wildhome.html
Project WILD is a nationally recognized curriculum that emphasizes wildlife as the basis for an interdisciplinary, supplementary, conservation and environmental education program for kindergarten through high school age students.

U.S. Environmental Protection Agency
Contact your local office.
Outreach programs, including speakers and publications, are available to schools. They also sponsor the President's Environmental Youth Awards.

U.S. Forest Service
Contact your local office.
Posters and forestry related materials.

U.S. National Park Service
Contact your local office.
Offers teacher training for outdoor classrooms, outdoor curriculum, workshops and campus evaluations. USNPS also offers Staff Development Units.
Funding for Outdoor Classrooms

There are many sources of funding within your local area and state. Inquire with the Department of Education for your area. Most districts have grant offices set up just to assist educators. They can make you aware of funds and grants that are available to you. You also need to find out if your state has an outdoor classroom grant made available specifically for outdoor education. The majority of grants are fairly small - $500 or less. However, a number of regional and national agencies offer substantial grants - $5,000 to $25,000+ - to fund entire programs. Remember, not all grantors give cash grants. Many, such as Home Depot, give materials and supplies. Listed below are sources you can contact. Also, consider approaching local businesses, religious and civic organizations, garden clubs and your school's PTA for grants, materials, supplies, and even volunteers.

American Greenways Program
1800 N. Kent St., Suite 1120
Arlington, VA 22207
(703) 525-6300
Greenway Grant for trails and ecological corridors. ($500 - $2500)

Captain Planet Foundation
One CNN Center
Atlanta, GA 30303
(404) 827-4130
Mini-grants to facilitate and support hands-on environmental projects for children and young adults (ages 6-18) and empower them to solve environmental problems in their neighborhoods and communities. ($250 - $2500)

Environmental Protection Agency
Contact your local office and reference the Environmental Education and Outreach Program. The EPA awards grants up to $25,000 to carry out environmental education projects.

Local Department of Education
A number of state and federal grant programs administered through your local Department of Education may be used for the development of outdoor classrooms. Some examples are:

- Eisenhower Grants may be used to fund staff development programs relating to the outdoor classroom.
- Innovation Grants are available to fund innovative educational programs.
• **Learn and Serve American Grants** are available for programs that involve students in community service activities while providing them with hands-on learning experiences.

**National Environmental Education and Training Foundation**
915 fifteenth Street, NW
Suite 2000
Washington, D.C. 20005
(202) 628-8200
Special funding from the USDA Forest Service allows NEETF to support a small number of one-time matching grants for model environmental education and training projects that emphasize the interdependency of communities and ecosystems, both natural and built. ($10,000+)

**National Fish and Wildlife Foundation**
1120 Connecticut Avenue, suite 900
Washington, D.C. 20036
(202) 857-0162
Supports a range of conservation and environmental education projects.

**National Gardening Association**
180 Flynn Avenue
Burlington, VT 05401
[www.wowpages.com/nga/edu](http://www.wowpages.com/nga/edu)
Youth Garden Grants Program offers grants of materials and supplies worth $500.

**National Trees Trusts-Community Tree Planting Program**
1120 6 Street, Suite 770
Washington D.C. 20005
Director 1-800-846-873 ext. 813
Tree Planting Program as part of the Growing Together Program offers grants for trees and soil.

**Phillips Petroleum**
16 D1 PB
Bartlesville, OK 74004
e-mail: osu@ce.com
Phillips Environmental Partnership awards grants to public and private primary and secondary schools, adult non-profit community organizations, and nature centers for programs meeting a local environmental need. ($500 - $5000)
Sea World
Education Department
7007 Sea World Drive
Orlando, Fl. 32821
(407) 363-2389

Anheuser-Bush Theme Parks sponsor the "A Pledge and Promise Environmental Awards" program. The program awards prizes to schools that have created programs that demonstrate creativity, innovation and positive environmental impact in their community. Three prizes (ranging from $2500 to $12,500) are given in each grade category (K-5, 6-8, 9-12, college), with one grand prize of $20,000 going to the project that best meets the award criteria.

* Just a footnote - The Outdoor Classroom Council that provided much of the information for this resource section was funded, in part, by an Urban and Community Forestry grant from the USDA Forest Service.
Materials and Supplies

Mail order catalogs offer an easy way to purchase materials and supplies for your outdoor classroom. They also may give certain discounts if you order through your school’s science department. Products range from books and posters to videos and lab equipment. Large school suppliers, like Carolina Biological Supply and Delta Education, now offer a wide range of products for outdoor classrooms. Other companies that may have what you need are listed below.

Acorn Naturalists
17300 East 17th Street, #J-236
Tustin, CA 92780
(800) 422-8836
fax (800) 452-2802
e-mail: EmailAcorn@aol.com
www.acorn-group.com

books, equipment and supplies

Ben Meadows Company
3589 Broad Street
Atlanta, GA 30341
(800) 241-6401
fax (800) 628-2068
e-mail: mail@benmeadows.com
www.benmeadows.com

professional landscape tools and supplies

Carolina Biological Supply
2700 York Road
Burlington, NC 27215-3398
(800) 364-5551
www.carosci.com

books, science equipment and supplies

Delta Education
P.O. Box 3000
Nashua, NH 03061-3000
(800) 282-9560
www.delta-ed.com

books, science equipment and supplies
Gardens for Growing People
P.O. Box 630
Point Reyes Station, CA 94956-0630
(415) 663-9433
e-mail: GrowPeople@aol.com
children's garden equipment, books and supplies

Green Brick Road
8 Dumas Court
Don Mills, Ontario
Canada, M3A 2N2
(800) 473-3638 or (416) 465-1597
fax: (416) 537-7515
e-mail: staff@gbr.org
http://gbr.org
books (North American distributor for Learning Through Landscapes
publication)

Insect Lore
P.O. Box
Shafter, CA 93263
(800) LIVE BUG
fax: (805) 746-0334
e-mail: Insect@lightspeed.net
www.insectlore.com
insect related products

Let’s Get Growing
1900 Commercial Way
Santa Cruz, CA 95065
(800) 408-1868
www.letsgetgrowing.com
children's gardening supplies, books and science equipment

Nature Watch
9811 Owensmouth Avenue, #2
Chatsworth, CA 91311
(800) 28-5816
www.webmerchants.com/natwatch/default.htm
hands-on science products
Videos

Videos are available from a number of local organizations in your area. Contact the County Extension Office where you live as well as local libraries and environment groups. Mail order companies are also a good source for video and technology resources. Below are a few videos that may be of interest.

Attracting Butterflies to Your Backyard (K-College) A program on butterflies, moths, their life cycle and their habitat. It provides information on planning and establishing butterfly gardens. Includes teacher’s guide. 58min. $29.95.

In Celebration of Trees (K-College) A poetic relationship between man and the tree. The video shows Olympic National Park, the Florida Everglades and the Shenandoah Valley. 50 min. $19.95.

