Development of a life science curriculum for kindergarten and first grade reflecting the theories of multiple intelligence and brain-based learning

Barbara Jean Dudeck

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Development of a Life Science Curriculum for Kindergarten and First Grade Reflecting The Theories of Multiple Intelligences and Brain-Based Learning

A Project
Presented to the
Faculty of
California State University, San Bernardino

In Partial Fulfillment
Of the Requirements for the Degree
Master of Arts in
Interdisciplinary Studies

by
Barbara Jean Dudeck
June 2001
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ABSTRACT

The purpose of this project was to address the need for making the subject matter of life science accessible to all kindergarten and first grade students. The Theories of Multiple Intelligence and elements of Brain-Based Learning were used to create life science lessons specifically tailored to the kindergarten and first grade curriculum. Also, to identify a variety of learning and instructional techniques, styles, and strategies to better facilitate in the educational process of all learners, and integrate different types of assessment to meet the needs of every student.
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CHAPTER ONE: INTRODUCTION

This unit is designed to immerse the students in the world of plants. The goal of this unit is to focus on a learning environment that will enable the student to learn the basic skills they can relate to in their own life at home and at school. Lessons and assessments are designed to allow all students to learn at their own rate and in their dominant intelligence. Many people in the teaching world believe that Dr. Howard Gardner's research on the Theory of Multiple Intelligence is the new wave in education. It stresses that everyone can learn if taught in the way they learn best. The key is to tap into the different ways that each student learns. Currently teaching and testing methods only focus on the linguistic and logical-mathematical learners. There is a wealth of learning to be done if more educators would acknowledge the unique talents, gifts, and abilities that can be found in those who are stronger in the musical, spatial, bodily-kinesthetic, naturalistic, intrapersonal, and interpersonal intelligences.

This unit integrates the three elements of brain-based learning by creating a state of relaxed alertness in students and teacher, which is a combination of low threat, or safety, and challenge. Orchestrated immersion allows the brain to do what it does best, make sense of experiences and active processing of experiences enables
students to get more meaning from those experiences (Caine, Caine, and Crowell, 1994).

Activities in reading, writing, listening, speaking, math, science, social studies, art, music, drama, physical education, movement, cooperative learning, social and life skills are included to help the students to understand the skills presented in the lessons. As students grasp these skills they enhance their abilities to become productive members of society. Multiple intelligences are identified in each activity.

Reading and writing activities include student made books, Venn diagrams, and illustrated reflection papers expressing their ideas and concepts about how science fits into their everyday experiences.

Math activities include measuring, comparing and contrasting, sorting, counting, and graphing many objects within the plant world (living things/non-living things, plants, seeds, leaves, etc.) Mastering these skills could help the student give meaning to real life situations and may carry over into other content areas.

Students will work independently, with buddies, and in cooperative groups. They will observe, record, and report what they learned from each lesson. Multiple forms of assessment and rubrics are used throughout the unit to grade students for group and individual participation.
This unit is based on the national standards and designed to follow the Fontana School District Science Standards for the curriculum of Life Science in kindergarten and first grade. These standards state that the students will know and understand the characteristics and structure of living things; the processes of life and how living things interact with each other and their environment.

Students will participate in a variety of activities and projects designed to enhance their knowledge of plants and the importance of everything in nature working together to survive. This unit encompasses investigations of plants that begin with the basic difference between non-living and living things. This leads to the study of the three different kinds of plants, which gives the students a general overview of the plant kingdom and the different characteristics of each. Then the students will learn the life cycle from seed to plant, including what they need to grow and change. As the unit continues, students will do different hands on experiments in the investigation of the basic structure and function of plants. Next they will move into a more detailed classification of plants. Then they will discuss the difference between plants and animals.

This finally leads to the discovery that plants and animals interact with each other, and their environment,
and that each depends on the other for their continued existence.

The major points that will be covered include definition of living and non-living thing. Comparing their similarities and differences will identify the three general types of plants, flowers, and trees. Understanding the life cycle of plants in general and what they need, may give students a clearer view of how they can protect all living things for future generations. The investigation of seeds, roots, stocks, and leaves, may give students a better appreciation for their functions and their contribution to other living things. A closer look at flowers, trees, fruits, and vegetables, clarifies their roll in giving food and shelter to animals. By comparing plants and animals student will understand that all living things have the same basic needs and each needs the other to survive. Therefore, it is up to humans to take care of the environment and all things that live in it.

This project includes a supplemental unit on the metamorphous of caterpillars to butterflies following the same curriculum guidelines, theories of multiple intelligence, and Brain-based elements.

Suggested Activity Centers

• Science areas where students can investigate projects and grow plants.
• Math centers where students can practice different skills.
• Reading centers where students can go to share student made books from their Browsing Boxes or other books.
• Art areas where students can draw, color, cut and paste to express thoughts and feelings and make costumes for the play.
• Big Book cart and pointers where students can reread materials.
• Plant centers for growing plants according to lessons.
• Outdoors so that students can collect objects, play games and interact with their environment.
• Drama centers where students can practice with props and prepare for the commutation activity (A play presented to entire school at an assembly)
• Homework is encouraged to extend the learning process to the home environment then added to the appropriate center.
• Parents are encouraged to participate in classroom activities and experiments.
CHAPTER TWO: LITERATURE REVIEW

It is difficult to believe that the idea of childhood was not accepted prior to the Middle Ages. Nancy Cobb traced this theory through Philippe Aries (1962), a French Historian, who noted that there were no words to refer to childhood at this time because children were viewed simply as miniature adults. Later, Neil Postman (1982) suggested that the concept of childhood began in the mid-1400s along with the invention of the printing press. Adults were defined as those who could read. Thus, the concept of adulthood came to be based on reading comprehension, and childhood on reading incompetence. Before this time, adulthood followed infancy, which was about the age of seven. Postman argued that the "knowledge gap" that developed with printing press created a need for schooling (Cobb, 1992), which in turn generated the need for schools, teachers, and some form of the educational process. As described in a Developmental Tasks Table (p. 36), learning the fundamental skills of reading, writing, and calculating begin in Middle Childhood. The concept of formal assessment could have stemmed from the need to determine if these skills had been mastered.

Jean Piaget, a Swiss scholar, recognizing that children were not simply miniature versions of adults and that they learn in stages, he formulated a theory that was
unique to educational goals. "Piaget's theory separates two processes that are related but conceptually quite different: development and learning. Development has to do with general mechanisms of action and of thinking; it pertains to intelligence in its widest and fullest sense. Everything that can be called characteristic of human intelligence comes about chiefly through the process of development as distinct from the process of learning. Learning deals with acquisition of specific skills and facts and the memorizing of specific information" (Furth & Wachs, 1974).

Piaget concluded that the general development of intelligence is the basis on which any specific learning rests and can only take place on the condition that the child has general mechanisms to which he can assimilate the information contained in that learning and suggests that intelligence is the most necessary instrument of learning.

Piaget said, "A little child knows more than he can verbalize." Furth and Wechs (1974) expand on this comment by citing that Piaget makes two things very clear: first, the difference between knowing a word (word knowledge) and comprehending a situation (intelligence), and of the need for "formal" mechanisms of thinking in order to master the difficulties of the linguistic medium. It is important that educators understand that verbal language is the most
difficult medium for thinking and may be unsuitable as the
main intellectual teaching and assessment tool for young
children.

To understand this concept, one can follow Piaget's
type of developmental stages. Sensorimotor thought lasts
from infancy to about two years of age and can be thought
of as intelligent-like actions. The child learns by
feeling, tasting, smelling, and experimenting with objects
in his environment. Piaget calls these actions building
schemes, and when repeated with new objects the child can
assimilate this experience with his or her prior knowledge.
When what one already knows changes in the process of
exploring something new, accommodation occurs.
Assimilation and accommodation occur at all stages of
cognitive development and account for the gradual growth of

When preoperational thought occurs between the ages of
two and seven, the child has gained more language and can
represent their experiences symbolically. Three limitations
exist in the beginning of this stage. First, the tendency
to think of something in a single way is called centration.
Piaget's test of conservation measures the ability to see
that something remains the same despite changes in its
appearance. Second, young children have difficulty moving
beyond the concept of how things look to how things might
look if position or shape changed. Reversibility occurs
when mental operation emerges at the next stage. Third is egocentrism. Young children fail to understand that their view of something may not be shared by others (Cobb, 1992).

In middle childhood, concrete operational thought becomes more integrated and logical. Piaget attributes this logic to the emergence of mental operations, actions that can be carried out in one's head and then reversed, this in turn, leads to more flexible thinking and reflects a new ability to mentally order one's world.

Formal operational thoughts begin at about age eleven and opens up new worlds of possibilities for adolescents. They can begin to think about their thinking. Chronological age is no guarantee that one's thinking and reasoning skills are consistent with behavior. Adolescents do not always exercise logic in their thinking. It would seem that under certain sociological, environmental, and economical circumstances not all adolescents achieve formal operational thought.

Piaget's work has been extremely influential in early childhood education in the United States since the late 1960s. One of the most important contributions has been to help parents and teachers become aware that children's thinking is fundamentally different from that of adults and to help them focus on understanding the nature of the individual child's thought. It is important that teachers realize that the thinking processes of children are
affected by their stage of cognitive development and their prior experiences at home and school. Another important lesson that educators have gained from Piaget's work is the importance of assessing children's intellectual development is not only the answer to a question, but also the line of reasoning that led to that particular response (Feeney, Christensen, and Moravcik, 1979).

Early Projects

Piaget's work formed the theoretical basis for Hans Furth, a professor of Psychology Catholic University and Harry Wachs, a Doctor of Optometry in private practice and Director of the Pennsylvania Vision Institute, to create the Tyler School for Thinking in Charleston, West Virginia in 1970. Their prime objective was to create a thinking environment. This project was geared to prevention rather than remediation of school failures and was to aid and nourish the normal developing process of thinking in the primary school age child.

One major outgrowth of this program would be the prevention of many academic failures and learning disabilities and the excessive expenditures in remedial programs. Their second goal was to prepare children for the task of further education. The program was limited to the primary grades because during this most critical period the child could form healthy habits of thinking as a foundation for intelligent reading and the successful
acquisition of all other academic skills (Furth and Wachs, 1974).

The School for Thinking classrooms, schedules, teachers, curriculum, and assessment in no way resembled the traditional methods. Laughter, discussion, activity, and movement marked the classroom. There was freedom, but it was freedom with structure. The student was allowed to perform at the level that most challenged his interest and ability. This was accomplished through a series of specially designed activities or "Games". Each activity is intended to help the student deal successfully with specific academic subjects (Furth and Wachs, 1974). The thinking activities included body and sense thinking games (bodily-kinesthetic), logical thinking games (logical-mathematical), social thinking activities: drama, excursions, affect games, (interpersonal and intrapersonal) reading and writing (linguistic), math, science (logical-mathematical), arts and crafts (spatial), music, (musical) and physical education (bodily-kinesthetic). These "games" are examples of Piaget's theory that intelligence and knowledge be integrated into each aspect of the curriculum. According to Piaget, all thinking develops from the coordination of external actions; therefore, these activities stimulate intellectual development.
Play

By investigating the role of play in intellectual development educators can relate to how children process information. According to Erikson (1950), play progresses through stages that mirror children's psychosocial development. Through play, children create model situations that help them master the demands of reality and contribute to normal personality development. Vygotsky, (1976) a Russian psychologist, believed that young children are incapable of abstract thought, because for them meaning and objects are fused together as one. When children begin to engage in make-believe play and the use of objects to stand for things, meaning becomes separated from objects. Thus, symbolic play has a crucial role in the development of abstract thought. Bruner (1972) suggests that play promotes creativity and flexibility. He states that when playing children do not worry about accomplishing goals they can experiment with new and unusual combinations of behavior they never would have tried if they were under pressure to achieve a goal. Once these new behavioral combinations occur in play, children can use them to solve real-life problems (Johnson, Christie, and Yawkey).

Vygotsky focused on language and the social origin of each child's experience as critical components in the development of thought and intellect. He explained, that as a child grows and develops, social interactions with
capable others eventually enable the child to function as an independent, self-regulated problem solver. Vygotsky saw the child-adult dyad functioning as an integrated social system, with the adult initially responsible for planning, implementing, and monitoring the strategies and behaviors necessary for reaching a goal. Working in the "zone of proximal development," the social interaction provides the origins of metacognition (Woolfolk, 1993).

Robert Sternberg, a psychologist at Yale University, analyzed intellectual function into three components, or processes that operate on information. Metacomponents allocate the resources that are available for processing information. Performance components carry out the actual procedures selected by the delineations. Knowledge-acquisition components acquire new information, as it is needed. People of all ages use the same components to construct analogies, but spend different amounts of time on each. Sternberg's componential analysis gives us an expanded view of intelligence rather than ranking one person relative to another in terms of a single number, resources, encoding information, monitoring feedback, and so on. Is it a single intelligence that works for us or does intelligence take more than one form? (Cobb, 1992).

It is safe to say that a good percentage of teachers, administrators, psychologists, and researchers recognize
the fact that there is more to education than has been acceptable in the past. The theory that all students may learn in different ways has sparked the interest and curiosity of many dedicated professionals to investigate the possibility of multiple intelligences and also the implications of brain-based learning.

Multiple Intelligence in Theory

Howard Gardner, a Professor of Education at Harvard Graduate School of Education in Cambridge MA, who specializes the developmental psychology and neuropsychology, realized that his research was turning his path of concern towards issues of human intelligence in two areas, theoretical and practical. As a result of his research on the development and breakdown of cognitive and symbol-using capacities, he became uncomfortable with the Piagetian theories that were so widely accepted (Gardner & Hatch, 1989). According to Gardner's Theory of Multiple Intelligences, each human being is capable of at least seven relatively independent forms of information processing, with individuals differing from one another in the specific profile of intelligences that they exhibit. Gardner has stated that the linguistic intelligence, logical-mathematical intelligence, spatial intelligence, bodily-kinesthetic intelligence, musical intelligence, intrapersonal and interpersonal intelligence (he later added naturalist intelligence) provides for different
windows into the same room. It is therefore, logical to assume that the range of human intelligences is best assessed through contextually based "intelligence-fair" instruments.

These allegations could lead to flaws in the currently accepted method of assessments that focus on skills of those students who do well in reading, writing and mathematics specifically. Standard intelligence tests do not reflect or measure the various intelligences of the majority of students in the school system but focus mainly on linguistic and mathematical intelligences.

Gardner's definition of intelligence related to the capacity to solve problems or to fashion products that are valued in one or more cultural settings and he also detailed a set of criteria for what counts as a human intelligence (Gardner & Hatch, 1989). Neither this definition nor his criteria coincided with the established practice in the field of intelligence.