Georgia Schoolyard Wildlife Habitats Video (1994) A 14-minute video providing an introduction to Schoolyard Wildlife Habitats by touring several outdoor classrooms in Georgia and speaking with the students, parents and educators whom developed them. $9.95 + $3.50 S&H (Also available for 2 week library loan – only cost is return shipping.). Available from the Georgia Wildlife Federation, 1930 Iris Drive, Conyers, Ga., 30094, 770-929-3350.

The Life of a Forest (K-8) A two part series covering all aspects of the forest. Includes teacher’s guide with student activities, blackline masters and lesson plans. Two 15 min. videos. $145.00.

A Walk in the Woods (K-8) A video about forest stewardship and issues surrounding regeneration of a forest. One of a number of videos available from the Georgia Forestry Commission. For a video catalog, contact the Macon, Georgia office’
Internet Resources

The Internet is a great source of information that will assist you with your outdoor classroom. There are an abundance of ideas, projects, and lesson plans for teachers as well as for students. Many sites will help you in the building and maintenance of your outdoor classroom while others provide hands-on and cross-curricular activities. The following list is a good “starting point” to introduce you to the incredible instructional potential of projects linking technology and the outdoor classroom.


EE-Link [http://www.nceet.snre.umich.edu](http://www.nceet.snre.umich.edu) Extremely comprehensive site relating to all aspects of environmental education. Links to virtually every environmental education curriculum resource.

E-MALL Pals Growing Network [www.2.garden.org/nas/EDU/penpals.htm](http://www.2.garden.org/nas/EDU/penpals.htm). A feature of NGA’s Kids and Classroom Web site, this network allows teachers to share information, brainstorm solutions to problems, and to set up e-mail communication with other gardening classrooms. This is a “must-see”!

EnviroNet [http://www.earth.simmons.edu](http://www.earth.simmons.edu) Sponsors many interactive programs that utilize telecommunications to enhance environmental science education.

The Evergreen Foundation [http://www.evergreen.ca](http://www.evergreen.ca) Non-profit organization working to improve school grounds in Canada - lots of pictures and descriptions of outdoor classrooms.

Greening Schoolgrounds [http://www.greengrounds.org](http://www.greengrounds.org) Excellent resource for creating educational landscapes (from British Columbia).

Journey North [http://www.ties.k12.mn.us/~inorth](http://www.ties.k12.mn.us/~inorth) Sponsors excellent hands-on multidisciplinary projects that combine classroom learning, telecommunications and the outdoor classroom.

National Gardening Association [www.2.garden.org/nga/EDU](http://www.2.garden.org/nga/EDU). The NGA offers incredible resources for all school gardeners.

Seeds of Change Garden [http://www.horizon.nmsu.edu/garden/welcome.html]
Information on creating gardens that demonstrate how the world has changed since the arrival of Columbus in North America.

Specialized Sites of Interest

About Rainbows [http://www.unicat.uchicago.edu/staff/blundis/rnfw.html]
High School level and up.


Bat Conservation International [http://www.batcon.org]
Excellent resource on bats.

BugWatch [http://www.bugwatch.com]

The Butterfly Website [http://isit.com/butterfly]

The Butterfly Zone [http://www.butterflies.com]

Cornell Composting [http://www.cals.cornell.edu/dept/compost]

Cornell Lab of Ornithology [http://www.ornith.cornell.edu/MAIN.HTML] Lots of information plus opportunities to participate in classroom projects to supply Cornell scientist with data.

The Ethnobotany Café [http://countrylife.net/ethnobotany]
Great site relating to plants, their uses, and how they relate to cultures around the world.

Frogland [http://www.teleportcom/~dstroy/frogland.html]
Excellent site created by a teenage girl (good role model of female as scientist/computer expert).

Geologist’s Lifetime Field List
http://www.uc.edu/www/geology/geologuist/index.html
Describes and links to sites every geologist should visit.

GREEN (Global Rivers Environmental Education Network)
http://www.iqc.apc.org/green/green.html Global network that promotes watershed sustainability.

Horticulture for All
http://ourworld.compuserve.com/homepages/Jane_Stoneham/homepage.html
A horticultural therapy resource with information on the benefits of horticulture for the disabled.

Horticulture Therapy Links
http://www4.ncsu.edu/eos/users/k/kdmuelle/public/Hort-therapy/ht.html

Hummingbirds http://www.derived.com/~lanny/hummers

Hummingbird Nest http://www.hummingbird.org

Insectencyclopedia http://insecto LOTS of information, but very advanced - high school.

Links to anything you could possibly ask about botany.

Kids and Classrooms http://www.wowpages.com/nae/edu
The National Gardening Association's forum for teachers, teacher educators and community parts interested in using plants and gardens to enrich learning. Grant applications are online here as well as discussion groups, articles, and more.

Earth Sciences

National Geographic http://www.nationalgeographic.com

North American Association for Environmental Education
http://nceet.snre.umich.edu/naacehtml

Pete's Pond Page http://realitv.sgi.com/employees/peteo
One of many pond sites on the Web. This site provides an excellent overview of designing, building and maintaining a pond.
Refuge Net http://www.refuagenet.com Activist site with lots of information about endangered wildlife habitats - excellent interdisciplinary possibilities for middle and high school classes.


The Weather Unit http://faldo.atmos.uiuc.edu/WEATHER/weatherhtml Multidisciplinary curriculum.


Worm World http://www.nj.com/lucky/worm Fabulous site about worms, which includes multidisciplinary activities, information, and even an interview with the author of "Worms Eat Our Garbage.”
Free and Low-Cost Publications

There are many resources available to educators that are free or cost very little money. Obviously, you will find additional resources as you research for your outdoor classroom. Below is a brief list of organizations that you may want to consider as you begin gathering information.

Callaway Gardens
(Georgia)
(706) 663-2281
Contact: Education Department
Publishes “Nature Naturally,” a newsletter with activities for kids. Five editions per school year cost $5.00. They also provide free educational material on butterflies.

Center for Environmental Educators
881 Alma Real Dr., Suite 300
Pacific Palisades, Ca. 90272
(310) 454-4585
Free newsletter providing a link between educators and environmental resources.

Cooperative Extension Service
Many communities have a County Extension Service that can assist residence in all matters of environmental concerns. They provide many free publications with information that may be useful in your outdoor classroom. Contact your local extension office to find out which publications are available. Titles include:

- Butterflies and Hummingbirds: Attracting and Enjoying
- Composting: Feed Your Landscape
- Home and Garden Tips: Building Houses for Birds, Hawks, Owls and Bats
- Ornamental Horticulture Facts: Environmental Enhancement with Ornaments: Butterfly Gardening
- A Shady Perennial Garden
- Soil Preparation and Planting Procedures for Ornamental Plants in Landscape
- Those Incredible Hummingbirds
Florida Game and Fresh Water Fish Commission
Nongame Wildlife Program
620 South Meridian St.
Tallahassee, FL 32301
- Planting a Refuge for Wildlife. Habitat building, planting, and identification.

Georgia Experiment Station
P.O. Box 645
Experiment, GA 30212
(770) 229-3367
- Butterfly Starter Kit/Curriculum. Contact the station in March for details concerning price and ordering information. Includes specifics on all plants included in the kit and common butterflies that the plants will attract.

Indiana Division of Forestry
402 W. Washington, Room 296
Indianapolis, IN 46204
(317) 232-4105
- Teaching Outdoors on Your School Site. Free pamphlet describing how certain features in your school ground can be used for education.
- Guidelines and Features for Outdoor Classrooms. A 53 page reference with lesson plans and features of the outdoor classroom.

Meta Nature Products
P.O. Box 1099
Hudson, NY 12534
1-800-META-013

National 4-H Council Publication
4-H Supply
P.O. Box 79126
Baltimore, MD 21279-0126
(301) 961-2934
- Exploring the World of Plants and Soil
- Food Production and Pesticides
- Soils Alive from Tiny Rocks to Compost
National Wildlife Federation Publications
You can contact your local city NWF office, or contact the National headquarters at:
Schoolyard Habitat
8925 Leesburg Pike
Vienna, VA 22184-0001
(703) 790-9582
- Schoolyard Habitats Information Kit. A 15-page introduction to developing schoolyard wildlife habitats, including a reference list. Prepaid application for Certification of Habitat is included.
- Ranger Rick and Your Big Backyard magazine offer kids (and adults) ages 3 and up a chance to learn more about wildlife through stories and photos. Ranger Rick also sponsors an Earthsavers Club for youth.
- Animal Tracks Activity Guide for Educators grades 4-6. Activity guide with 40+ classroom tested, cross-curriculum, hands-on activities. Companion student workbooks also available free with shipping and handling.

Orkin Pest Control
550 Technology Park
Lake Mary, FL 32746
- Insect Zookeeping. Classroom projects. Free to teachers (send request on school letterhead).

Texas Agricultural Extension Service
College Station, Texas 77840
- Nature Trails. Describes different types of nature trails – planning and developing. For a copy, contact: Soil and Water Conservation Specialist.

U.S. Department of Agriculture
Natural Resources Conservation Service
Many different resources available. Check with your local office.
- Using 10 Minute walks in Outdoor Classrooms. Free and can be reprinted as needed.

U.S. Fish and Wildlife Service Publications
- Backyard Habitat for Wildlife – Attracting Butterflies
- Backyard Habitat for Wildlife – Plants for Your Backyard Habitat
- Backyard Habitat for Wildlife – Attracting Hummingbirds
Books

There are many books available as resources for your outdoor classroom. Most are available through mail order sources, local libraries and Internet book sites. The list below will help you in your search for materials and ideas. These are exceptional resources that will help you in every aspect of outdoor classroom learning. A key explaining abbreviations has also been provided to help you target the group of students participating in the various projects of the outdoor classroom with the material suited for their needs.

KEY TO ABBREVIATIONS

EC - Early Childhood (Age 2-4)  
P - Primary Grades (K-12)  
E - Elementary Grades (3-5)  
M - Middle Grades (6-8)  
H - High School (grades 9-12)  
T - Teacher  
Ref - Reference  
J - Juvenile (multiple ages)


Dragonfly Beetle Butterfly Bee. Maryjo Koch. (Swans Island Books, 1996) All Ages


Garden Wizardry for Kids. L. Patricia Kite. (Barrons, 1995) Indoor gardening activities which could be used to extend gardening activities into the classroom. J/T/Ref. [ISBN:0812013174]


Learning for All Seasons. William Klein (Iowa State University Press, 1993) 224 pp. 50+ “discover labs” that encourage problem solving and the use of the scientific method. Laboratory manual and teacher’s guide. M/H

Learning Under the Sun. William Klein (Iowa State University Press, 1993-OP) 291 pp. Activities with common plants, animals and environmental issues that can be completed in one 45-50 minute period. Laboratory manual and teacher’s guide. M/H


The Magic School Bus series. (Scholastic Trade) A number of the Magic School Bus books feature stories relevant to teaching in the outdoor classroom. P/E


Mud, Muck and Other Wonderful Things. 4-H Council. Activities and curriculum ideas. Available from 4-H Supply, c/o Crestar Bank, P.O. Box 79216, Baltimore, MD. (301) 961-2934. ($8.00 plus S&H) P


122


Worms Eat Our Garbage: Classroom activities for a better environment. Mary Appelhof, Mary Frances Fenton and Barbara Loss Harris (Flowerfield, 1993) 214 pp. Classroom worm composting with interdisciplinary activities and lessons. All Ages/Ref. [ISBN:0942256050]
[ISBN:087596706X]
<table>
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</tbody>
</table>
APPENDIX A

The Landscaping Plan is usually submitted to the school administration when an outdoor classroom is being proposed. It can also contribute to grant writing and be included in the schools records and district reports. Names and personal information has been deleted for confidentiality reasons.
Landscaping Plan

Idea:__________________________________________

Submitted by:__________________________________

Date submitted:_________________________________

Purpose:________________________________________

_________________________________________________________________

Location:________________________________________

Time line:_______________________________________

Materials Needed:________________________________

_________________________________________________________________

Cost:___________________________________________

Source of Funding:________________________________

Implemented by:_________________________________

Maintenance Required:_____________________________

_________________________________________________________________

Curriculum Connection:_____________________________

_________________________________________________________________

Ideas must be submitted to at least one month in advance of the date you would like to have the project implemented so that it can be approved by the Landscape Committee and Mrs. Thank you for your interest in helping to improve our campus. Your ideas and suggestions are appreciated.
Landscaping Plan

Idea: ____________________________

Submitted by: ____________________________

Date submitted: October 9, 1997

Purpose: To add an aesthetically pleasing butterfly, herb, and rose garden to provide more habitat and food sources for birds and butterflies; and to offer a memorial to Mr. ________, who has been so instrumental in helping with environmental issues.

Location: between yellow hall wing and the portables

Timeline: complete by Earth Day 1998

Materials Needed: soil to raise beds, brick to line pathway, most plants and materials will be donated by parents and classrooms

Cost: minimal cost for dirt and mulch and a few plants

Source of Funding: PTA, donations, Adopt-a-Tree funds

Implemented by: students, teachers, and parents

Maintenance Required: weeding and watering done by the Adopt-a-Bed classrooms and parent volunteers

Curriculum Connection: To help with the study of plants, birds, butterflies, and other insects. It will be an extension of the Discovery/Science Lab.
APPENDIX B

The following are examples of actual grant applications offered both on the state and local level. They are included to give educators a sense of the information required for submitting a grant. All the names, personal information and sponsors of the grants have been deleted for confidentiality reasons.
Outdoor Classroom Grant Application

Name of School: ____________________________________________

School Address: __________________________________________

City/State/ZIP: ____________________________________________

Project Title: _____________________________________________

Project Manager:
Name_________________________________GradeLevel/Position_____

MailingAddress: ____________________________________________

DayPhone___________________________EveningPhone___________

Note: This is the address to which all official correspondence will be mailed.

Name and affiliation of person submitting this application, if other than Project Manager:
_________________________________________________________

Has this school previously applied for a $500 grant through this Outdoor Classroom Grant Program? Yes____ No____

Has this school previously received a $500 grant through this program? Yes____ No____

On a separate sheet(s), please address the following questions. Answer each of the following questions individually, limiting your response to 2 pages. Simple, direct responses are best.