In defining his list of intelligences, Gardner and his colleagues examined the literature in several areas: the development of cognitive capacities in normal individuals; the breakdown of cognitive capacities under various kinds of organic pathology; the existence of abilities in "special populations," such as prodigies, autistic individuals, idiots savants, and learning-disabled
children; forms of intellect that exist in different species; forms of intellect valued in different cultures: the evolution of cognition across the millennia; and two forms of psychological evidence the results of factor-analytic studies of human cognitive capacities and the outcome of studies of transfer and generalization (Gardner & Hatch 1989). The capacities that were dominant in these studies and came out repeatedly made up the provisional list of human intelligences. Detail, methods, and results can be found in Gardner's 1983, *Frames of Mind*. Gardner concluded that although all humans exhibit the range of intelligences, individuals differ, possibly for both hereditary and environmental reasons, in their current profile of intelligences. Also, there does not seem to be any correlation between any two intelligences, and they could entail quite distinct forms of perception, memory, and other psychological processes (Gardner and Hatch, 1989).

Gardner and Hatch (1989) express their concerns about standardized tests that stress linguistic and logical skills. The multiple intelligence theory takes a different approach of assessment that is consistent with the idea that each intelligence can be assessed with culturally meaningful activities that are "intelligence-fair." The theory sounds good, but will it work in the real world?
Multiple Intelligence in Practice

Under the direction of Howard Gardner and his colleagues, at Harvard University, Project Zero pioneered several projects to create models of assessment that follow the philosophy of the multiple intelligence theory.

The Pittsburgh Public School System and the Educational Testing Service began the Arts PROPEL project at the junior and senior high school level. The goal was to assess growth and learning in areas like music, imaginative writing, and visual arts by using a series of modules, or "domain projects", that serve as both curriculum and assessment. Students completed sets of exercises and curriculum specific to their artistic domain and the results were placed in portfolios for assessment of growth. Could this have been the seed for what we now call "magnet schools"?

The Key School in Indianapolis was established to further the MI Theory using a variety of special classes. Computing, bodily-kinesthetic activities, and other enrichment activities were presented to all of the students at this school. The goal was that each student discovers his or her areas of strength and develops the full range of intelligences. Students completed a number of projects based on school wide themes that were videotaped for assessment.
Project Spectrum curriculum activities and assessments were compatible with the "child-centered" structure of preschools and kindergartens. The activities targeted a particular intelligence or set of intelligences in an environment that was equipped with "intelligence-fair" materials. Students were encouraged to explore miniature replicas and props and respond by story telling (linguistic). They played with household objects to determine spatial skills, discovered natural objects and experiment to show their logical abilities, create movement to exercise their bodily-kinesthetic intelligence, etc. The teachers used observations and more formal assessment games, Modified Spectrum Field Inventory (MSFI), to assess students' growth.

The teachers in Pittsburgh, Indianapolis, and Boston reported that the students were more motivated and that the students appreciated the opportunity to reflect on their own growth and development (Gardner & Hatch, 1989).

PIFS (Practical Intelligence for School) Units is a middle school infusion curriculum that is aimed at helping students develop metacognitive skills and understanding in school-related activities. Students are evaluated on the different units through performance-based assessments (Armstrong, 1994). According to Howard Gardner (1999) in a personal interview, the purpose of education is to help us
understand our various worlds - the physical, the biological, the social, and the personal. He states that we get this understanding by delving deeply into topics, not by memorizing a certain number of terms and concepts each year. He also knows, as do we all, that it will be the teacher in the classroom everyday that is going to make the difference with students. He encourages teachers to approach a topic in many ways.

His suggestion is to teach each subject with multiple entry points because each entry point taps into one or more of the multiple intelligences. Narrative entry points, such as stories, will spark students with linguistic or personal intelligences. Numerical entry points, which include mathematical model and deductive reasoning, will appeal to mathematically oriented kids. Students with spatial or musical intelligences will be drawn to aesthetic entry points - visual art, drama, music, and dance. Kids with kinesthetic intelligence will respond to hands-on activities. Students who have strong personal intelligences will enjoy debating and roll playing.

Thomas Armstrong, psychologist, author, teacher, and Director of Armstrong Creative Training Service, regards Howard Gardner as the archeologist who discovered the Rosetta stone of learning. He describes the multiple intelligence theory as a template in constructing
strategies for student success. His template translates Gardner's seven intelligences into seven different kinds of smarts: word smart (expressing verbal intelligence), picture smart (thinking with your mind's eye), music smart (using your melodic mind), body smart (using your kinesthetic intelligence), logic smart (calculating mathematical and scientific abilities), people smart (connecting with others), and self smart (knowing yourself). According to Armstrong (1994) one can use this model to teach virtually anything. The key to this learning style is simple: for whatever you wish to teach, link your instructional objective to words, numbers or logic, pictures, music, the body, social interaction, and/or personal experience. The more you can combine these intelligences in unique ways, the better. He also states that children do not leave their multiple intelligences behind as they enter adolescents, they become more intense. Students should be doing activities that prepare them for experiences that they will encounter in the real world. (Armstrong, 1993).

Armstrong reflects (1993) that childhood is the original spawning ground of all seven intelligences. Children's early language is quite musical in character. Their first spatial representations often have a kinesthetic quality about them. Out of this multimodal mix of behaviors and experiences a certain pattern of strengths
begins to emerge. If this is true, it is the obligation of the educational world to promote the development of intelligence by investigating alternative methods of teaching students to think and how to assess that thinking.

Armstrong (1993) states that intelligence depends on the contest, the task, and the demand that life presents to us and not on IQ scores, a college degree, or a prestigious reputation. He admits that the Multiple Intelligence theory is not the first model to suggest that there are different ways to be smart. Around 150 kinds of intelligences have been explored over the last 200 years. Armstrong contends that the backbone of Gardner's theory is the bases of research from a wide range of fields, including anthropology, cognitive psychology, developmental psychology, psychometrics, biographical studies, animal physiology, and neuroanatomy. (Armstrong, 1993).

Multiple Intelligence Criteria

Armstrong describes Gardner's eight factors of Criteria that distinguish intelligence from a talent or aptitude.

1. Potential Isolation by Brain Damage. For example, damage to the left frontal lobe would impair the ability of a person to speak, read, or write but they could still easily sing, draw, and dance, etc.

2. A Distinctive Developmental History and a Definable

4. An Evolutionary History and Plausibility. Gardner says that each intelligence has its roots deeply embedded in evolution of humans and other species.

5. Susceptibility to Encoding in a Symbol System. According to Gardner, the ability to symbolize is one of the most important factors separating human from most other species. (For more details on each of the above criteria see the Multiple Intelligence Theory Summary Chart on pages 6-8.)

6. The Existence of Savants, Prodigies. Gardner has found that these exceptional individuals exhibit superior skills in one intelligence and little or none in the other six.

7. Support from Psychometric Findings. Standardized measures of human ability provide the "test" that most theories on intelligences (and learning styles) use to check the validity of a model.
8. Support from Experimental Psychological Tasks.
Gardner suggests that we can witness intelligence working in isolation from one another and that people can demonstrate different levels of proficiency across the seven intelligences in each cognitive area.

9. An Identifiable Core Operation or Set of Operations
Gardner says that just as a computer program requires a set of operations in order for it to function, each intelligence has a set of core operations that serve to drive the various activities indigenous to the intelligence (Armstrong, 1994).

After careful scrutinizing, these are the Seven Intelligences that Gardner deemed to be true intelligences as described by Armstrong:

**Linguistic Intelligence:** The capacity to use words effectively, whether orally (e.g., as a storyteller, orator, or politician) or in writing (e.g., as a poet, playwright, editor, or journalist). This intelligence includes the ability to manipulate the syntax or structure of language, the phonology or sounds of language, the semantics or meanings of language, and the pragmatic dimensions or practical used of language. Some of these uses include rhetoric (using language to convince others to take a specific course of action), mnemonics (using language to remember information), explanation (using
language to inform), and met language (using language to talk about itself).

**Logical-Mathematical Intelligence:** The capacity to use numbers effectively (e.g., as a mathematician, tax account, or statistician) and to reason well (e.g., as a scientist, computer programmer, or logician). This intelligence includes sensitivity to logical patterns and relationships, statements and propositions (if-then, cause-effect), functions, and other related abstractions. The kinds of processes used in the service of logical-mathematical intelligence include: categorization, classification, inference, generalization, calculation, and hypothesis testing.

**Spatial Intelligence:** The ability to perceive the visual-spatial world accurately (e.g., as a hunter, scout, or guide) and to perform transformations upon those perceptions (e.g., as an interior decorator, architect, artist, or inventor). This intelligence involves sensitivity to color, line, shape, form, space, and the relationships that exist between these elements. It includes the capacity to visualize, to graphically represent visual or spatial ideas, and to orient oneself appropriately in a spatial matrix.

**Bodily-Kinesthetic Intelligence:** Expertise in using one's whole body to express ideas and feelings (e.g., as an actor, a mine, and athlete, or a dancer) and facility in
using one's hands to produce or transform things (e.g., as a craftsperson, sculptor, mechanic, or surgeon). This intelligence includes specific physical skills such as coordination, balance, dexterity, strength, flexibility, and speed, as well as proprioceptive, tactile, and haptic capacities.

Musical Intelligence: The capacity to perceive (e.g., as a music aficionado), discriminate (e.g., as a music critic), transform (e.g., as a composer), and to express (e.g., as a performer) musical forms. This intelligence includes sensitivity to the rhythm, pitch or melody, and timbre or tone color of a musical piece. One can have figural or "top-down" understanding of music (global, intuitive), a formal or bottom-down" understanding (analytic, technical), or both.

Interpersonal Intelligence: The ability to perceive and make distinctions in the moods, intentions, motivations, and feelings of other people. This can include sensitivity to facial expressions, voice, and gestures; the capacity for discrimination among many different kinds on interpersonal cues; and the ability to respond effectively to those cues in some pragmatic way (e.g., to influence a group of people to follow a certain line of action).

Intrapersonal Intelligence: Self-knowledge and the ability to act adaptively on the basis of that knowledge. This intelligence includes having an accurate picture of oneself.
(one's strengths and limitations): awareness of inner moods, intentions, motivations, temperaments, and desires; and the capacity for self-discipline, self-understand, and self-esteem.

Gardner has added an eighth intelligence titled Naturalistic Intelligence. Some have said that Charles Darwin inspired this intelligence and it allows people to distinguish among, classify, and use features of the environment. The naturalistic intelligence, as described by Leslie Wilson (Fall'97) deals with sensing patterns in and making connections to elements in nature. People possessing high level of this intelligence may also be interested in other species, or in the environment and the earth. Children who are "nature smart" may have a strong affinity to the outside world or to animals, and this interest often can be seen at an early age. They may enjoy subjects, shows and stories that deal with animals or natural phenomena. They may show unusual interest in subject like biology, zoology, botany, geology, meteorology, paleontology, or astronomy. Due to their highly developed levels of sensory perception these people are keenly aware of their surroundings and changes in their environment, even if these changes are at minute or subtle levels and notice similarities, differences and changes in their surroundings more rapidly than others. They may be able to categorize or catalogue things easily too. These
people may notice things that others might not be aware of. As children these people like to collect, classify, or read about rocks, fossils, butterflies, feather, shell, and other things from nature. Wilson states that Gardner's final justification for existence of natural intelligence will be related to sites of the brain responsible for recognizing patterns, for making subtle connections, and to those areas responsible for acute sensory perceptions, and to sites related to object discrimination and classification. We are all eagerly awaiting Gardner's full description of "nature Smarts."

Armstrong (1994) reminds us that beyond the descriptions of the seven intelligences and their theoretical implications, other points are important to consider. First, that each person possesses all seven intelligences. Second, most people can develop each intelligence to an adequate level of competence. Third, intelligences usually work together in complex ways and lastly, that there are many ways to be intelligent within each category. Keeping in mind, that development depends on three factors: biological endowment, personal life history, and cultural and historical background, he encourages each person to become aware of their own intelligences by taking the Multiple Intelligence Inventory for Adults (p. 18-20), as a start.
Armstrong's contribution to the advancement of the multiple intelligence theory in the educational world can be found in his ideas about integrating the seven intelligences into the curriculum. He outlines thirty-five teaching strategies, sets up classroom with activity centers specific needs of each intelligence, provides effective classroom management interventions based on individual student's differences, and presents a variety of assessments key to tracking the development of the students. Plus, easy to follow suggestions, informative charts, and comprehensive checklists, make it possible to bring multiple intelligence into any classroom.

According to Dr. Sue Teele, (1990) Director of Education Extension at the University of California, Riverside, the public education must create a system in which the curriculum allows each learner to proceed at a rate and pace that is challenging and achievable, makes no unfair comparisons with the progress of others, assures positive reinforcement and provides assessment procedures that reflects the learning styles of all students.

Educators of today are influencing the lives of the very people who will be dictating the standards of living in the future. Therefore, it is critical that they acknowledge the possibility that each student will process information in a different way, attempt to identify the student's dominant intelligence, teach meaningful lessons
to which the students will relate, and be open to alternative methods of assessment. Teele states (1990), that the vision into, through and beyond the 1990's is to see a resurgence of the thirst for knowledge, and eagerness for education and greater opportunities for students to reach their full potential. The year 2001 has arrived and more and more schools, teachers, and districts join in the battle to reform the curriculum and provide more thematic, constructive, hands-on, interactive activities and intelligence-fair assessment in all contents areas that would address the needs of all students. Fontana Unified School District in California has adopted math curriculum with exploration centers specifically designed to target skills development in each of the seven intelligences (Randall, Brummett, Wortzman, Harcourt, Barnett, and Kelly. 1995).

There is no best way of teaching that will work in all situations. Therefore, teachers need to develop several strategies that include both a structured, directed environment and a more flexible, unstructured, self-directed environment. The key to success is the matching of appropriate teaching models to the students' learning characteristics and assess appropriately (Teele, 1990).
Multiple Intelligence Assessments

For the purpose of identifying the dominant intelligences of students, Dr. Sue Teele (1992) developed The Teele Inventory of Multiple Intelligences (TIMI). It can be administered to students from the preschool level to those in college or even institutions of higher education.

The TIMI is a forced choice pictorial inventory of 56 numbered pictures of panda bears representing characteristics of each of the seven intelligences and provides students twenty-eight opportunities to make their selection of two choices. There are no right or wrong answers and when the test is scored, the inventory identifies the dominant intelligences. After determining the dominant intelligence of students, teachers can then determine which teaching, environmental, and assessments strategies would be most appropriate to integrate into the curriculum.

After extensive testing, Teele (1998) concluded that scores in linguistic intelligence appear strongest at grades kindergarten through fourth. Logical-mathematical intelligence was strongest from first through fourth. Spatial and bodily-kinesthetic intelligence remained the two most dominant intelligences throughout elementary. Intrapersonal was dominant in kindergarten. Interpersonal intelligence immerses in third grade, musical intelligence in fourth grade and continues throughout middle school.
From Theory to Practice

By putting theory into practice the Renaissance Project conducted by The University of California, Riverside Extension in 1991 studied methods for integrating instructional strategies and assessment measures with the multiple intelligence theory. The premise was that student learning would be maximized and students would be better able to reach their maximum potential when teachers used methods emphasizing all seven intelligences and authentic assessment measures. The goal that students would become more engaged in learning, have greater motivation, achievement, and higher self-esteem was realized at the conclusion of the year. The first grade bilingual teacher and principal of this California school indicated that the students in this class did increase their engagement with learning and thus their potential for future success (Teele, 1992).

In 1994, Dr. Sue Teele field-tested a project in an elementary school in California that provided instruction based on the theory of multiply intelligence and identified the relationship of multiple intelligence to the instructional process.

Teele (1994) explained that the physical setting, organizational factors, human aggregate, and social climate were the four domains used and that they interrelate with one another to facilitate the growth and development of the
students. Each of the domains has five elements that contribute to creating a personalized learning environment for all students. She found that the social climate was the strongest factor in creating a child-centered education because it directly impacted the school. The physical environment conveyed commitment to multiple intelligence and reflected a positive atmosphere. The organizational factors included philosophy, curriculum, instruction, and assessment. The human aggregate included all students, teachers, parents and the principal internally and community, school board, and district office externally. Dr. Teele proved that using the Rudolph Moos's (1979) model can provide a common framework in establishing other schools where multiple intelligence and the philosophy that all children can and will learn is the foundational base (Teele, 1994).

Assessment Menu for Careers

Dr. Teele (1998) conducted a four-day class; Institute for the Study of Multiple Intelligences, Part I, where she elaborated on Gardner's eight intelligences, cited careers that require each of the intelligences, and outlined a Multiple Intelligence Assessment Menu for each intelligence. Below is a description of indicators for each intelligence, careers that students might choose, and a multiple intelligence assessment menu designed by Dr. Sue Teele for Gardner's Eight Intelligences.
The linguistic learner has highly developed auditory skills, likes to read, processes information through listening, spins tall tales, loves to tell jokes or stories, and has a good memory for names, places, dates or trivia. They also enjoy writing, using a word processor, speaking to groups, they spell words accurately and have a well-developed vocabulary. They prefer doing crossword puzzles or playing word games like scrabble or anagrams.

Careers in which the linguistic learner might excel are: Author, journalist, language teacher, librarian, poet, proofreader, public speaker, typist, speech pathologist, novelist, newscaster, playwright, comedian, curator, archivist, storyteller, secretary, radio or T.V announcer. The well-informed teacher might use several of these language arts based assessment instruments in addition to the standard required assessments: Written essays, vocabulary quizzes, recall of verbal information, audiocassette recordings, poetry writing, linguistic humor, formal speech, cognitive debates, listening and reporting, learning logs, and journals to obtain a broader base of understanding and assessing the linguistic learner.

The logical-mathematical learner likes to explore patterns, categories and relationships, compute arithmetic problems quickly, solve mathematical problems, use computers, particularly database, spreadsheet and problem
solving, they are able to group and order data and then analyze, interpret and make predictions. These students' reason things out logically to solve problems, enjoy playing checkers, or strategy games and they like to win. They can devise experiments to test out things that are not easily understood. These students might choose to be an accountant, auditor, banker, bookkeeper, doctor or dentist, economist, mathematician, science teacher, science or math researcher, statistician, technician, computer analyst, computer programmer, actuary, business person, legal assistant, purchasing agent, or underwriter. Cognitive pattern based assessment instruments could be cognitive organizers, higher-order reasoning, pattern games, outlining, logic and rationality exercises, mental menus and formulas, deductive reasoning, inductive reasoning, calculation processes, and logical analysis and critique problems.

The musical learner is sensitive to a variety of sounds in the environment, can play musical instruments or enjoy music, remember melodies of songs, tell when a musical note is off-key, collects records, tapes or CD's, and can relax with music on when studying or working. They love to sing songs, keep time rhythmically to music and are usually humming or whistling tunes for their own pleasure. These students are the ones that might test a teacher's patience but will surely seek careers as choral directors,
music teachers, disc jockeys, composers, sound engineers, singers, studio engineers, musicians, advertising agents or film makers. These students have a different way of looking at the world and this is reflective of their unique dominant intelligence. Some auditory based assessments could be creating concept songs and raps, illustrating with sound, discerning rhythmic patterns, composing music, linking music and rhythm with concepts, orchestrating music, creating percussion patterns, recognizing tonal patterns and quality, analyzing musical structure, and reproducing musical and rhythmic patterns.

The spatial learner thinks in images and pictures. They like to draw, paint, sculpt and participate in art activities. They can report a clear visual image when thinking about something. These students can easily read maps, charts, and diagrams, draw accurate representations of people and things. They like to see movies, slides or photographs, enjoy doing jigsaw puzzles or mazes, and can often be found daydreaming. Careers that require spatial intelligence might be: architect, cartographer, drafter, engineer, artist, painter, inventor, photographer, urban planner, pilot, graphic designer, interior designer, sculptor or surveyor. A few imaginal based assessment instruments would look like murals, and montages, graphic representation and visual illustrating, visualization and imagination, reading, understanding, and creating maps,
flowcharts and graphs, sculpting and building, imaginary conversations and mind mapping, video recording and photography, and manipulative demonstrations.

The bodily kinesthetic learners find it difficult to conform to a structured classroom environment. They learn best by moving around, touching, or acting things out, move, twitch, tap or fidget while sitting. They enjoy participating in physical activities or sports and like sports. They like to touch people when talking to them, work well doing skills that uses hands like woodworking, sewing, carving or sculpting. These are the students who do well with hands-on active learning experiences where they can make or create things. They prefer physical exercise, games, competitive sports and action-packed stories. This type of student is most likely to be an actor, athlete, carpenter, choreographer, craftsman, dancer, farmer, forest ranger, inventor, jeweler, mechanic, PE teacher, coach, recreational director, or physical therapist. Performance based assessment instruments would be lab experiments, dramatization, original and classical dance, charades and mimes, impersonations, human tableaux, invention projects, physical exercise routines and games, skill demonstrations, and illustrations using body language and gestures.

The intrapersonal learner has a deep awareness of inner feelings, strengths and weakness, displays a sense of
independence or a strong will and is self-directed, reacts with strong opinions when controversial topics are being discussed, prefer their own private inner world, and like to be alone to pursue some personal interest, hobby, or project. These are the students who have a deep sense of self-confidence and march to the beat of a different drummer in style of dress, behavior, or general attitude. They are self-motivated and do well on independent study projects and have an intuitive ability. Some psychological based assessments instruments are: autobiographical reporting, personal application scenarios, metacognitive surveys and questionnaires, higher-order questions and answers, concentration tests, feelings diaries and logs, personal projection, self-identification reporting, personal history correlation, personal priorities and goals.

The interpersonal learner enjoys interacting with people, have many friends, socialize at school, work or at home. They organize, communicate and sometimes manipulate and learn best by relating and cooperating with others. They enjoy participating in many group activities, serve as the "family mediator" when disputes arise, have a lot of empathy for the feelings of others, and respond to the moods and temperaments of other individuals. Some relational based assessment instruments are: group
"jigsaws", explaining to or teaching another, "think-pair-share", "round Robin", giving and receiving feedback, interviews, questionnaires, and people searches, empathic processing random group quizzes, assess your teammates, test, coach and retest.

The Naturalist learner is sensitive to the natural world, notices relationships in nature, and sees connections and patterns within the plant and animal kingdoms. They enjoy being outdoors, listens and hears sounds in the natural world, and categorizes and classifies flora and fauna goals (Teele, 1994).

Leslie Wilson (Fall '97) lists possible traits exhibited by children with naturalistic intelligence.

1. Have keen sensory skills—sight, sound, smell, taste, and touch.

2. Readily use heightened sensory skills to notice and categorize things from the natural world.

3. Like to be outside, or like outside activities like gardening, nature walks or field trips geared toward observing nature or natural phenomena.

4. Notice patterns easily from their surroundings -- like differences, similarities, and anomalies.

5. Are interested and care about animals or plants.

6. Notice things in the environment others often miss.
7. Create, keep or have collections, scrapbooks, logs, or journals about natural objects -- these may include written observations, drawings, pictures and photographs or specimens.

8. Are very interested, from an early age, in television shows, videos, books, or objects from or about nature, science or animals.

9. Show heightened awareness and concern of the environment an/or for endangered species.

10. Easily learn characteristics, names, categorizations and data about objects or species found in the natural world.

Applications

Hoerr (1994) describes what began as a discussion on the nature of intelligence and resulted in a revised curriculum, varied instructional techniques, alternative assessment, and new ways of communication with parents at the New City School in St. Louis, Missouri. The teachers formed support committees and began to experiment with multiple intelligences until the entire school was involved with the philosophy about education for how kids learn, how teachers should teach, and how schools should operate. They found that it is not easy to incorporate all of the intelligences into the curriculum design and planning, musical intelligence being the most difficult. Also, incorporating multiple intelligence in the 5th and 6th grade
curriculum was a real challenge because of the expectations for subject matter mastery and preparations for the transition to secondary schools. Despite many difficulties, they found multiple intelligence to be a powerful tool for helping kids succeed in today's educational system.

In 1994, Farmington K-5 Elementary (a pseudonym) in north central Indiana with a population of almost entirely Caucasian and economically diverse, embarked on the task of implementing multiple intelligence curriculum school wide. Students were grouped heterogeneously grouped in self-contained classes. A block-scheduling plan (called flow time) grouped the entire student's outside activities, such as library, music, activity room, and gym. Flow also let all teachers in a grade level share planning time. An activity room contained games and activities that stimulated each of the seven intelligences. Enrichment clusters brought together children of all ages with a common interest ranging from folk dancing to story telling. Teacher's attitudes were positive but agreed that training and support was crucial, because implementation depends on teacher initiative. Students embraced the concept because it celebrated their diverse talents. Parents were happy because their children were excited about learning. Knowing that poverty is correlated with low school achievement and the fact that Farmington school was at 43%, the principal was concerned about test scores. Test scores during the 1st
year of implementation (1995 testing) were higher than before and even higher in 1996. When compared with other elementary school in the same district across the past eight years, Farmington showed a recent dramatic increase. That score increase coincided with the implementation of the multiple intelligence curriculum (Mettetal, Jordan and Harper, 1998).

When Cambell (1992) incorporated the multiple intelligence teaching model in his third through fifth grade classroom he found that students' learning improved as measured by classroom and standardized testing. He also stated that using the MI theory emphasized learning and learning how to learn rather than teaching. The program was adapted to the students as their needs were met, rather than expecting the students to adapt to the program. (Hoker, 1997).

Learning Styles

Some authors have used the term "learning styles" synonymously with "multiple intelligences", but theoretically they do differ. Carl Jung (1927) theorized major differences in the way people perceived (sensation versus intuition), the way they made decisions (logical thinking versus imaginative feelings), and how active or reflective they were while interacting (extroversion versus introversion). Most models are limited to four basic styles
that focus on process and emphasize personality. The mastery learner, the understanding learner, the self-expressive learner, and interpersonal learner. Keefer and Ferrell (1990) indicated learning styles are innately interwoven with the affective, temperamental, and motivational structures of the total human personality.

Silver, Strong, and Perini (1997) suggest that leaning styles develop as a person learns and grows and that all individuals develop and practice a mixture of styles as they live and learn. They agree that learning style models fail to recognize how styles vary in different content areas and disciplines and how context and purpose affect learning. They also admit that the multiple intelligence theory looks where the learning style does not. Their solution would be the integration of learning styles and multiple intelligences. They acknowledge that the learning styles' emphasis on the individual learning process and Gardner's content-oriented mode of multiple intelligences are surprisingly complementary. (Silver, Strong, and Perini, 1997).

More and more educators are realizing that if students do not learn the way they teach, then teach them the way they learn. To help students get the most out of each day's lesson, teachers need to be flexible and allow students more than one way to learn. That is why James Keefer, a researcher at the National Association of
Secondary School Principals, says teachers need to consider three dimensions of students' learning-cognitive, affective, and physiological - as they prepare lessons. In other words, they need to prepare lessons that address students' intellectual, behavioral, and physical needs. (Black, 1993).

Counselors are committed to humanizing educational systems, enhancing the school climate, and providing for individual differences to develop the potential and uniqueness of each student. Griggs (1991) found that many counselors have implemented learning style approaches in counseling students and teachers and they have reported positive changes in students' academic achievement and attitudes toward school as a result.

Learning styles and multiple intelligence theories can work together in specific content areas. According to the research by the National Reading Styles Institute (NRSI) in Syosset, New York, there is a way to reach every learner. If teachers understand that students have different reading styles - that they learn to read in different ways - they can match a child's style to a blend of instructional strategies (Carbo, 1999).

Research in this field has identified six reading styles. Given Carbo's (1999) description of each, one can see the correlation to the multiple intelligences: visual
(spatial), auditory (linguistic), tactile (kinesthetic),

global (intrapersonal and interpersonal), and analytic
(Logic-mathematical).

The significance of considering different theories
makes it possible to integrate an accumulation of teaching
strategies that work in your classroom and with your
students. According to Stein, Carnine, and Dixon (1998)
effective teaching techniques must be tied to well-
designed, generalizable instructional strategies in order
for students to succeed academically. The most important
aspect in teaching according to the multiple intelligence
model is to provide a variety and balance of learning
situations that allow all students to be reached.

Dillon (1989) asks in her research, what makes a
teacher effective? The answer to this question and others
about how teachers and students work together to create
meaning during classroom lessons depends on the theoretical
perspective and research methodology adopted by the
researcher to study the acts of teaching and learning. She
cites Erickson (1986b) as stating, Empirical findings of
interpretive research differ from those found in the more
usual approaches to educational research. From an
interpretive point of view, teacher effectiveness is a
matter of the nature of the social organization of
classroom life, what we have called the enacted curriculum
(p.122, 133). Based on a yearlong ethnographic study of a
high school English-reading teacher, appraised as effective by his administrators and others in the community. Dillon reported that this teachers belief in, what is know as symbolic interaction as described by Blumer (1969) and Dezin (1978), served as a successful vehicle to interact with his students in ways that met their cognitive and affective needs, establish an environment in the classroom that resulted in reduced resistance to learning and increased active participation during lessons. Meaning is gained through interaction with others, how a person understands other individuals, how the other individuals perceive the person, and how the person understands herself himself, and works with the messages communicated around her or him (Blumer, 1969). These statements could be comparable to the combination of Howard Gardner's sixth and seventh intelligence as described by Thomas Armstrong (1993). The sixth intelligence being the interpersonal. This is the ability to understand and work with other people. It requires a capacity to perceive and be responsive to the moods, temperaments, intention, and desires of others. The seventh intelligence is intrapersonal or the intelligence of the inner self. A person strong in this kind of smart can easily access their own feelings, discriminate between many different kinds of inner emotional states, and use their self-understanding to enrich and guide their life.
Dillion concluded by saying that at the heart of these models are the goals of developing relationships with students, believing in students' abilities to learn, listen to students to gain a better understanding of what they know and how they learn, and providing students with meaningful experiences during classroom lessons. Her last concern was that in a time of growing accountability, where effectiveness is being measured only through rising test scores, effective teaching and meaningful learning may soon be lost. She hopes that her research will enable teachers, educators, and practitioners to improve teaching and learning.