1. State the overall goal of your outdoor classroom project, i.e. what do you plan to accomplish?

2. Describe how this grant will be used to support the overall goal. What specific project objectives will be met using this grant?

3. How will students be involved in the project funded with this grant?

4. How will this project be connected to school curricula and the QCC?

5. In implementing this project and using the outdoor classroom for teaching, what ecological concepts will be covered?

6. How will this project benefit students, faculty, the community, and the environment?

7. How will you and your students communicate and share the activities and outcomes of your project with others?

8. What steps will be taken to assure the long-term sustainability of the project?

9. Provide a timeline detailing when objectives and project milestones will be accomplished.

10. Provide documentation of prior training in environmental education, Project WILD, Project Learning Tree, or Project WET; or, give a description of your training plans for the year (1 SDU course required).
Project Budget: Please give amount and nature of item (ex. lumber, tools, wildlife feed, scientific instruments, shrubs). Continue on other page if necessary.

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<th>Items</th>
<th>Grant funds requested</th>
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Total (A): $  
Total (B): $  
Total project cost (A+B): $

Any public or private school is eligible to apply for an Outdoor Classroom Grant (OCG), providing that other eligibility requirements are met as described in the accompanying program narrative. Grants will be awarded to support planned projects or to enhance existing projects. An Outdoor Classroom is an area on the school campus where the restoration or creation of plant and wildlife habitats has been accomplished to provide a place where students, their parents, and teachers can learn about the natural environment.

Grants will be awarded in the amount of $500, with required minimum matching funds of $100 of materials, moneys, or in-kind services. Only expenses incurred after the award date are eligible. Costs for overhead, salaries, honoraria, consultant fees, or teacher training fees will not be allowed. Project managers will be required to submit a final report by June 30, 1999, including an accounting of all expenditures and documentation of matching funds.

Please read and sign below:
I understand that awarding of all grants, and the amount of any grant, shall be subject to the sole discretion of the Environmental Education Council, hereafter referred to as the Council. I further understand that all project descriptions become the property of the Council and that in the event I am awarded a grant for the project herein described, the Council shall have the right to supply others with a description of the project and to disseminate its underlying concepts and/or ideas. If I am awarded a grant, I agree to submit an exact expense accounting, including copies of receipts for expenses when the project is completed. Any funds not expended for this project will be returned to the Council. The Council and/or any of its agents, officials, and employees shall assume no responsibility or liability for claims of damage of any kind to property or for claims of injury to any person in connection with such a grant.

Project Manager Signature ___________________________  Date ______________

I have read the attached project proposal and support this grant application.
Principal’s Signature ___________________________  Date ______________
Typed Name ______________________________________

Superintendent’s Signature _________________________  Date ______________
Typed Name ______________________________________

Submit application postmarked by December 11, 1998 to:

Faxed applications will not be accepted.
Grant Application Form
1997-1998

Name(s)__________________________________________

Position(s)________________________________________

Project Title:_______________________________________

Target area of Grant____________________ Funds Requested_____

Student Grade Level______ Number of Students Served______

School Name________________________________________

School Address_______________________________________

School Telephone______________________________

Principal’s Signature______________________________

Please include 13 copies of your typed application. Please do not include the name or specific location of your school in the application in order to ensure a blind screening. Applications must be in the front office with your school secretary by noon, Thursday, November 6, 1997. NO EXCEPTIONS. The applications will be picked up by the contact person assigned to your school. Winners of the 1997-98 grants will be announced by mail in late November. Each school will have a contact person from the who will answer any questions you may have, or you may contact:  

2241
Project Title: ____________________________

Target Area: ______________ Funds Requested: ______________

Grade Level: ____________

I. Describe the overall project:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
II. Cite any research, statistics or demographics that would support the need for this project.

III. What areas of learning would be used by the student for this project? (example: math skills, physical coordination, independent thinking, responsibility, etc...)

IV. Describe a typical encounter a student would have by participating in this project.
V. List all materials that will be purchased with these grant funds.

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Shipping and handling: ________________________________

TOTAL COST: ________________________________

VI. Please relate how you will evaluate the success of this project.
APPLICATION

Application must be typed!
Use this form with a typewriter. If you need more space, feel free to add extra pages.

Title of Project:

________________________________________

Funds Requested: $________

Grade Level:  __________
Subject Area:  __________
Number of Students Involved:  __________

I. Describe the overall project.
II. Cite any research, statistics, or demographics that would support the need for this project.

III. What skills or areas of learning would be used enhanced by this project? (example: math skills, physical coordination, independent thinking, responsibility, etc...)
IV. Describe a typical encounter a student would have by participating in this project.

V. List all materials that will be purchased with these grant funds, and include exact costs. If the cost of the project exceeds $250, please explain source of additional funds.

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<th>VENDOR</th>
<th>COST</th>
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Shipping and handling:

TOTAL COST: ________
VI. Please explain how you will evaluate the success of this project.
Grant Information Sheet

Who may apply?
Any certified employee of a County Middle School or a Middle School.

How much money can I get?
The maximum amount is $250 per project. The reserves the right to determine if an application will be fully or partially funded. For projects costing more than $250, the grant is willing to fund up to $250 with additional funds provided by the school or other source.

Can I keep the materials?
Materials and supplies purchased with the grant money will become the property of the individual teacher and not the school in which that teacher is employed. However, if a grant is won by a team of teachers, then the materials purchased remain at that school.

How will grants be evaluated?
Grants will be judged based on the following criteria:
Student Benefit: Provides memorable, meaningful learning experiences.
Student Involvement: Provides many students with active involvement in hands-on experiences.
Enrichment of Curriculum: Clearly expands and enriches the curriculum content.
Creativity: Incorporates non-traditional activities and unique experiences.
Efficient Use of Funds: Items can be reused year after year with many groups of students.

What are the rules for applying?
- Applications must be typed, complete, and received by the due date. Failure to do any of these will invalidate your application.
- If retyping using a word processor, duplicate the application form exactly with appropriate headings.
- Write application in lay terms, and define all educational jargon. Also describe any materials and related research trends in a way that is easily understood by a non-educator.
- To ensure objectivity of judges, do not use your name or your school's name within the application text.
- Turn in one complete copy of cover page stapled to the application, and provide 8 additional copies of application only. Do not put application in any kind or cover or binder.
- Send application through county mail by Wednesday, September 30, 1998 to Middle School. Deadline is Friday, October 2, 1998. (You may hand-deliver application to Middle School on Friday.)
- If you are awarded a grant, you must provide a receipt for items purchased by April 1, 1999. Failure to provide a receipt will result in applicant's permanent ineligibility for all future grants.

When are applications due?
All applications are due by 5:30 PM FRIDAY, OCTOBER 2, 1998. NO EXCEPTIONS!

When will winners be notified?
All applicants will receive notification of award status at the end of October, and winners will be invited to a reception, held in November, where they will receive a check for their project.