Cultural Influences

Sternberg and Kaufman (1998) looked at the definition of intelligence in different cultures and stated the cultures designate as "intelligent" the cognitive, social, and behavioral attributes that they value as adaptive to the requirement of living in those cultures. Although conceptions of intelligence may vary across cultures, the underlying cognitive attributes do not.

Erwin (1998) focused on the idea that knowledge of cultural differences provides valuable information for educators to anticipate and accommodate those differences in the classroom. Knowing about culturally related learning styles might also help teachers increase students'
success. Knowledge about differences can influence reform efforts, educational-findings decision, hiring practices, and curriculum design. Armstrong (1993) reminds us that the theory of multiple intelligence declares that intelligent behavior can best be viewed by looking at civilization's highest accomplishments and celebrates the diversity of ways different cultures show intelligent behaviors.

Emotional Intelligence

Intelligence or no intelligence, that is the question. You be the judge. Daniel Goleman, Ph.D. (1997), writer for the New York Times, teacher at Harvard, was senior editor at Psychology Today, and author of several books on the behavioral and brain sciences, presents his views on this question. Goleman said that, "While there is ample room in Gardner's descriptions of the personal intelligences for insight into the play of emotions and mastery in managing them, Gardner and those who work with him have not pursued in great detail the role of feeling in these intelligences, focusing more on the cognitions about feelings. This focus, perhaps unintentionally, leaves unexplored the rich sea of emotions that makes inner life and relationships so complex, so compelling, and so often puzzling. And it leaves yet to be plumbed both the sense in which there is intelligence in the emotions and the sense in which intelligence can be brought to emotions."
Carolyn Pool (1997) interprets Goleman's five dimensions of emotional intelligence:

Self-awareness is the basis for self-confidence. Kids need to learn from a very young age what the words for feelings are, why they feel the way they do and what action options they have.

Knowing how to handle emotions and upsetting feelings or impulses, is the root of emotional intelligence.

Self-motivation is the third element of emotional intelligence that gives us hope in striving for a goal and knowing how to take small manageable steps to reach that goal. A positive attitude and persistence will help us to follow through.

Empathy, the fourth element, gives us the ability to read the feelings of others by tone of voice or facial expression, not necessarily words. This is a fundamental human ability seen even in infants and small children. Those who have come from loving environments will try to comfort others in distress. Those who have been abused of neglected early in life will, most likely, abuse others in distress. These students tend to be the classic playground bullies. Studies have shown that I.Q. has nothing to do with this element of emotional intelligence, as in the case of the Santa Curz Strangler who murdered seven people.

Social skills is the art of positively responding to and dealing with the emotions of others.
Pool states that emotional intelligence matters for school achievement, job success, marital happiness, and physical health. Teachers can raise the emotional intelligence of the students by providing supports for those children whose parents are not around. Teachers can plan activities to get children away from TVs and video monitors and teach children how to handle their feelings. Bullies can be taught peaceful options and shy kids can be taught how to "fit in" by developing their social skills. Pool and Goleman emphasized that social-emotional development should be integrated into the curriculum and the life of the school by involving parents and community mentors. Only then can we ourselves become healthier emotionally.

Studies related to the Attachment Theory suggest that the first opportunity for shaping the ingredients of emotional intelligence begin at birth, through these capacities continue to form throughout the school years. The emotional abilities children acquire in later life build on those of the earliest years and these abilities are the essential foundation for all learning. The attachment theory is concerned with the emotional bond that develops between a child and their caretaker and how it affects one's self-concept and social view of the world.
John Bowlby (1969) determined that early attachment to a primary caregiver would influence a person as they became and adult. Mary Ainsworth (1978) identified Anxious, Avoidant, and Secure as three primary attachment styles in infants the influence the development of that child’s personality. Mary Main (1985) expanded the theory to include the concept of particular types in internal working models of relationships, models that direct not only feelings and behavior but also attention, memory, and cognition. These models are believed to shape the personality and guide later social behavior. In other words, adults relate to others based on familiar experiences. Securely attached people find it easy to get close to others, can trust and depend on others, want others to depend on them, and are comfortable with emotional attachment. Those who are avoidant are uncomfortable being close to others, find it hard to trust or depend on them, and reject emotional contact. Those who are anxiously attached find others are reluctant to get as close as they would like, and fear being unloved or abandoned. They want to merge completely with others but this sometimes scares people away. Goleman states that babies that have gotten a goodly dose of approval and encouragement from the adults in their lives: they expect to succeed in life’s little challenges. By contrast, babies who come from homes too bleak, chaotic, or neglectful go
about the same small task in a way the signals they already expect to fail. A report from the National Center for Clinical Infant Programs makes the point that school success is not predicted by a child's fundamental knowledge of facts or the ability to read, so much as by emotional and social measures: being self-assured and interested; knowing what kind of behavior is expected and how to rein in the impulse to misbehave; being able to wait, to follow directions, and to turn to teachers for help; and expressing needs while getting along with other children. Almost all students who do poorly in school lack one or more of these elements of emotional intelligence. All seven key ingredients in the report are related to emotional intelligence:

1. **Confidence.** A sense of control and mastery of one's body, behavior, and world; the child's sense that he is more likely than not to succeed at what he undertakes, and that adults will be helpful.

2. **Curiosity.** The sense that finding out about things is positive, and leads to pleasure.

3. **Intentionality.** The wish and capacity to have an impact, and to act upon that with persistence. This is related to a sense of competence, of being effective.

4. **Self-control.** The ability to modulate and control one's own actions in age-appropriate ways; a sense of inner control.
5. **Relatedness.** The ability to engage others based on the sense of being understood by and understanding others.

6. **Capacity to communicate.** The wish and ability to verbally exchange ideas, feelings and concepts with others. This is related to a sense of trust in others and of pleasure in engaging with others, including adults.

7. **Cooperativeness.** The ability to balance one's own needs with those of others in group activity.

Goleman agrees that whether or not a child arrives at school on the first day of kindergarten with these capabilities depends on how much the parents - preschool teachers - have given her/him the kind of care that he calls “Heart Start.”

Goleman support for emotional intelligence is rooted in brain research. Our emotions are controlled by the limbic brain, right in the middle of the three main layers of the human brain: the cortex, limbic brain, and brain stem. In the middle of the limbic area, behind the eyes, are two amygdala. Recent neurological research has shown that these two almond-shaped organs receive and send all emotional messages. These messages are sent to the cortex influencing our analytical thinking. According to pool, an amygdala attack in the brain sets the heart racing, poised
for fight or flight. When there is a mature, healthy connection, a controlled response to the amygdala's message goes to the cortex, which tells the brain to calm down and forget the "fight" response. Children who are chronically sad, angry, or anxious find it difficult to concentrate or to learn. Because the amygdala doesn't mature until a child is 15 or 16, teachers have many chances to teach children how to handle their feelings.

"Intervention" has become the latest "buzz word" in education. Some schools are using interventions such as, inter-session, after-school tutoring, student study teams, special classroom and school pullout programs (Fast Forward, R.S.P, Speech, P.I.P), teacher aides, and many more for students who are having difficulties learning, for whatever reason.

Other schools from coast to coast have integrated Goleman's subject of Self Science - know your own feelings and those that erupt in relationships - into their curriculum as a prevention program. The main components of the Self Science curriculum are:

Self-awareness: observing yourself and recognizing your feelings; building a vocabulary for feelings; knowing the relationship between thoughts, feelings, and reactions.
Personal decision-making: examining your actions and knowing their consequences; knowing if thought or feeling is ruling a decision; applying these insights to issues such as sex and drugs.

Managing feelings: monitoring "self-talk" to catch negative messages such as internal put-downs; realizing what is behind a feeling (e.g., the hurt that underlies anger); finding ways to handle fears and anxieties, anger, and sadness.

Handling stress: learning the value of exercise, guided imagery, and relaxation methods.

Empathy: understanding others' feelings and concerns and taking their perspective; appreciating the difference in how people feel about things.

Communications: talking about feelings effectively: becoming a good listener and question-asker; distinguishing between what someone does or says and your own reactions or judgments about it; sending "I" messages instead of blame.

Self-disclosure: valuing openness and building trust in a relationship; knowing when it's safe to risk talking about your private feelings.

Insight: identifying patterns in your emotional life and reactions; recognizing similar patterns in others.
Self-acceptance: feeling pride and seeing yourself in a positive light; recognizing your strengths and weaknesses; being able to laugh at yourself.

Personal responsibility: taking responsibility; recognizing the consequences of your decisions and actions, accepting your feelings and moods following through on commitments (e.g., to studying).

Assertiveness: stating your concerns and feelings with anger or passivity.

Group dynamics: cooperation; knowing when and how to lead, when to follow.

Conflict resolution: how to fight fair with other kids, with parents, with teachers; the win/win model for negotiating compromise.

Goleman shares the learning results of the students involved in these school projects. The success rate was overwhelmingly positive in all areas of social and emotional learning.

Rebecca Novick (1998) describes how the Comfort Corner at Helen Baller Elementary School provides a safe supportive environment for students to learn and practice recognizing and manage their emotions, understand how others think and feel, and have the ability to form caring relationships. Kathy has served as "a special friend and listener" to over 300 children since the program began by
fostering emotional intelligence and resiliency which are considered as important as the traditional subjects. Research on resilience shows that when schools establish high expectations for all children - and give the support necessary to live up to the expectations - they have high rates of academic success (Benard, in Novick, 1998). Students form a positive self-image as learners, problem solvers, friends and family members in psychologically safe environments that offer stimulating activities and opportunities to form personally meaningful relationships. Schools have become a vital refuge for many children (Novick, 1998).

The final goal of the educational process should be to produce caring, responsible, productive adults that will perpetuate our society and improve the quality of life for all its members. Just as Gardner's multiple intelligences have identified career prerequisites, so too, has several qualities of the emotional intelligence and this has generated a generic emotional competence framework for future employment (The Consortium for Research on Emotional Intelligence in Organizations, June, 1999):

Personal Competence

Self-Awareness:
Emotional awareness: Recognizing one's emotions and their effects.
Accurate self-assessment: Knowing one's strengths and limits.
Self-confidence: Sureness about one's self-worth and capabilities.
Self-Regulation:
Self-control: Managing disruptive emotions and impulses.
Trustworthiness: Maintaining standards of honesty and integrity.
Conscientiousness: Taking responsibility for performance.
Adaptability: Flexibility in handling change.
Innovativeness: Being comfortable with and open to novel ideas and new formation.
Self-Motivation:
Achievement Drive: Striving to improve or meet a standard of excellence.
Commitment: Aligning with the goals of the group or organization.
Initiative: Readiness to act on opportunities.
Optimism: Persistence in pursuing goals despite obstacles and setbacks.

Social Competence

Social Awareness:
Empathy: Sensing others' feelings and perspective, and taking an active interest in their concerns.
Service Orientation: Anticipation, recognizing, and meeting customers' needs.
Developing Others: Sensing what others need in order to develop, and bolstering their abilities.
Leveraging Diversity: Cultivating opportunities through diverse people.
Political Awareness: Reading a groups' emotional currents and power relationships.
Social Skills:
Influence: Wielding effective tactics for persuasion.
Communication: Sending clear and convincing messages.
Leadership: Inspiring and guiding groups and people.
Change Catalyst: Initiating or managing change.
Conflict Management: Negotiating and resolving disagreements.
Building Bonds: Nurturing instrumental relationships.
Collaboration and cooperation: Working with others toward shared goals.
Team capabilities: Creating group synergy in pursuing collective goals.

Our schools are caught in the middle of a heartbreaking, frightening, and immoral upheaval of violence on their campuses. Students of all ages, gender, ethnicity, and religious and political background, are killing other students and teachers. School is no longer a safe place to be. The emotional impact of this tragic fact
is devastating to all. There have been shootings from small farm town communities to large metropolitan cities. No one is safe, anywhere in the United States. It's time to address the needs of the students before these terrible atrocities happen. Realizing that there is a need for a nonviolent social change, Guy, de Mallac (1994) details strategies of action for combating this violence. The format covers human basics for survival, economics, communication, government/politics, and education and reflect the qualities of emotional intelligence. His five strategies of a nonviolent education are:

- Develop education for peace and nonviolence, education in nonviolent communication, in mutual understanding and cooperation. This should be the basis for curriculum and the framework within which all educational subjects fit.

- Have the students/learners learn from work and learn from life. Encourage full and responsible involvement in various crafts and in various other forms of work (such as agriculture). All should do some necessary manual work.

- Work on self-improvement, on achieving knowledge and mastery of self, on education the individual character and on development of truthfulness, and fearlessness.
• Self-sufficiency is to be developed on the basis of student's ability to learn from life, and to cope with a variety of manual tasks. Self-sufficiency is the ability to adapt to tomorrow's knowledge and context, after aspects of today's knowledge become obsolete. Educate for tomorrow's context.

• Develop the crucial dimension of outreach. Learn to intuit or discover the needs of others, to meet such needs, and to do committed volunteer service for the welfare of all.

As Mahatma Gandhi so wisely said, “Mankind has to get out of violence only through nonviolence. Hatred can be overcome only by love. Mankind is at a crossroads. It has to make its choice between the law of the jungle and the law of humanity. Nonviolence cannot be preached. It must be practiced.”

Robert Sylwester (1995) Professor of Education at the University of Oregon, says that current educational system pays lip service to educating the whole student, but school activities tend to focus on the development of measurable, rational qualities. They measure students' spelling accuracy, not their emotional well-being. As the budget gets tighter, districts cut the difficult-to-measure curriculum that tilt toward emotion, like art, music, dance, and drama. Many studies show that emotion is very
important to the educative process because it drives attention, which drives learning and memory. Control and accountability aren't as central to emotion as they are to schools. Recent research developments are unlocking the mysteries of how and where our body/brain determines what it likes, merely tolerates, and avoids. The emotional system emerging from this research is complex, widely distributed, and error-prone system that defines our basic personality very early in life and is quite resistant to change.

Brain-Based Learning

Many educators and others know that schools must change and move beyond simplistic, narrow approaches to teaching and learning. Renate Nummela Cain, an Associate Professor of Education at California State University, San Bernardino and Executive Director of CSUSB Center for Research in Integrative Learning/Teaching and Geoffrey Caine, a consultant specializing in adult learning and an Adjunct Member of Faculty at the University of Redlands, California, Whitehead Center for Lifelong Learning, offer a challenge for change using brain-based learning. Research shows that "the brain does not separate emotions from cognition, either anatomically or perceptually. Hence, brain research challenges the belief that teaching can be separated into the cognitive, affective, and psychomotor
domains. A physiological model of memory also calls into question the notion that learning must take place through rote memorization. In addition, by understanding properties of our spatial memory system, educators can understand that teaching to behavioral objectives ignores other functions of the brain and other aspects of memory and learning” (Caine and Caine, 1991). By gleaning from cognitive psychology, education, philosophy, sociology, science and technology, the new physics, and physiological responses to stress, and well as neurosciences, the Caines (1991) have created a framework, with integrity, that integrates human behavior and perception, emotions and physiology.

Crowell, Caine, and Caine (1998) suggest that now is the time to look at a new approach to learning. It is possible that the “delivery method”, that has so long been the dominant approach to learning and teaching, may not be the way for all students to obtain knowledge. They explain about the three kinds of knowing. The first is surface knowledge mostly found in textbooks and curriculum guides. It is mounds of facts and information that teachers are expected to “cover” and that students “need to know it.” Some students find this surface knowledge boring and meaningless to them because of their various ethnic and cultural backgrounds. The second kind of knowledge is technical or scholastic knowledge that is more skill based
and places a greater emphasis on depth and relationship. Unfortunately, this kind of knowledge rarely goes outside its disciplinary boundaries. The third kind of knowledge is dynamical knowledge that comes alive for the students. Most people experience dynamical knowledge when they are absorbed in hobbies, special interests, or creative activities. It is important that all students experience dynamical knowledge at all levels of schooling. Crowell, Caine, and Caine believe that if teachers aim for "learners as experts," there will be a new kind of energy throughout education. They define brain-based learning as a process of making natural, self-determined changes in the learning environment, the teaching, and the curriculum that reflect a deeper understanding of how we learn is what we learn.

Based on a synthesis of research from the fields of neuroscience, physiology, optimal performance studies, neuropsychology, stress management, psychology and more, Crowell, Caine, and Caine (1998) have made this research particularly relevant to educators in the form of twelve brain-based principles:

1. The brain is a complex system.

Perhaps the most potent feature of the brain is its capacity to function simultaneously on many levels and in many ways, which is one reason we have combined two principles (the brain is a parallel processor and
learning engages the entire physiology). Thoughts, emotions, imaginations, predispositions, and physiology operate interactively as the entire system interacts with and exchanges information with its environment. Moreover there are emergent properties of the brain as a whole system that cannot be recognized nor understood when isolated parts are explored. Education must come to terms with the multifaceted nature of the human learner.

2. The brain is a social brain

We begin to be shaped as our immensely receptive brains/minds interact with our environment and within relationships. Vygotsky is partially responsible for noting the connection between social interaction and knowledge. Throughout our lives, our brains/minds change in response to their engagement with others - so much so that individuals must always be seen to be integral parts of larger social systems. Indeed, part of our identity depends on establishing community and finding ways to belong. Learning, therefore, is profoundly influenced by the nature of social relationships.

3. The search for meaning in innate.

"The search for meaning" refers generally to making sense of our experiences. This search is survival
oriented and basic to the human brain/mind. While the ways in which we make sense of our experience change over time, the central drive to do so does not. At its core, the search for meaning is purpose and value driven. Maslow noted the extent of this human search. Included are such basic questions as “Who am I?” and “Why am I here?” The search for meaning ranges from the need to eat and find safety through the development of relationships and a sense of identity to an exploration of our potential and the quest for transcendence.

4. The search for meaning occurs through patterning.
Patterning includes innate and acquired schematic maps and categories. The brain/mind needs and automatically registers the familiar while searching for and responding to novel stimuli. Therefore, the brain/mind is both scientist and artist, discerning and understanding patterns as they occur and giving expression to unique and creative patterns of its own. It resists having meaninglessness imposed on it. By Meaninglessness, we mean isolated pieces of information unrelated to what makes sense to a particular learner. Effective education must give learners an opportunity to formulate their own patterns of understanding.
5. **Emotions are critical to patterning.**

What we learn is influenced and organized by emotions and mind-sets involving expectancy, personal biases, self-esteem, and the need for social interaction. Emotions and thoughts shape each other and cannot be separated. Emotions color meaning. The emotional impact of any lesson or life experience may continue to reverberate long after the specific event that triggers it. An appropriate emotional climate is indispensable to sound education.

6. **Every brain simultaneously perceives and creates parts and wholes.**

Although there is some truth to the "left-brain/right-brain" distinction, it does not tell the whole story. In a healthy person, both hemispheres interact in every activity, from art and computing to sales and accounting. The two-brain doctrine is most useful for reminding us the brain reduces information into parts while perceiving holistically. Good training and education recognize this phenomenon, for example by introducing natural global projects and ideas from the beginning.

7. **Learning involves focused attention and peripheral perception.**
The brain absorbs information of which it is directly aware, but it also directly absorbs information that lies beyond its immediate attention. In fact, it responds to the larger sensory context in which teaching and communication occur. "Peripheral signals" are extremely potent. Even the unconscious signals that reveal our inner beliefs have a powerful impact on students. Educators should pay extensive attention to all facets of the educational environment.

Learning always involves conscious and unconscious processes.

One aspect of conscience is awareness. Much of our learning is unconscious in that experience and sensory input is processed below the level of awareness, which means that much understanding may not occur during a class but hours, weeks, or months later. It also means that educators must organize what they do so as to facilitate that subsequent unconscious processing of experience by students. In practice, this organization includes proper design of the context, the incorporation of reflection and metacognitive actives, and the incorporation of methods to help learners creatively elaborate on the ideas, skills, and experiences. Teaching largely becomes a matter of helping learners make visible what is invisible.
9. We have at least two ways of organizing memory. Although there are many models of memory, one that provides an excellent platform for educators is the distinction made by O'Keefe and Nadel (1978) between taxon and local memories. They suggest that we have a set of systems for recalling relatively unrelated information (taxon system, from taxonomies). These systems are motivated by reward and punishment. They suggest that we also have a spatial and autobiographical memory that does not need rehearsal and allows for instant recall of experiences. This system registers the details of your meal last night. It is always engaged, inexhaustible, and motivated by novelty. Thus we are biologically supplied with the capacity to register complete experiences. It is through a combination of both approaches to memory that meaningful learning occurs. Thus meaningful and meaningless information are organized and stored differently.

10. Learning is developmental. Development occurs in several ways. In part, the brain is plastic, which means that much of its hard wiring is shaped by the experiences that people have. In part, there are predetermined sequences of development in childhood, including windows of opportunity for laying down the basic hardware necessary for later
learning. For this reason, new languages and the arts ought to be introduced to children very early in life. Finally, in many respects, there is no limit to growth and to the capacities of humans to learn more. Neurons continue to be capable of making new connections throughout life.

11. **Complex learning is enhanced by challenge and inhibited by threat.**

The brain/mind learns optimally - that is, it makes maximum connections - when appropriately challenged in an environment that encourages taking risks. However, the brain/mind downshifts under perceived threat. It then becomes less flexible and reverts to primitive attitudes and procedures. We must create and maintain an atmosphere of relaxed alertness that involves low threat and high challenge. However, low threat is not synonymous with simply feeling good. The essential element of perceived threat is a feeling of helplessness or fatigue. Occasional stress and anxiety are inevitable in genuine learning because genuine learning involves changes that lead to a reorganization of the self. Such learning can be intrinsically stressful, irrespective of the skill of, and support offered by, a teacher.
12. **Every brain is uniquely organized.**

We all have the same set of systems, yet we are all different. Some of this difference is a consequence of our genetic endowment; some of it is a consequence of different environment and experiences. The differences express themselves in terms of learning styles, differing talents and intelligences, and so on. An important corollary is both to appreciate that learners are different and need choices while ensuring that they are exposed to a multiplicity of inputs. Multiple intelligences and vast ranges of diversity are, therefore, characteristic of what it means to be human.

To be able to put this brain based principles into practice, teachers will need to place an emphasis on three factors of brain-based learning.

The first is **relaxed alertness**, which refers to a state of mind that allows optimal performance, and to the creation of an environment that supports this condition. There should be an absence of threat but the presence of challenge. The learner must be physically relaxed and open to expend energy toward a focused and purposeful goal. This is necessary to achieve and maintain high levels of performance.

Second, is **orchestrated immersion** in complex experience. Students learn best when they are immersed in
multilayered experiences that allow them to recognize relevant patterns and understand their connections. The key to orchestrated immersion is that it involves complex experiences. A skilled teacher will be able to help students glean information, skills, value lessons, and concepts that present themselves as parts of many wholes rather than as separate parts.

And last, active processing refers the ways we process or learn from our experience. In short, active processing provides an opportunity for meaning making. Asking quality questions, giving feedback of substance, and the desire to explore beyond the present are but a few of the rewards a teacher can assist students in perceiving each experience as a learning opportunity. It would seem logical that thematic lessons might be a perfect vehicle for putting this brain-based principals into action.

By recognizing that students learn in various ways and at different rates, Ellen Weber (1998) states that it is imperative for educators to adjust their classroom practices to accommodate multiple ways of knowing, while honoring the demands of curriculum mandates, state requirements, college entrance expectations and use alternative assessment tools. She feels that it is important to have a collaboration of students, teachers, and parents to ensure that quality ideas and materials will arise for relating student's knowledge to real life. Weber
points out that teachers who involve other cultures in their classrooms can avoid the problem of narrow expectations by letting parents and students bring the best of their past and their expectations into the classroom. Weber also agrees with Gardner and his research team that has led the way toward improved testing that relates abstract theories and facts to solve real-world problems by engaging students' unique abilities and interests.

Weber reminds us that, authentic assessment refers to facts related to real life and it is important to remember that authentic assessment, or brain-based assessment, which include collaboration, is not about out with the old and in with the new. It is about introducing tools that engage multiple intelligences to accommodate expanded methods of solving common problems. Whenever the dynamics of interpersonal relationships, diverse learning styles, or power imbalances obstruct a group's flow of communication, Weber offers a menu of conflict resolution strategies that can help students resolve and diffuse conflict situations. It is critical that students be given rubrics that clearly define criteria and expectations, at the beginning of any assignment, to help guide them through planning and execution of their ideas. Without this they may feel confused and frustrated. Weber also provides a checklist for implementing brain-based tasks that will enable
teachers to survey specific approaches that support and accommodate brain-based learning.

Carolyn Pool (1997) discussed the impact that early childhood development has on the way children learn and the findings have enormous implications for schools, even preschools, because so many neurological pathways critical for later life are laid down from age zero to three years old. These pathways affect the way children interact with formative experiences in later developmental stages. These patterns also include children's beliefs about themselves and their world, which continue into adulthood. Pool is concerned about the threats to learning - child abuse, poverty, malnourishment, family and community violence - that many children are faced with everyday. Children who live with such fear develop perceptual loops by looking for signals in their environment and feel helpless because of their limited choices of behavior. When students do as teachers ask, they downshift into what they do well, like memorizing, because the brain perseverates under threat and likes to do things over and over again - this repetition gives them a sense of safety when they feel helpless. "Real learning - making connections, higher-order think, and creativity - is incompatible with that kind of environment" (Pool, 1997).
Caine and Caine (1998) reflect on the role of low threat/high challenge and its relation to learning. They make a connection between emotions and cognition by looking at their first four principles and acknowledging the importance of the "affective domain" and also realize that cognition and emotion tend to be regarded as separate. The interaction of cognition and emotion is now being seen to be more intricate. These authors refer to the work of LeDoux and his colleagues' research (1996) that has traced the role of fear in the brain. Information entering the brain is processed by the appropriate sensory thalamus. The thalamus, only perceives a very crude impression of what is "out there." If what is out there does not engender panic or fear, the information splits, going to the visual cortex for a clearer impression and also to the amygdala, which deals largely with the emotional impact of what is being perceived by the person.

When threat and fear are relatively absent, the brain appears to be able to engage in more complex processes. Novelty, purpose, and meaning tie to new information or experience create conditions for exciting neurons into new patterns or connections that challenge the learner into new ways of thinking or doing.

Caine and Caine (1998) state that it is imperative that the school creates a safe, authentic community, both
among the adults in a school and among adults and children. "The most critical aspect of brain research on learning is that at least at the level of understanding we are discussing here, brain research is not only true for our students but for ourselves as educators, as well." This could be a difficult task, given the current obstacles of the educational system. Administrators and teachers are being evaluated on the basis of how much students memorize and how well they perform on standardized tests, then asking us to change what we do or learn new methods that do not lead directly to that result will be fruitless. When students in our classes are being asked to memorize for the test, our reaction will be to do what is necessary to enhance our own "grade." At the same time our assumptions about learning and teaching may be challenged by research and even our own beliefs, there is little room for change. Politicians deeply entrenched in the industrial model of learning and teaching are pushing for ever higher scores on standardized tests that reflect memorization more than the ability of students to think and use such information (as they are learning, not "someday").

Educators should be held accountable but accountability should refer to doing what research is telling us about learning and being continually informed. Educators, just like doctors and engineers, cannot afford
to keep practicing without continuously incorporating the best research about learning and practice. After all, educators hold the lives of their students in their hands just as much as doctors do, if not more!

Eric Jensen (1998), a former teacher and staff developer and member of the Society for Neuroscience, shares his thoughts on how teaching does not equal learning and how this mismatch creates frustration, underperformance, and hopelessness. Jensen also explains how new knowledge in neuroscience is redefining possibilities for education by looking at the five critical variables in the learning process. First, the brain is not a blank like a tabula rasa but is customized by one's life experiences. Our neural history is founded on a dynamic interplay between nature and nurture called emergentism. At each developmental stage, different genes are affected the environment and are uniquely expressed (Elman et al., 1998). Genes are not templates for learning. For example, a child raised in isolation would automatically be able to speak if there were a "language gene." Jensen (1998) states that prior learning, character, the environment, peers, and life experiences influence how we learn. If students spend too much time in car seats and not enough time on swings and merry-go-rounds they may have insufficient motor stimulation and experience poor school
readiness. Jensen agrees that exposure to constant threat or early trauma often alters the brain's behavior, creating extreme levels of serotionin and noradrenaline and that a lack of early enriching activities may influence brain development. Extended television watching may create learned helplessness or unduly passive or aggressive behaviors.

Second, the typical adolescent brain may be too immature to learn context by reading complex facial clues. Inappropriate reactions may be the result of misreading peer or role model facial cues. Neuroscience Candace Pert says, "Unexpressed emotions can inhibit many functions, including learning. Therefore, teachers should allow for a wider range of emotional expression by including more singing, drama, sharing, music, writing, drawing, open discussion, and celebrations. Educators must help reconnect learners with peers, teachers, and content.

Third, Too much attention to anything may be counter adaptive. Peer discussion or environmental stimuli are important factors that are learned through indirect acquisition. Brain-compatible teachers keep attention demands to short bursts of no more than the age of their learners, from first graders at about 6 consecutive minutes to high school students up to 15 minutes.
Fourth, elaboration is the sorting, sifting, analyzing, testing, and deepening of learning in a way that gives students genuine feedback on how well they understand. It ensures that their information is correct. The best feedback is specific and timely. By providing different kinds of feedback teachers might see more accuracy in what students learn and students may develop greater intrinsic motivation for learning. Students' brains develop better patterns of thinking because they have more thorough, detailed, reality-tested models for learning.