What is there have other questions?
Please call the chair of the Middle School Grants Committee.
APPENDIX C

The following completed grant applications are provided to the educator for guidance through the grant writing process. All three grant applications were actually submitted and awarded the indicated monetary amounts. As stated earlier in the financial section of this manual, the completed applications are not supplied for the purpose of replication. Each educator must decide the needs of the school's facility. They are displayed as examples of the technique and verbiage required to secure grants. All the names, personal information and sponsors of the grants have been deleted for confidentiality reasons.
Outdoor Classroom Grant Application

1. Project Title: **THE SCIENCE OF NATURE; REAPING THE BENEFITS OF HANDS ON SCIENCE IN AN OUTDOOR CLASSROOM**

2. Name of School: ____________________________________________
   School Address: ____________________________________________

3. Project Manager:
   Name ___________________________ Grade Level/Position 8th GRADE TEACHER
   Mailing Address *
   ________________________________
   Day phone __________________ Evening phone ________________________
   * Note: This is the address to which all official correspondence will be mailed.

4. Name and affiliation of person submitting this application, if other than Project Manager:
   N/A

5. Has this school previously applied for a $500 grant through this Outdoor Classroom Grant Program? Yes__ No X
   Has this school previously received a $500 grant through this program? Yes__ No X

6. On a separate sheet(s), please address the following questions. Limit your response to 2 pages.
   a) State the overall goal of your outdoor classroom project, i.e. what do you plan to accomplish?
   b) Describe how this grant will be used to support the overall goal. What specific project objectives will be met using this grant?
   c) How will students be involved in the project funded with this grant?
   d) How will this project be connected to school curricula and the QCC?
   e) In implementing this project and using the outdoor classroom for teaching, what ecological concepts will be covered?
   f) How will this project benefit students, faculty, the community, and the environment?
   g) How will you and your students communicate and share the activities and outcomes of your project with others?
   h) What steps will be taken to assure the long-term sustainability of the project?
   i) Provide a timeline detailing when objectives and project milestones will be accomplished.
   j) Provide documentation of prior training in environmental education, or give a description of your training plans for the year (1 SDU course required).
Project Title: The Science of Nature: Reaping the Benefits of Hands on Science in an Outdoor Classroom.

Target Area: Earth/Life Science Grade Level: 6th-8th

Our school’s outdoor classroom will provide an opportunity for students to participate in hands-on learning through activities in general nature, earth science, botany, weather and math. By using concrete concepts, from the appropriate grade level science curriculum, and linking them with hands-on projects, instructors can successfully create effective, entertaining and educational programs for their students.

Funds from this grant will assist in the construction and maintaining of the proposed nature project through the purchasing of materials such as organic soil mixes, fencing, plants, and tools.

The outdoor classroom will consist of a vegetable garden, butterfly garden, composting site, weather station, worm farm and growing plots. Students will participate in all aspects of the outdoor classroom - building the gardens, planting the seeds (outdoors as well as indoor propagation of seedlings), building the compost site and worm farm. They will maintain the classroom and record in journals the progress of the crops and information from the weather station.

Instructors will build activities around topics that lend themselves to the outdoor classroom. These may include plant growth, photosynthesis, plant cells, bacteria under microscopes, measure of pH in soil, measurement with math skills, and weather topics such as temperature, barometric readings, and rainfall. Science classes may also sponsor individual growing plots for their own nature activities.

Community involvement will also be encouraged throughout the project. There has been interest from local Eagle Scout candidates to assist in the construction and maintenance of the classroom as part of their community service project. Ann Kirk from Smyrna Clean and Beautiful has offered to donate time and resources in educating students on recycling and ecology. She has also committed to starting a landfill project that can be monitored year after year. The local Home Depot has been contacted and invited to participate in the classroom through its Corporate Giving Program and Environmental Grant Programs.

Teachers, students, and parents will, however, be the guiding force in the success of the outdoor classroom. Through PTSA, “Weekends in the Garden” will be promoted to have students, families, and friends of the school gather for a day of activities - work and fun - in the classroom. Students from the elementary school will be encouraged to participate in the classroom so that they will feel a part of the project when they attend the middle school. This is why it is important to open the classroom to 6th - 8th grade - a sense of ownership can be established for years to come.

By working together, a better appreciation for nature can be achieved and, hopefully, teach us to be more responsible in our daily lives.

II. Areas Of Learning Used By The Student For This Project And How It Ties To The Quality Core Curriculum.

Cooperative learning activities, observations skills and raising level of nature awareness, interactive experience, simulating actual scientific processes, cognitive skills through problem-solving tasks, creativity with hands-on projects, math skill. * specific content standard objectives of QCC: Objectives 1,2,3,5,8,18,19,20

(Please see appendix as a reference)

III A Typical Encounter A Student Would Have By Participating In This Project.
A student will log in a journal observations made at the growing site. This would include measurements of plant growth, condition and appearance of plant, fruit/vegetable production, soil condition, and expectations met over a period of time. This information will be used as data in the students scientific method outline to support his/her hypothesis for a particular plant growth.

Dependent upon classroom instruction and progression of the garden, the student will test pH of soil using kits provided by the science department, monitor rainfall to determine irrigation needs, and check for insect infestation. Plant cuttings may be gathered for analysis in the science lab as well as problem solving for plant growth that is hindered. Soil samples may also be sent to the County Extension Service (kits provided) to determine a need for added organic material. The compost site and worm farm will also be tended on every outing.

IV. Time Line - 1998

February - complete plans/layouts for outdoor classroom
order seeds/worm farm housing
March - begin purchasing of material (fencing, soils, tools)
start soil preparation - construct weather station/compost center
April - propagate seeds - indoor/outdoor - decide on plants
begin planting butterfly garden
official opening
May - plant vegetable garden/butterfly garden
June - maintenance of garden closing ceremonies for the year

Summer maintenance - 6th & 7th grade volunteers

V. Training In Environmental Education.

Dec. 10, 1997  Smyrna Clean and Beautiful - Trash to Treasures Contest
Dec. 5, 1997  NSTA Southern Area Convention - Nashville, TN
             "The Ins and Outs of Creating an Outdoor Classroom."
             Daniel A. Edmiston, Cordova, TN
Nov 22, 1997  The Science of Packaging: "Beyond Store Shelves and Landfills"
             Fernbank Museum of Natural History
Nov 10, 1997  Presenter at Middle School Mini-Conference
             Wendy Delano, Supervisor
             "How to Begin an Outdoor Classroom"
Oct 17, 1997  Learning from the Ground Up: A Symposium on Outdoor Classrooms - Atlanta Botanical Gardens
Feb. 7, 1997  Georgia Middle School Association 19th Annual Conference
             "Build Your Own Outdoor Science Center" Ginger Tarver East Coffee Middle School
1998  Plan to enroll in future staff development courses pertaining to environmental Education
7. Project Budget: Please give amount and nature of item (ex. lumber, tools, wildlife feed, scientific instruments, shrubs). Continue on other page if necessary.