Fifth, Jensen elaborates on encoding. A memory trace may be created by learning the information but may not be strong enough to activate at test time. Retrievability depends on rest, emotional intensity, context, nutrition, and quantity of associations, matching states, and learned pathways. Rest is a powerful memory aid, during our dreamtime, we process learning from the previous day by discarding meaningless information and strengthening the rest. When deprived of dreamtime, or REM (rapid eye movement) sleep, we can still learn material by memorization, but we are weaker at logic and cannot learn complex material.

The brain activity that occurs as we sleep is critical to maintaining our memories; according to Robert Sylwester (1995) "The development of long-term memory requires the
physical reconstruction of the brain's synapses in the affected neural networks. But this requires shutting off activity during the rebuilding process, much as a paving crew must detour traffic while a road is rebuilt. Our brain has this opportunity as we sleep, reducing sensorimotor activity while it reconstructs and resets the memory networks that have emerged during the days events."

Jensen goes on to explain that an intense emotion during or after learning is a reliable way to produce long-term memory encoding. The neurotransmitter acetylcholine is good for long-term memory formation. Researchers have found that the chemistry of our body, which regulates our physiological states, is critical in triggering our recall. By increasing the quantity of associations we increase recall because all recall is associative. Finally, Jensen says that teachers must match the memory mechanism at assessment time or a student will know the information but will not be able to demonstrate knowing it. The semantic memory system processes words, facts, pictures, stories, and text if students learn with this pathway (linguistic or spatial intelligence) they will need to activate similar association to retrieve information. The episodic memory pathway is activated by unique circumstances rather than content. The procedural and reflexive pathways are harder to test because they reflect a different kind of learning
that includes body learning, conditioned response, and intuitive knowing. (bodily kinesthetic, musical, spatial, interpersonal, intrapersonal, and emotional intelligence).

Jensen stresses that each memory pathway appeals to different students and has strong implications for assessment and learning transfer. The more that schools and teachers can make their classrooms brain-compatible and the more that schools try to match teaching to the way students learn, the more likely they are to reach students and bring out their natural motivation to learn.

Lawrence Lowery (1998) describes how learners do not simply mirror what they are told or what they read and that the brain does not store a picture of an event. The brain does store a record of the neural activity that takes place in the learners' sensory and motor systems as they interact with the environment. Each record is a pattern of connections (dendrites/synapses) among brain cells (neurons) that can be reactivated to recreate the component parts of the experience. The reactivation defines the materials involved in the experience and other characteristics of the event. All events that the learner does, perceives, or feels while acting in the world gets processed through complex systems of storage and pathways. It would be to a teacher's advantage to understand that the brain categorized nonlanguage sensory perceptions of the world in different places. Shapes are stored in one place,
color in another. Movement, sequence, textures, and emotional states are each stored separately. Aspects of language are also stored in various parts of the brain. Nouns are separated from verbs, and phonemes are separated from words. As the brain constructs connections among brain cells, it connects the organizations of words, objects, events, and relationships in successively interwoven layers of categories. The result is that human knowledge is stored in clusters and organized within the brain into systems that people use to interpret familiar situations and to reason about new ones. When this all comes together, the totality forms the basis for abstract thinking and problem solving. Thus, the goal of the teacher and the curriculums must be to make what the student is capable of learning more useful, effective, relevant, and interesting and enable the student to progressively build, from grade level to grade level, an understanding of the grand idea of a subject by relating subsequent knowledge to prior knowledge.

Within the educational setting, Pat Wolf (1999) presents four goals to better understand how the brain/mind works and to explore the implications of the research for:

1. you personally - your own learning.
2. your students - how they learn and what you can do to increase their understanding and ability to use information.

3. your teaching - how you structure your classroom and instructional activities.

4. our educational system, especially in the areas of curriculum and assessment.

Someone once said, "Know your self." It would seem that the brain is a good place to start. Wolfe explains how the neurons, 10 percent of the brain's cells, are the basic functional unit of the nervous system and glial cells, 90 percent, provide support and nutrients for the neurons and that these cells are responsible, from fetal development to adulthood, for the development of short-term, working-memory, and long-term memory systems. With the input of sight, sound taste, smell, and touch, it takes these cells about 1 to 2 seconds to go from the sensory-memory to and from the working-memory then to and from the long-term memory. Wolfe believes that this process is important because anything that captures the students' attention and gets their minds engaged, has the potential to produce learning. Need, novelty, cognitive dissonance, intensity of stimuli, meaning, emotion are factors that influence attention. On the other hand, no attention, no engagement, thus no learning.
It is known that the brain is continuously trying to make sense out of its world, attempting to determine what is meaningful in what it experiences. It does this by sending the stimulus on a journey, starting with the sensory receptors then to the thalamus and on to the appropriate sensory cortex, next to the amygdala and hippocampus, where it questions "meaningful" or "emotional," and ending the journey in the frontal cortex. Every encounter with something new requires the brain to fit the new information into an existing memory category, or network of neurons. If it cannot do this, the information will have no meaning. Only by linking new information to a prior experience or creating the experience with students, can teachers make the information meaningful.

According to Wolfe, emotions are biological functions of the nervous systems and strongly influence attention and memory and that emotional arousal occurs in response to events of any kind that the organism finds important. The "fight or flight" responses take place in the amygdala because it is the psychological sentinel that continually assesses the importance of stimuli, asking if it is potentially dangerous, hurtful, joyful, aversive, etc. If the answer is "yes," chemical messages are immediately sent out through the nerves of the autonomic nervous system to
bodily organs to adjust the activity of those organs to match the demands of the situation. The amygdala controls the emotional memory, feelings and the hippocampus controls the declarative memory, facts.

The implications for meaning, emotion and learning are threefold. First, Information is more likely to be attended to and remembered if it has meaning to the student and contains an emotional "hook." Second, an optimal level of emotion is necessary for learning to occur. Either too much or too little reduces the efficiency of the neocortex. Third, while many emotional responses are automatic, humans have the ability to switch to willful control and develop emotional plans. Students can be taught to be actors, not just reactors (Goleman's Emotional Intelligence). As Joseph LeDoux so aptly put it, "Surviving is not just something to do in the presence of a wild beast. Social and learning situations are often survival encounters."

Brain researchers have been asking, "Why do most adults react differently than adolescents to the same information?" As viewed on the (Discovery Channel Science Series, 2001) "The Brain and How it Works," researchers have learned that adolescents are still processing information in the amygdala and adults have transferred this process to the frontal cortex giving them the advantage of reason and logic. This might tend to explain
that student's actions or reactions may not be linked to behavioral problems but simply, a normal processing function of the brain. Researchers have ruled out I.Q. as a factor and admit that there is no chronological age, since all humans are different, for this transfer to occur.

According to Juan Pascual (1970), the capacity of short-tern memory appears to develop with age. The number of spaces increased by one unit every other year beginning at age three. That might explain the "use it or lose it," theory. Studies of older people, some over 100, show that those who have a love of learning, keep mentally active, interact with others, read books, love music, appreciate art, or have some kind of hobby promotes a healthy brain and can continue to lead a fruitful life. Would it not be a joyous feeling to know that, as a teacher, you might spark that love of learning in a student that just might live to be over 100 years old.

It is extremely important for teachers to understand how the brain grows and functions because, early experiences are so powerful that they can completely change the way a child turns out. Wolfe suggests that the neural plasticity of the brain is changed by the environment. Enriched environments will increase cell weight and branching of dendrites in the brain. Impoverished environments will decrease in cell weight, cause possible
loss of cells, and diminish dendrites. Genes are the basic building blocks but the environment provides the instruction for the final construction of the brain. Myelination is a fatty substance (glial cells) that coats the axon and speeds the electrical impulse, it appears to develop in a preset pattern from birth to about age 20, and in the human brain, myelination is delayed in the sensory pathway. Its function appears to determine the critical periods or "windows of opportunity" for proper development of neural pathways. If the necessary stimuli aren't available or if certain skills remain unused during these periods, the pathways may not develop properly and the potential for those skills may never be developed (Wolfe, 1999).

David Sousa (1998) offers justification for the inclusion of brain-based research in the classroom. The rapidly changing, multimedia-based culture and the stress from ever increasing pace of living have a dramatic impact on how the developing brain interprets and interacts with its world. Today's children spend much more time with television and other electronic media than their parents. They have become accustomed to rapid sensory and emotional changes, and they respond more readily to the unique and different - what we might now call novelty. Teaching and schools have changed little from the industrial model and
agrarian calendar persist (although year-round schedules are on the increase). Lecturing continues to be the main method of instruction and overhead projectors the most advanced technology used. Because students see the relevancy in what they are learning, they have a difficult time focusing for extended periods and are easily distracted. Too many students, school is seen as a dull, non-engaging environment that is much less interesting than what is happening outside of school.

The advancements in neuroscience require that we now shift our focus to the learning process. The sooner the districts acknowledge that the brain-based is not a packaged program or bandwagon the sooner they can get down to the business of teaching students. With this acknowledgment teachers must have a thorough understanding of how the brain develops, learns, and organizes itself, then they can make better decisions about teaching and using programs such as multiple intelligences, learning styles, and cooperative learning more efficiently. It comes down to working smarter, not harder.

The public has never before demanded so much of schools and teachers. Yet, at the same time, we have a continuous stream of knowledge about how the brain learns that will enhance our school and classroom practices. This is an exciting time to be in education because neuroscience
holds the promise for a quantum leap in our profession. "We are like pioneers, venturing not westward, but inward." (Sousa, 1998) Guild and Chock-Eng (1998) tell us that there are overlapping messages in multiple intelligence, learning styles, and brain-based education. They state that the educators who believe in these concepts will bring an approach and attitude to their teaching of focusing on how students learn and the unique qualities of each learner.

They propose that there are six commonalities that overlap. Each of the theories is learning and learner-centered.

The learner is the most important focus of the educational system. In an appropriate way, students are the center of attention. Schools that are learner-centered focus their energies on helping all students to be successful learners. They weigh decisions about structure, rituals, routines, class composition, curriculum content and materials, and assessments and evaluation for their effect on the learners' needs and interests. Curriculum in organic, not preset to be covered in a specific time. The learning process is the dominant focus.

The teacher is a reflective practitioner and decision maker. In order to appropriately apply learning styles, multiple intelligences, and brain-based
education, teachers must understand the theories, continue to study and reflect upon them, and make appropriate applications for their own students and their own situation. The principles of the theories are a rational for decisions and a catalyst for continual examination of schooling practices. Teachers have frequent and challenging conversations about their work.

The student is also a reflective practitioner. Students talk about their own learning and are active in the planning and assessment process. They are engaged in exploring, experimenting, creating, applying, and evaluating their ways of learning as well as interacting actively with the content and concepts they are studying. Students develop and appropriate sense of control over their own learning by applying skills to access knowledge and gain content mastery. The whole person is educated. Teachers pay attention to the cultural, physical, social, and emotional life of the young adolescent as well as to his or her academic life. Each of the theories promotes personalization of education by connecting the students' total life to the learning in the classroom.
Educators acknowledge developmental stages of young adolescents and consider it in the instructional and curriculum decisions. They consciously value the adolescent's search for self-awareness. Respect for every individual is paramount and is evident in the climate of the school, including its management and its discipline procedures. When a student has a learning problem, comprehensive knowledge about the student becomes the basis of the solution.

The curriculum has substance, depth, and quality. Basic skills are treated seriously and frequently learned in context of the appropriate applications. Schools spell out high and sometimes uniform standards for learning outcomes, but they consciously avoid standardization of curriculum and methodologies. Proponents of brain-based education, learning styles, and multiple intelligences convincingly demonstrate that accommodating the students' learning strength and individual intelligences and attending to ways the brain absorbs and processes information will result in more effective and efficient learning.

Each of these theories promotes diversity. It is a core principle in each theory that individuals are unique and that this uniqueness has an effect on students' various ways of learning. Teachers and students celebrate and foster diversity. They promote
respect for both the differences and similarities among people in the school. They practice working together in productive ways.

Guild and Chock-Eng express some common cautions and remind teachers to not get caught up in the specific terms, labels, and vocabulary and to know that the original researchers of the theories warn against trivial quick-fix practices in the name of the theory. “Currently, too many students are not learning successfully in our schools—for a whole variety of reasons. Application of the theories of multiple intelligence, learning styles, and brain-based education offers more students the opportunity to succeed by focusing attention directly on how they learn. This priority is long overdue in our schools. We would be wise to keep the common principles of the theories of learning styles, brain-based education, and multiple intelligences in mind and not let competitiveness and differences among vocabulary and specific applications threaten the positive impact for teacher and students.” (Guild and Chock-Eng)

All of this can be a bit overwhelming but if you take one day at a time, one student at a time, and one lesson at a time, it will all come together and teaching will naturally take on a new meaning and glow. You will be able to look at that one student and recognize his/her dominant intelligence or learning style. You will look at you
In 1988 Bill Honig, Superintendent of Public Instruction for the California State Department of Education, formed the School Readiness Task Force to evaluate the kind of education necessary during the crucial early years of a child's life that would prepare them for the twenty-first century. He reminded the Task Force that these students would be expected to participate in a society far more complex than previous generations encountered. These students must have the necessary skills to compete in an increasingly technological job market. They also must have the civic and ethical values to keep our democracy alive and develop the potential. While it is important for children to learn basic skills, the teaching techniques and the curriculum used must reflect the proper balance between child-centered activities and content-curriculum approaches that are appropriate to each child.

In 1992 the Elementary Grades Task Force was formed to look at elementary education in California for three principal reasons. Each of these reasons has to do with fundamental change - in the make-up of the student.
population; in societies, expectations about what elementary school should accomplish; and in our understanding of how children learn. They looked at modern cognitive research and found that children are more like natural scientists bent on making sense of the world as opposed to the view that children are empty vessels that the teacher filled up with knowledge. The Task Force developed 32 recommendations to implement the restructuring of the California educational system. Qualitatively, they called for a shift from a skills-based pedagogy in which the teacher serves as the dispenser of knowledge to a hands-on, student-centered, experiential one. Quantitatively, they called for a greater depth of understanding in a wider range of knowledge areas than were ever before attempted at the elementary level.