<table>
<thead>
<tr>
<th>Items</th>
<th>Grant funds requested</th>
<th>Match/In-kind Value</th>
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<tbody>
<tr>
<td>ORGANIC SOIL MATERIALS (PEAT, COMPOST)</td>
<td>$70.00</td>
<td>$70.00</td>
</tr>
<tr>
<td>FENCING MATERIALS (FENCE, POSTS, CONCT)</td>
<td>$81.76</td>
<td>$65.00</td>
</tr>
<tr>
<td>BULK SEED (VEGETABLE &amp; PLANT)</td>
<td>$18.00</td>
<td>$20.00</td>
</tr>
<tr>
<td>STARTER PLANTS</td>
<td>$20.00</td>
<td>$20.00</td>
</tr>
<tr>
<td>TOOLS (SHOVELS, GLOVES, CART, HOSE, CANS)</td>
<td>$199.72</td>
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<tr>
<td>WEATHER STATION (WOOD, THERM, BAROMETER)</td>
<td>$110.00</td>
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<tr>
<td><strong>Total (A)</strong>: $499.48</td>
<td><strong>Total (B)</strong>: $175.00</td>
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<td><strong>Total project cost (A+B)</strong>: $674.48</td>
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</table>
Project Title: The Science of Nature: Reaping the Benefits of Hands on Science in an Outdoor Classroom.

Target Area: Earth/Life Science  
Funds Requested: $250.00

Grade Level: 6th - 8th

I. Describe the overall project:

Our school’s outdoor classroom will provide an opportunity for students to participate in hands-on learning through activities in general nature, earth science, botany, weather and math. By using concrete concepts, from the appropriate grade level science curriculum, and linking them with hands-on projects, instructors can successfully create effective, entertaining and educational programs for their students.

The outdoor classroom will consist of a vegetable garden, butterfly garden, composting site, weather station, worm farm, and growing plats. Students will participate in all aspects of the outdoor classroom - building the gardens, planting the seeds (indoors as well as indoor propagation of seedlings), building the compost site and worm farm. They will maintain the classroom and record in journals the progress of the crops and information from the weather station.

Instructors will build activities around topics that lend themselves to the outdoor classroom. These may include plant growth, photosynthesis, plant cells, bacteria under microscopes, measure of pH in soil, measurement with math skills, and weather topics such as temperature, barometric readings, and rainfall. Science classes may also sponsor individual growing plats for their own nature activities.

The opportunities provided by the outdoor classroom will help students discover how nature works and how they can be a part of it.

II. Cite any research, statistics or demographics that would support the need for this project.

g) Fernbank Science Center (1997) Home Composting Demonstration Site: Atlanta, GA
III. What areas of learning would be used by the student for this project? (example: math skills, physical coordination, independent thinking, responsibility, etc.)

Cooperative learning activities, observational skills and raising level of nature awareness, interactive experience, simulating actual scientific processes, cognitive skills through problem-solving tasks, creativity with hands-on projects, math skills.

IV. Describe a typical encounter a student would have by participating in this project.

A student will log in a journal observations made at the growing site. This would include measurements of plant growth, condition and appearance of plant, fruit/vegetable production, soil condition, and expectations met over a period of time. This information will be used as data in the students scientific method outline to support his/her hypothesis for a particular plant growth.

Dependent upon class instruction an progression of the garden, the student will test pH of soil using kits provided by the science department, monitor rainfall to determine irrigation needs, and check for insect infestation. Plant cuttings may be gathered for analysis in the science lab as well as problem solving for plant growth that is hindered. Soil samples may also be sent to the County Extension Service (kits provided) to determine a need for added organic material. The compost site and worm farm will also be tended on every outing.

V. List all materials that will be purchased with these grant funds.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>VENDOR</th>
<th>COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic Soil Materials</td>
<td>The Home Depot</td>
<td>$79.60</td>
</tr>
<tr>
<td>(top soil, composted manure, peat 25lb. bags)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wire Fencing</td>
<td>The Home Depot</td>
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</tr>
<tr>
<td>Metal Fence Posts</td>
<td>The Home Depot</td>
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<td>Bulk Vegetable Seeds</td>
<td>Elizabeth Feed &amp; Seed</td>
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<tr>
<td>Starter Plants</td>
<td>Pike Family Nurseries</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Garden Center</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shipping and Handling</td>
<td>$0</td>
</tr>
<tr>
<td></td>
<td>Total Cost</td>
<td>$247.36</td>
</tr>
</tbody>
</table>
VI. Please relate how you will evaluate the success of this project.

The success of the project will be measured two ways. The first will be based on the students participation and involvement in the outdoor classroom. Based on observation and overall condition of the gardens, the students cooperative energies and interactive experiences can be assessed as a positive or negative result.

Second, by meeting established objectives set in the classroom, the students ability to test hypothesis' using the scientific method in real life application can not only be monitored by an instructor's grade, but by self evaluation of the student in his/her findings and results as the strive toward their state goals.
APPLICATION

Application must be typed!
Use this form with a typewriter. If you need more space, feel free to add extra pages.

Title of Project:
Outdoor Classroom & Garden: Reap What You Learn!

Funds Requested: $250.00

Grade Level: 6th – 8th
Subject Area: Earth/Life Science
Number of Students Involved: 35 per class school wide

I. Describe the overall project.

Our school’s outdoor classroom project is a continuation of the outdoor classroom and
gardens that was established during the 1997-1998 school year. The outdoor classroom provides
students an opportunity to participate in hands-on learning through activities in general nature,
earth science, botany, weather, and math. By using concrete concepts, from the appropriate grade
level curriculum, and linking them with hands-on projects, instructors can successfully create
effective, entertaining and educational programs for their students.

The outdoor classroom consists of a vegetable garden, butterfly garden, two composting
sites, weather station, worm farm, and six growing plats. Last year’s students participated in all
aspects of the outdoor classroom – building the gardens, planting the seeds and plants (outdoor as
well as indoor propagation of seedlings), building and maintenance of the compost sites, and the
worm farm. This year’s students will continue in the building and care of the garden classroom
while recording the progress of the crops and information from the weather station.

Instructors will build activities around topics that lend themselves to the outdoor
classroom. These have and will continue to include plant growth, photosynthesis, plant cells,
bacteria observation through microscope and chemical analysis, measure of the pH in soil,
measurements with math skills, and weather topics such as temperature, barometric pressure, and
rainfall. Any class in the school is welcome to sponsor individual growing plats for their own
nature activities on a “first come, first served” basis.

This year’s growth of the outdoor classroom will concentrate on additional growing plats
and a Georgia History theme for our vegetable garden. The crops will include cotton, peanuts and
soybeans. It is hoped that a raised garden plat can be added for special education classes, which
use the gardens quite extensively for learning and recreation. Through our technology
department, a remote telecast from the gardens to science classrooms will be tested this year. This
will entail experiments performed in the outdoor classroom and telecast to the labs so that
students can perform specific test using comparable samples with live field instruction.

The opportunities provided by the outdoor classroom help students discover how nature
works and how they can be a part of it.

II. Cite any research, statistics, or demographics that would support the need for this project.

a) Georgia Wildlife Federation – HABITAT: Georgia’s Schoolyard Wildlife Habitats Exchange


III. What skills or areas of learning would be used enhanced by this project? (example: math skills, physical coordination, independent thinking, responsibility, etc...)

Cooperative learning activities, observational skills and raising level of awareness, interactive experience, simulating actual scientific processes, cognitive skills through problem-solving tasks, creativity with hands-on projects, math skills.