Jasparro (1998) says that along with the standards movement, system thinking is emerging as a powerful influence on school improvement. He sees such reform requires coordinated changes in the entire educational system and should focus simultaneously on the core areas of the educational system: organization, curriculum, instruction, assessment, and professional development. Hopefully Gardner's multiple intelligence theory, learning styles, brain-based learning will be considered.
Spiritually in Education

Spirituality in education is but another alternative strategy to be considered. It is not about church, state, religion, or politics. Glazer stated (1999) that the heart of learning is within each one of us and comes from our experiences and perceptions. Practicing it can be seen as one approach towards dealing with anxiety or meaningless. Hooks said, “So think first about how you can love your students. Do this even before you think about how you're going to teach them. Think: How can I love these strangers, these others that I see in the classroom? What practice of compassion can I bring to the moment...This kind of awareness or mental discipline is something that dedication and other kinds of awareness practices can enable in us...But you can't develop this kind of awareness without practice, without examining again and again how to are seeing the people you are teaching.” (Glazer, P. 125)

Sam Crowell said, (James Reserve retreat, Sum. 1999) that we must remember three things. First, that the heart is more important than the brain because it is the seed that makes us do things and is the center for nurturing all things. Second, being is more important than doing because our lives are just a series of experiments. Third, doing together is better than doing alone.
To make this work in the classroom and put spirituality into education we must acknowledge the work of past educators like Montessori and Steiner who believe that "the hands are the instruments of man's intelligence...and education flows from experience" (Glazer, p. 196). By following the examples of Emilia and Piaget. "Teachers need to give children more opportunities - and more time - to construct their understanding," (p. 197) and be mindful of Waldorf's model of holistic education. Do not be afraid to experiment with whole language, thematic teaching, multiple and emotional intelligences, brain-based theories, and (TPR) total physical response principles. A good rule of thumb might be, if it works, do it!

As teachers we need two kinds of creativity to reach the students that come to our classes with low self-esteem, limited vocabulary, no back-ground knowledge to scaffold on, and are physically, emotionally, academically and economically challenged. As Goswami explains (Glazer, 1999) that outer creativity involves discoveries external to oneself; the product of outer creativity is meant for the society at large. In contrast, inner creativity is inner-directed. Here the product is personal transformation of one's own context of living. Teachers should be aware of and open their hearts and minds (unconscious and conscious) to events that take place as "ah-ahs" experiences in our
lives. An unconscious event might be driving home and not remembering how you got there. A conscious ah-ah could be the thrill of seeing a student's face light up as they "get" what you were teaching. This is the "ah-ha" that will stay with you forever because you know that through a combination of your outer and inner creativity you made a difference in another being's life in some positive way.

Harding (1999) tells us that one of the most important components of spirituality is the power to overcome our fears. In short, be good to yourself, believe in yourself, listen to your heart, and treat your students in the manner that you hope your children are being treated by their teachers.

Curriculum

William G. Wraga (1997) looks at learning from a curriculum point of view through the eyes of Dewey, Meriam and Bonser. Wraga states that Dewey placed great value on the ways of unifying the curriculum in terms of establishing connections both among its component parts and between the school and the wider society. His ideal was that the experience gained by the child in a familiar, commonplace way is carried over and made use of there, and what the child learns in school is carried back and applied in everyday life, making the school an organic whole, instead of a composite of isolated parts. Meriam proposed
that the traditional subject curriculum be abounded in
favor of organizing student experience into four “studies”: observation, play, stories, and handwork. These new studies are better suited to child development and to achieving the desired quality of purposefulness, focus on “concrete and practical” life activities. Meriam summarized, “The concrete is found in real experience and in actual situation. The practical (the application of content and methods) contributes to both work and leisure.” Echoing McMurry and Dewey, Meriam stated, “Correlation will be natural when the problem studied belongs to real life.” When selecting curriculum, school districts should, like Bonser, insist that any general curriculum must of necessity be organized in terms of purposive activities connections the general interests of pupils with the social objects through the use of stimulating as well as immediately satisfying subject matter.

Some school districts have found that the concept of expeditionary learning works for them. It also turns the old lecture-and-drill inside out. As described by Joanna Richardson (1994), the school-based expeditions run about three to nine weeks and blend together several disciplines under a common theme. Students spend about 25 percent of their time out of the classroom - a big change from periodic field trips, of the past. The rest of their time
is spent on hands-on classroom activities that require students to make connections between their studies and draw their own conclusions. Teachers also take care to make sure expeditions at every grade level meet the district's expectations for teaching such basic skills as reading, writing, and problem solving. But beyond that, schools design many activities simply to encourage a love of books, the desire to learn, or the ability to work with others. Parents get involved as volunteers and feel the biggest benefit of expeditionary learning has been the professional belief the effects of the program will be cumulative. Expeditionary learning builds on the principles of Outward Bound, an outdoor-adventure program founded in England in 1941 by Kurt Hahn, and educator expelled from Nazi Germany. The program made its way to the United States in the 1960's, touting its wilderness expeditions as a way to teach about teamwork, leadership, and perseverance. This is an extreme for most school districts but its good to know that these kinds of programs are out there working and using the basic concepts of the multiple intelligence theories, brain-based principles, and learning styles, even they are not written anywhere.

Fontana Unified School District in California has adopted core curriculum from several publishers that recognize the need to teach to the need of all students and show growth in basic skills. Addison-Wesley incorporates
the use of exploration centers that are specifically geared to tap into each of the seven intelligences in the context of math. Scott Foresman deals with language arts, social studies, and science using a thematic approach that includes art, music, social studies, library, dramatic play, science, writing, and manipulative centers for each lesson. Hampton-Brown is geared to the needs of bi-lingual students. Themes are presented using visuals, literature, audiocassettes, manipulative (picture cards), and technology, to teach songs, poems, chants, stories, and writing to help students move through the stages of language acquisition. In each of the programs, the curriculum design and assessment is in line with the district and state standards for each grade level. The implementation now falls to the teacher to assimilate all of these materials into unique teaching strategies that will facilitate the learning, growth, and assessment of each student.

Date Elementary and other schools in the Fontana Unified School District are participating in a program called Fast Start, which is based on brain research and its implications. This computer program targets third to fifth grade students who would benefit from concentrated lesson as an intervention.
CHAPTER THREE: THEORETICAL FOUNDATIONS

This project is grounded both in theory and research and based on the findings of Howard Gardner and many others in a wide range of fields, including: educational psychology, cognitive psychology, developmental psychology, psychometrics, biographical studies, animal physiology, neuroanatomy, sociology, and anthropology. This curriculum project is guided by sound teaching strategies supported by research and projects of Piaget, Gardner, Teele and others writing in the curriculum theory.

It should be obvious that the multiple intelligence theory is here to stay. Howard Gardner, now author of 19 books, is still doing what he does best. He has joined the ranks of teachers who love children, care about their profession and are fed up with being asked to stuff students with facts to spit back, and who are frustrated with the public's focus on standardized tests.

As facilitators for learners of the future it is our responsibility to accommodate the various needs of all students and their dominant intelligence. Sue Teele spoke to this need by reflecting (unknown author):

ONE TEACHER can make a difference.
ONE TEACHER can open the hearts and minds of students, can instill a feeling of true worth and human dignity that will enable students to surmount the tragedies of poverty, of prejudice, of futility.
We need go no further than the nearest classroom to find students already beaten by life, students who already know they are nobody.

But just ONE TEACHER can help students feel they are somebody - won't you be that one teacher.

The University of California Riverside Extension regularly offers many conferences, seminars, and institutes on the Theory of Multiple Intelligences and makes available for purchase the lessons, from pre school to sixth grade, that are submitted. As part of the credit assignment students (educators) have submitted lesson plans which tap into the dominant intelligences students possess. The goal of these assignments is to introduce an approach to teaching have accesses not only the traditional linguistic and logical-mathematical modes of learning, but those other avenues of learning strengths which often go untapped. It was discovered that after using these lessons, students who were indifferent learners became those who experienced academic success and who, as a result, became committed to long term learning goals (Teele, 1994).

The goal of this project is three fold. First, to provide students with an opportunity to demonstrate their knowledge of basic skills, conceptual understanding, and problem solving related to life science. Second, to expose students to their multiple intelligences, hopefully evoke
enthusiasm for the love of learning using their different kinds of smarts, and encourage them to expand this knowledge into other academic areas and into their everyday life experiences. Third, to dispel the assumptions about the teaching and the learning process, encourage other educators to explore the ideas that are presented here, and boldly go beyond the boundaries to find alternative ways of teaching, assessing, and presenting the curriculum to their students.

Project Design

This project is designed to immerse the students in the world of plants. The goal of this unit is to focus on a learning environment that will enable the students to learn the basic skills they can relate to their own life at home and at school. Lessons and assessments are design to allow all students to learn at their own rate and in their dominant intelligence. It is also designed to integrate the three elements of brain-based learning by creating a state of relaxed alertness in the students and the teacher, orchestrated immersion allows the brain to make sense of experiences and active processing of experiences enabling students to get more meaning from those experiences.

This project is based on the Nation Standards and designed to follow the Fontana Unified School District Science Standards for the curriculum of Life Science in kindergarten and first grade. These standards state that
the students will know and understand the characteristics and structure of living things; the processes of life and how living things interact with each other and their environment. For more details, refer to the introduction.
CHAPTER FOUR: EVALUATION

The nature of this project dictates that the evaluation be done qualitatively and the rational for this is based on the following. According to Strauss and Corbin (1998), Patton, a qualitative evaluation researcher, stated that, "Qualitative evaluation inquiry draw on both critical and creative thinking - both the science and the art of analysis" (p.13). Patton suggested that every analyst needs to keep several behaviors in mind that could promote creative thinking. They included: being open to multiple possibilities, generating a list of options, exploring various possibilities before choosing any one, making use of multiple avenues of expression such as art, music, and metaphors to stimulate thinking, using nonlinear forms of thinking such as going back and forth and circumventing around a subject to get a fresh perspective, diverging from one's usual ways of thinking and working, again to get a fresh perspective, trusting the process and not holding back, not taking shortcuts but rather putting energy and effort into the work, and above all, having fun while doing it. They went on to say that "Analysis is the interplay between researchers and data" (Strauss and Corbin, 1998).

The strengths for this type of evaluation can be found in the format of each lesson assessment section, which
details and describes the assessments to be considered for that lesson.

- **Performance Assessment** uses a plus/minus checklist to evaluate students' performance and growth over time (Appendix L).
- **Personal Communication Assessment** is observations, interviews and antedotal notes (Student Interview Form Appendix K) to evaluate student reasoning and identify dominant intelligences for each lesson.
- **Open-ended Questions Assessment** provides teacher with insight on how students are problem solving.
- **Scientific Investigation Assessment** measures the individual learning capabilities and strengths of students through hands-on experiments. Results and example are placed in the student's portfolio file (student comments, teacher observations, pictures, etc.)
- **Portfolio Assessment** provides a permanent long-term record of students' progress, reflections, and evidence of performance beyond factual knowledge gained (Appendix J).
- **Selected Response Assessment** demonstrates certain types of student achievements with accuracy and efficiency. Pre and Post-test to determine prior knowledge and final knowledge gain as a result of
participation in this unit, also specific level of
growth as units progress. Results and examples are
then placed in the student's portfolio file.

This project was designed with a pre-test and post-
test to tap knowledge, mastery, and reasoning. Dr. Sue
Teele (1998) suggests that these multiple types of
assessment can be used to engage the student in challenges
that are more realistic.

Each lesson also has an explanatory Rubric for
Assessment ranging from 4, which describes “full
accomplishment”, to 1 that describes “little or no progress
toward accomplishment.” Before this project was presented,
each student was given the TIMI (The Teele Inventory for
Multiple Intelligences) to determine his or her dominant
intelligences. This information can be used to correlate
different student intelligences, assessments, and analysis
of the project.

The participants in the project were students in a
kindergarten and first grade combination class at Date
Elementary school in the Fontana Unified School District.
Students were placed in this class according to age and
date of enrollment by the principal. Their ages range
between five and seven years. There were ten kindergartners
and ten first graders in the class. They are from White,
African American, and Hispanic ethnic backgrounds. Their
general state of mental and physical health was good according to the Fontana Unified School District health standards. The study took place during regular class time at Date Elementary and lasted from nine to eighteen weeks.

It would appear that this is a valid and researchable project and is descriptive in nature because the study took place in the classroom. It is not trivial because the results may influence other teachers to examine their teaching styles and try something new.

Possible categorical variables are: sex of student, parent involvement, working/non-working parents, single parent in home, siblings/no-siblings, English/Spanish speaking, and ethnic background (White, African American, Hispanic).

Possible continuous variables are: reading level, district language arts and math scores, attendance, socio-economic status of family (as defined by Fontana Unified School District's policy to qualify for a free lunch program), and “at risk student” (as defined by the school policy to qualify for Student Study Team intervention program and/or Healthy Start Program), and behavior, or speech problems.

The dependent variables could be, time constraints, student attendance, teacher illness, accessibility of materials, reading/math/content comprehension of student.
The independent variables would be the instructional method of using Multiple Intelligence strategies and Brain Based Principles to teach this unit.

The extraneous variables might be the amount of sleep and nourishment of the student prior to instruction and/or assessment, and health and emotional state of the student during instruction and/or assessment.

The confounding variables are, the behavior of students during instruction and/or assessment (on task), inappropriate level of instruction and assessments, and outcome of assessment changes due to method of presentation.

A TIMI test was given to each student before the unit was presented to determine their scope of intelligences. A pre-test assessment (selected response assessment) was also given to each student before the unit was presented to determine their prior knowledge of plants. The Performance Assessment checklist was used to record each student's participation and level of interest in each lesson. The Student Assessment form was used to record the Pre-test, Rubric score of each lesson, and post-test scores to track growth. The Student Interview Form was used to record student conferences on their feelings about each lesson answering the questions, “What I liked best” and “What I learned”. This data could be linked to the student's
dominant intelligence. Finally, a post-test was given to
determine the student's growth in knowledge about plants.
The portfolios and scientific investigation data from each
student was analyzed to determine growth not shown on
tests. (Examples of all forms can be found in the
appendix.)
CHAPTER FIVE: CONCLUSIONS

The purpose of this unit was to determine to impact of using the theory of Multiple Intelligence and Brain-Based Learning principles to enhance student motivation and achievement by linking these teaching strategies and a variety of assessments to the students' dominant intelligence and an understanding of how the brain processes information.

Dr. Sue Teele (1998), in an analysis of over 6,000 answer sheets, documented the dominant intelligences for kindergarten and first grade students. Kindergarten students were spatial, bodily kinesthetic, linguistic and intrapersonal. First grade students were spatial, logical mathematical, bodily kinesthetic, and linguistic. She also notes that spatial and bodily kinesthetic intelligences remained as the two most dominant intelligences throughout elementary school, and spatial intelligence was very strong in all grades.

According to the Teele Inventory of Multiple Intelligences (TIMI), tests given to the students before this unit began to determine the four dominant intelligences of each student: eighteen scored high in spatial, thirteen in intrapersonal, twelve were bodily kinesthetic, ten were logical-mathematical, and nine were linguistic, musical, and interpersonal. These results support her analysis.
The **Performance Assessment** plus/minus checklist was used to evaluate the students' performance and growth over time (Appendix L). This assessment indicated that the majority of students showed positive motivation, growth, full hands-on involvement, development of self-confidence, and achievement during this entire unit. Students who are dominant in bodily kinesthetic, musical, and/or interpersonal intelligences could benefit most from this form of assessment.