IV. Describe a typical encounter a student would have by participating in this project.

A student will log in a journal observations made at the growing site. This would include measurements of plant growth, condition and appearance of plant, fruit/vegetable production, soil condition, and expectations met over a period of time. This information will be used as data in the student's scientific method outline to support his/her hypothesis for a particular plant growth.

Dependent upon class instruction and progression of the garden, the student will test soil pH using kits provided by the science department, monitor rainfall to determine irrigation needs, and check for insect infestation. Plant cuttings may be gathered for analysis in the science lab as well as problem solving for plant growth that is hindered. Seventh grade classes have already taken cuttings for plant cell samples (Life Science). Soil samples may also be sent to the County Extension Service (kits provided) to determine a need for added organic material. The compost sites and worm farm will also be tended to on every outing.

Special education uses their sites for active involvement in growing and caring of plants. They tend their sites in the spring several times a week as part of their science/environmental awareness. This includes planting, weeding, watering, harvesting, and observations. The special education class with profoundly disabled students has used the gardens as an area of relaxation and recreation. It is hoped that with the addition of a raised growing area, they too will be able to actively participate in the growing process.

V. List all materials that will be purchased with these grant funds, and include exact costs. If the cost of the project exceeds $250, please explain source of additional funds.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>VENDOR</th>
<th>COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic Soil Materials</td>
<td>The Home Depot</td>
<td>$62.25</td>
</tr>
</tbody>
</table>
Top soil 20 @ .93
Soil/humus 20@ .93
Mulch 15@1.67

Building Materials
Landscape ties 40@1.89
10inspikes 40@2.6
5intimbrnails 50@1.10
Lumber for raised plot 30.00

Seeds
Mixed
$1-2/ pack

Plants
Mixed-prices
Range from 1.33-1.99 9pk
1.99-3.43 1 gal peren.

Building Materials | The Home Depot | $122.00
Seeds | Elizabeth’s Feed & Seed | $10.00
Plants | Ga. Wildlife Fed. Sale | $55.75
Sticks | The Home Depot | 

Shipping and handling: $0
TOTAL COST: $250

*Prices based on purchases made spring 1998

VI. Please explain how you will evaluate the success of this project.

   The success of the project will be measured two ways. The first will be based on the student’s participation and involvement in the outdoor classroom. Based on observation and overall condition of the gardens, the students’ cooperative energies and interactive experiences can be assessed as a positive or negative result.

   Second, by meeting established objectives set in the classroom, the students’ ability to test hypothesis’ using the scientific method in real life application can not only be monitored by an instructor’s grade, but by self evaluation of the student in his/her findings and results as they strive toward their stated goals. The success and understanding of the importance of keeping precise records in written/computer logs will aid students in future projects (ex: Science Fair competition).
BIBLIOGRAPHY

&

REFERENCES
Bibliography and References

Callaway Gardens Education Department. (1997). *Butterfly gardening [Brochure]*.

Columbia Education Center’s Web Site. [http://www.col-ed.org/]


Outdoor Classroom Council (1997, October). *Outdoor classroom council resource guide*. Paper presented at the meeting of The Outdoor Classroom Council, Atlanta, GA.


* Illustrations provided by Microsoft Clip Art / Microsoft Clip Gallery 3.0
Chapter IV
Results & Conclusion
Measurable Results

It as been argued that hands-on science is of a greater learning benefit to students than the traditional text only approach to science. Shymanski, Kyle, and Alport (1982) examined this theory in their article How Effective Were The Hands-On Science Programs of Yesterday? Shymanski and others analyzed thirty-four studies that compared the performances of students using programs from the Elementary Science Study (ESS), the Science Curriculum Improvement Study (SCIS), and Science- A Process Approach (SAPA) with performances of traditional, textbook, programs. ESS, SCIS, and SAPA are programs that were initially developed in the 1960’s and continually evolved through the years as science programs based on learner based education – such as hands-on teaching. Shepherd and Ragan (1992) describe the common elements of the projects as:

- Emphasis placed on experiments to be performed by children upon objectives, events, and/or situations in order to find answers for them to accept.
- All projects are concerned with inquiry as the process of science.
- Opportunities are given the child to develop an understanding of the structure of discipline.
- All projects are designed to help children broaden their understanding of the environment.
- School experiences are expected to result in behavior changes.
- The central purpose of science is to awaken in the child a sense of joy, the excitement, and the intellectual power of science.

The average student in these classrooms, following the above mentioned programs, performed better than 62 percent of students in the traditional classrooms. In
percentage points on standardized achievement tests, students in ESS programs performed 4 percent higher, SCIS students performed 34 percent higher, and SAPA students performed 7 percent higher. They also analyzed the twenty-one studies comparing student attitudes toward science. More favorable attitudes were reported by students in these programs with a range of 3 percent for students in SCIS programs to 20 percent for students in ESS programs. On measures of process skills, students in the programs scored at least 18 percentage points higher than those students in traditional programs. The range was from 18 percent for ESS, 21 percent for SCIS, and 36 percent for SAPA students.

Shymanski concluded that, “Our quantitative synthesis of the research clearly shows that students in these programs achieved more, liked science more, and improved their skills more than did students in traditional textbook-based classrooms.”

There is further evidence that these results are achieved using outdoor classrooms. During the 1989-1990 school year, the Hardin School Districts and Montana State University-Billings established an outdoor learning center and developed an activity-based science curriculum for use by local schools. Zwick and Miller (1996) explain that the program that was developed consisted of 36 hands-on and largely outdoor-oriented activities. The goal of the program’s planning team was to develop a science curriculum that was activity-based, integrated with other disciplines in science, and educationally sound. The activities developed were to be factually correct, require the student to utilize the processes of science, develop critical thinking skills, and, since the district was located at the edge of the Crow Nation and educated many American Indians, be culturally acceptable by American Indian students.
In the addition to these requirements, the activities were developed for varies grade levels based upon Piagetian theory pertaining to student mental and emotional development as related to the cognitive and affective domains. The activities were developed to specifically teach science using direct experience with natural surroundings and/or a hands-on approach.

Evaluation of the program was accomplished by selecting two fourth grade classes of similar characteristics and size from the population of fourth graders in the Hardin School District. Statistical analysis showed these classes to be representative of the total population of fourth graders in the district. The two classes selected for the study were then divided into an experimental and a control class. The experimental class utilized the new activity based class, while the control class utilized the textbook based program that had been in place before the development of the activity based program.

The California Achievement Test scores registered on the CAT 85 were selected as a means of statistically comparing science achievement between the experimental and control classes as a function of curriculum design. The CAT 85 scores were selected because the scores in science are reported as a composite score and also reported as individual scores in the science sub-disciplines of botany, zoology, ecology, chemistry, physical, and earth science. This breakdown allows for a comparison between the experimental and control classes on the basis of overall science achievement and for comparisons by science sub-disciplines.

The evaluation reveals that the statistical t-test of the mean CAT 85 science scores between the experimental and control classes show significantly greater gains by the students in the experimental class. This indicates the experimental curriculum composed
of outdoor, hands-on activities contributed more toward student cognitive science learning than did the more traditional textbook based curriculum with few activities. The evaluation firmly stated that, "One can therefore conclude that the activity approach to teaching science concepts (as measured by the CAT 85 test) is superior to the traditional textbook approach."

There are other issues of evaluation to consider other than just test scores. In 1991, the Massachusetts Department of Environmental Protection (DEP) began promoting home composting of yard trimmings and biodegradable household waste (McGovern, 1997). The program educates the public about composting and distributed compost bins. The DEP used an outreach program to involve schools in promoting composting. The approach resulted in a profusion of school composting projects at all levels, from elementary through high school. Students from Harvard and Tufts University have even taken advantage of the program to compost food residuals from their housing facilities. Students take the lessons they have learned in their school's compost site and apply it to their home life. It is a way to involve the entire family and community in compost science.

Massachusetts tracks the success of its composting outreach and educational program through a variety of methods. In a 1993 telephone survey, 28 percent of respondents reported composting at least some of their yard trimmings at home. In a similar survey in 1996, 44 percent of respondents reported that they always or usually compost yard trimmings at home, indicating a 16 percent increase. This is an enormous waste reduction benefit.
The 58,000 compost bins that have been distributed in Massachusetts represents approximately 305 percent of the total number of households in the state. With an average capacity of 750 lbs per bin per year, at a 92 percent usage rate, the bins are diverting about 200,000 tons per year. That is more than enough to fill a 50 tpd landfill. This can obviously relate to economic benefits for compost education and bins. Using an average tip fee of $55 per ton, the compost bins currently in use are saving about $1.1 million in disposal fees each year. This is an evaluation that shows the benefit of outdoor classroom education and how it relates to the "real world" of our communities.

A committee at the school where the learning center is in operation should determine the process for individual evaluations of outdoor classrooms. Standardize test results can be compared between classes that are using the activity based outdoor curriculum and those classes that are textbook oriented. Comparisons in this manner may also be evaluated between schools that use outdoor classrooms and those that do not. Instructors may decide to compare how students meet objectives for different topics by using the outdoor classroom for one objective and then using traditional classroom procedures for another objective. This can be determined through class tests and writings as it is followed through a given time frame.

Though it may be difficult to state what is the best and most sound tool to statistically determine the benefits of hands-on science in an outdoor classroom, it should not be difficult to measure the enthusiasm and excitement generated by students and the community toward science and what is being taught. Getting students excited about science is the most important task of a science instructor.
Conclusion

The product created is a resource guide that will aid an instructor in creating, financing, and maintaining an outdoor classroom. It will act as a primary resource that will address most needs of an outdoor classroom program in one simple to use format. One of the main goals of the product is to save time and energy on the part of the user. The product eliminates the need to search for and obtain various resources from numerous locations. The author has done the work for the outdoor classroom facilitator, thus lessening the anxiety of starting such a project.

The product is unique not only as a “one-stop” resource, but also in the fact that it does not merely make suggestions or inferences. The product contains numerous examples, lesson plans, financial options, and an actual outdoor classroom model for the user to follow. This enables the user with a feeling that the product works and has been created by an educator, for an educator.

The product has another major goal. It has been created to encourage educators to use hands-on activities through outdoor learning centers. In showing that the construction of an outdoor classroom is not an impossible task and that the benefits to the students and educators are obtainable, the user will be enthusiastic about a new tool to convey their science curriculum and make learning come alive. The primary purpose of an outdoor classroom is to get the students into the environment and participate in hands-on activities. Through this form of instruction, retention and understanding of stated objectives and concepts will be achieved. The related literature and measurable results described in this text supports the use of hands-on activities and outdoor learning centers to promote the success of students in science and environmental education.
Finally, the use of the product in building an outdoor classroom will allow the educator to instill a sense of pride and awareness of the natural environment for the students. Working in nature relays a stewardship to the environment that students will have as they continue with their science education and in their own lives. This product supports environmental education by its very nature. Students also see an environmental appreciation in their instructors by the fact that the instructor is creating such a learning environment.

The product is simply that – a product. It will not build the outdoor classroom or teach students hands-on activities. What it will do is make it possible for educators to consider the creation of an outdoor classroom and guide them through all aspects of its conception. It will act as a “cookbook” for success in hands-on science.
Implications

The implications of using this product are that educators can return to what works best in their students' education. That is hands-on learning. Teachers know that hands-on activities are beneficial for the students, but lack a consistent vehicle to use this tool. The outdoor classroom provides this vehicle and offers a step-by-step guide to its creation. Once established, instructors will have an outdoor laboratory to provide hands-on activities and promote environmental awareness. Experimentation on the use of outdoor learning combined with hands-on activities implies that this form of instruction is superior to traditional textbook-based curriculum. The rise in students' standardize test grades and environmental awareness give support for the use of outdoor classrooms.

This product addresses the majority of concerns for educators who are considering an outdoor classroom and removes excuses that may hinder its creation. Whether it is on small or large scale, teachers and students will benefit from hands-on activities in an outdoor classroom.
Recommendations

It is recommended that educators use this product as a guide to begin an outdoor classroom. The product is not meant to be the final word in how an outdoor classroom is to be created or used. Rather, it is a base to build on what works for each facilitator according to their needs and objectives. The ideas and lesson plans in the product are to guide and motivate instructors to create their own outdoor curriculum. However, it is strongly suggested that the developed activities should be designed to teach sound concepts of science and require students to:

- Utilize the process of science (collection of data, measuring, classifying etc.).
- Analyze the data collected (critical thinking, processing data, interpretation of data).
- Apply knowledge or insights gained through data analysis to solve problems or use as a basis for group discussions.
- Evaluate the meaning of data collected and the validity of the method using the data when applied to problem solving or group discussions.
- Work in groups and have input into group discussions concerning the activities.
- Make connections between science, society, art, language arts, and other school curriculums.

The use of outdoor classrooms provides opportunities for students to learn in ways that might not have been available to them before. But, they also provide a means for teachers to learn and enhance their own instruction and perhaps a way to reach
students that was not considered previously. Suggestions for topics of further study in the use of outdoor classrooms are:

- What is it about developed outdoor activities that allow for greater cognitive gains in science concepts?
- Do outdoor-oriented science activities have a greater appeal to one population of students over another?
- Do outdoor-oriented science activities provide a more familiar base from which to learn science concepts than do indoor classroom oriented activities (as it applies to a group of students)?
- Is an application and integration approach a more appropriate method for teaching science concepts to a particular population of students?
- Can outdoor-oriented activities become an integral part of the curriculum for students in English As A Second Language classes or, for that matter, used in the teaching of any second language?
- What is the long term benefits for students who participated in outdoor classroom curriculums? Were the benefits carried over to future science classes (to be measured in years – 5, 10, 15 years later)?

Instructors will surely find topics to be evaluated and improved upon as their use of outdoor classrooms continue. The important factor is that these outdoor learning centers are created and used for the benefit of the students and of science.
References and Bibliography
References


http://www.newhorizons.org/trm_hoerrmi.html


Bibliography


*Recommended by the American Psychological Association. Washington D.C.:*

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