The **Personal Communication Assessment** was used as a tool to have one-on-one contact with each student and record observations, interviews and anecdotal notes (Student Interview Form Appendix K). It was helpful when evaluating the students' reasoning, problem solving skills, and identifying their dominant intelligences for each lesson. After compiling data from this assessment, the majority of (fourteen) students fell true to all the their dominant intelligences tested on the TIMI prior to the unit. Students who are dominant in the intrapersonal intelligence have the opportunity to express their feelings, thoughts, and opinions.

The **Open-ended Questions Assessment** provides teacher with the opportunity to interact with students and gain an insight on how students are problem solving and processing information. It also encourages students to present their ideas about how to solve problems and how they view their
world. This assessment was used informally during class discussions and brainstorming ideas, facts, and information relevant to each lesson. This assessment was especially helpfully in guiding the structure of each lesson for the limited English students in the class. Students having intrapersonal and interpersonal intelligences seem to do will with this type of assessment.

The **Scientific Investigation Assessment** is part of the Student Portfolio Assessment containing a combination of Science Experiment Worksheets, Plant Logs, and drawings in which students observed, then recorded information through illustrations and writings. This was used to measures the individual learning capabilities and strengths of students through hands-on experiments. This form of assessment provides a permanent record of the students' progress, reflections, and evidence of performance beyond factual knowledge. Results and example are placed in the student's portfolio file. Students having dominant intelligence in spatial, intrapersonal, interpersonal, naturalistic, as well as, linguistic and logical-mathematical seem to do well on this type of assessment.

The **Selected Response Assessment** demonstrates certain types of student achievements with accuracy and efficiency. The Pre and Post-test is a formal assessment to determine prior knowledge and final knowledge gained as a result of participation in this unit, also specific level of growth.
as unit progresses. Results are recorded on the Student Portfolio Assessment form and along with examples of student work, are then placed in the students' portfolio file. Pre to post-test scores were: Students *A:0-9, *B:ab-3, C:8-10, D:2-9, *E:3-6, *F:1-drop, G:ab-4, *H:3-7, I:6-7, *J:ab-2, *K:3-8, L:6-7, M:5-11, N:6-10, O:6-drop, P:3-10, Q:7-11, R:3-3, S:4-7, T:ab-9 (* indicates kindergarten and ab = absent). Other forms of selected response assessment tools (student made books, work sheets, surveys, directed art, etc.) show a steady increase in learning and achievement. Data from pre/post-test and other forms of selected response supports the fact that the teachers, students, lessons, and environments reflection the use of the multiple intelligence theory and brain-based principles excel in motivation, self-esteem, learning, and achievement. Students with linguistic and intrapersonal intelligences seem to do well on this type of assessment.

The Portfolio Assessment is a valuable form of assessment that provides a permanent long-term record of students' progress, reflections, and evidence of performance beyond factual knowledge gained (Appendix J). The portfolio file itself was self-explanatory during student lead parent conferences. It gives the parents a better understanding of how their child learns and how they can better facilitate that learning.
Implications

The educational system needs a shot in the arm. It is my hope that by presenting these science units and alternative strategies for teaching, that others will join in the quest for providing all students with the opportunity to learn in the way that they learn best. The qualities of Brain-Based learning and multiple intelligence help the students to be successful, give teachers more opportunities to be creative, and the unit provides guidelines for teachers to do it themselves. By giving students a way to show what they know in different ways parents, teachers, administrators, professionals, and government could open the minds of all students to see what true learning, knowledge, and achievement really looks like.

As finances, high enrollment, and politics tend to influence the administration to disregard the particular needs and welfare of the students learning, it is the job of the classroom teacher to make the difference for each student.

If we change the word "job" to "vocation" all of the controlling, confining, and stressful elements of the system (district curriculum, testing restrictions, unstable environment, etc.) become challenges. The challenge to work within the system, to be creative, to invoke enthusiasm, make learning a mystery, and above to all have fun.
To acknowledge and glean knowledge from those who have gone before you, to know yourself, to like yourself, to love yourself, and to share yourself with those around you in the present, is the greatest gift you can give to the future.
APPENDIX A: PLANT PROJECT

Lesson I

Subject: Plants (Science/Math/P.E./Language Arts)

Objective: Students will identify a particular thing as living or non-living. Sorting is used to help students understand the difference between living and non-living things. The items that they collect on their treasure hunt will also be added to this collection, and then placed in science center.

Materials: Four bags, four cookie sheets or large box lids, poster board, felt markers. Collection: book, pen, rock, carrot with greens, flowering plant, ivy, apple, lemon, bug/worm (in a jar), and things that students collect from outside. Is It Alive? (A student made Mini-Book) This book reinforces the concept of living versus non-living things.

I do: Direct instruction: Sitting on the rug, explain to students that they will be learning about plants. “A plant is a living thing it grows but it cannot move around by itself and it makes its own food.”

Visual: A class collection is used to help students understand the difference between living and non-living things. The items that they collect on their treasure hunt will also be added to this collection, and then placed in the science center for further investigation.
• Show class collection (one at a time), ask students to snap their fingers three times if they think the item is living, or clap their hands one time if it is not. Have a volunteer explain why. (Bodily Kinesthetic, Spatial, Linguistic, Logical-Mathematical)

• Brainstorm what else is alive or not. Encourage students to think about animals, people, signs, chairs, etc. Use cards (with student names) to choose each student to respond with something alive or not. Class will vote thumbs up for alive, thumbs down for not alive. (Bodily Kinesthetic, Linguistic - Active Processing)

• Outside Activity: Explain that students are going on a treasure hunt and that they are to look for things that they think are living or not living. (Linguistic, Bodily Kinesthetic, Linguistic, Logical-Mathematical, Naturalistic - Orchestrated Immersion)

• Divide students into four groups by counting and pointing to each student. They are to put up 1-2-3- or 4 fingers to show their group.

• They must hold their fingers up until we get outside and they must stay with their group. (Linguistic, Bodily Kinesthetic, Logical-Mathematical, Interpersonal)
• We do: Explain boundaries and have one person in each group repeat them back. Give each group a bag, when they have five things per group they return to teacher. Go out side and let them go. (Bodily Kinesthetic, Naturalistic, Interpersonal, Intrapersonal, Linguistic - Orchestrated Immersion)
• Monitor behavior but do not interfere with the process. Give them 15 minutes and call them back. Return to classroom.
• Provide a box lid for each group to display their treasures.
• You do: Students will make two signs, "Living Things" and "Non-Living Things" for class collection (cookie sheets). They may use words or pictures. (Linguistic, Spatial, Interpersonal - Active Processing)
• Each group will sort their items, and report to class if it is living or non-living and why. Each person must present one item. Performance Assessment (Appendix L) could be used to check for understanding and participation. (Logical-Mathematical, Interpersonal, Intrapersonal - Orchestrated Immersion)

Check for understand: If the class agrees they will give a "thumbs up", if not, a "thumbs down" and tell why. Vote must be unanimous before item can be placed on appropriate
cookie sheet for class collection. (Bodily Kinesthetic, Linguistic, Spatial, Interpersonal)

You do: Each student will color, cut out, and assemble Is It Alive? Mini-book. (place in Book Box to re-read)

Student Interview Form (Appendix K) could be used at this time to interview students to evaluate their understanding, reasoning, and dominant intelligence as they work independently. To encourage Relaxed Alertness, play soothing music as students work. (Spatial, Logical-Mathematical, Intrapersonal - Orchestrated Immersion)

Clean up: (Interpersonal)

Close: Bring book to rug. Choral read book and share with class their favorite part of this lesson. (Interpersonal-Intrapersonal-Linguistic - Active Processing)

Performance Assessment: Use plus/minus checklist (Appendix L) to evaluate students' placement of collection in appropriate cookie sheet (before vote) and responses to alive or not alive activity.

Personal Communication Assessment: Student Observations, interviews, and antidotal notes (Student Interview Form Appendix K) are to assess knowledge, evaluate student reasoning, and identify dominant intelligences.

Open-Ended Questions: Listen during brainstorming and encourage students to solve problems. Provides teacher with insight into how students are thinking.
Scientific Investigation: Collect information and explain results.

Portfolio Assessment: Provide a permanent long-term record of student's progress, reflection life-long nature of learning.

Rubric for assignment

4 = Full accomplishment: Student sorts plants, colors, and sequences pages of mini-book and choral reads with class.

3 = Substantial accomplishment: Student sorts plants colors, and sequences pages of mini-book and choral reads with class with prompting.

2 = Partial accomplishment: Student sorts plants colors, and sequences pages of mini-book with difficulty and choral reads with class with prompting.

1 = Little or no progress toward accomplishment: Student colors pages but cannot sequences pages of mini-book and does not sort plants or choral read with class even with prompting.

Lesson II

Subject: Plants (Science, Math, Language Arts)

Objective: Students will learn that plants have observable characteristics. They will sort and group plants according to their characteristics.

Visual: These provide a general overview that help students understand the three basic classifications of plants, flowers, trees, and where they might be found.

I do: Review previous lesson and have students do a room search.

- Students with even numbers find something living, and those with odd numbers find something non-living and explain when they return to rug.
- (Spatial, Bodily Kinesthetic, Logical-Mathematical, Naturalistic, Linguistic)
- Introduce facts about the different kinds of plants that share our planet: Read, “What are plants?” Trees, flowers, cactus, vegetables, fruits, nuts, grass, ferns, mushrooms, vines, moss, algae.
- Where do they live? Forest, desert, mountain, jungle (rain forest), plains, lake, ocean, at school, at your house. (Linguistic)
- We do: Brainstorm Transparency, What are Plants? And Kinds of Plants:
- How are plants different from animals? What plants grow where you live?
- What do you think plants need to grow? What kinds of plants do not have seeds? (spore/fern/moss) (Linguistic, Spatial, Interpersonal - Active Processing)
• Pull student cards at random and ask “Have you ever climbed a plant, eaten a plant, smelled a plant, etc?” “What did it feel like?” “How did it taste or smell?” “It is very big and I like to read my books under it.”

• Record on board as students give hints. Have other students try to guess what the plant is. The student who guesses correctly gives next hint. (Linguistic, Interpersonal, Intrapersonal, Naturalistic, Spatial - Orchestrated Immersion)

Brainstorm felt board with headings: “PLANTS, FLOWERS, TREES”. Performance Assessment (Appendix L) could be used to evaluate student understanding and participation.

You do: Each student will choose a picture of a plant, flower, or tree and will place their picture under the appropriate heading according to its characteristics. After class vote, students will write about and illustrate their selected object. Student Interview Form (Appendix K) could be used at this time to interview students to evaluate their understanding, reasoning, and dominant intelligence as they work independently. To encourage Relaxed Alertness, play soothing music as students work. (Bodily Kinesthetic, Logical-Mathematical, Spatial, Naturalistic, Interpersonal, Intrapersonal - Orchestrated Immersion)

Check for understanding: If the class agrees they will give a “thumbs up”, if not, a “thumbs down” and tell why. Vote
must be unanimous before item can be placed under the appropriate heading.

Felt board will become a science center for students to take apart and reclassify and sort plants, flowers, and trees. They may work with buddy or independently. (Spatial, Logical-Mathematical, Intrapersonal, Interpersonal)

Close: Ask students to share their favorite plant and why they like it. (Intrapersonal-Interpersonal-Linguistic)

Performance Assessment: Use plus/minus checklist (Appendix L) to evaluate students' placement of plant, flower, tree pictures on felt board.

Personal Communication Assessment: Class observations, student interviews, and antidotal notes (Student Interview Form Appendix K) are to assess knowledge, evaluate student reasoning, and identify dominant intelligences.

Open-Ended Questions: Listen during brainstorming and encourage students to solve problems. Provides teacher with insight into how students are thinking.

Portfolio Assessment: Provides a permanent long-term record of student's progress, reflections life-long nature of learning. (Favorite plant writing and illustration.)

Rubric for Assessment

4 = Full accomplishment: Student chooses, illustrates, and writes a sentence about their favorite plant and what they learned about it. Reads to a buddy.
3 = Substantial accomplishment: Student chooses, illustrates, and writes a sentence about their favorite plant. Reads to a buddy with prompting.

2 = Partial accomplishment: Student chooses, illustrates, and writes a sentence about their favorite plant with some difficulty. Reads to a buddy with prompting.

1 = Little or no progress toward accomplishment:
   Student chooses plant but cannot illustrate or write a sentence according to directions.

Lesson III

Subject: Plants (Science, Art, Music. P.E., Language Arts)

Objective: Students will describe and illustrate the life cycle of plants and what they need to function.

Materials: From Seed to Plant, The Little People Study Plants (Mini-book), index cards, chart paper, science experiment worksheets, eight health green plants, petroleum jelly, soil, water, gravel, sand, cups, "What’s missing" worksheet, construction paper, markers, scissors, glue. Big plant poster.

I do: Introduce plants on the plant poster.

Explain that some plants make seeds and some do not.

Ask them if they have ever seen any of these plants. Have them share their experiences and what they know about the different plants. (Active Processing)
Shared Reading: From Seed to Plant by Gail Gibbons.

This book introduces the life cycle of flowering plants. Starting with pollination and a description of how seeds are produced by the flower parts (stigma, pistil and stamen) with the aid of insects, birds, and the wind. Next, we see the fruit or pod opening and depositing seeds on the ground, where they will grow into a new plant and start the process over again. It shows the importance of water, wind, or other living things also scattering seeds. Finally, it shows the cycle from germination, root, shoot, leaves, the flower and how water, soil, air, and sun make it all possible (Linguistic, Interpersonal).

We do: Have students stand up and pretend that they are a plant. Feet are your roots, legs and body is your stem, arms are your leaves, and your head is a flower. Your feet must stay in the same spot, because we know that plants cannot move around by themselves.

Lead students in following exercise.

Bend down and touch your feet and say, “Roots.”

Bring hands up legs and body and say, “Stem.”

Wave arms up and down and say, “Leaves.”

Frame your face with open hands and say, “Flower.”

Go slow at first, then speed up as students get the pattern and rhythm. (Linguistic, Musical, Bodily Kinesthetic,
Logical-Mathematical, Intrapersonal, Interpersonal – Orchestrated Immersion)

**Brainstorm** why plants have roots, stems, and leaves, and what they need to grow. (Active Processing)

**Plants Need Water Activity**

Students will observe and record how two green plants grow with and without water.

- Brainstorm how roots draw water from the ground, the stem holds the plant up and carries water and minerals to its leaves (active Processing).

- Explain that different plants have different kinds of stems (beans have long green stems, trees have thick trunks, and celery has stalks).

- Show students two healthy green plants. Explain that we are going to do a science experiment. Label plants “Water & No Water.”

- Tell students that for a few days we are going to water one plant and not the other. Ask students to predict what will happen to each plant. Have them write or draw a picture of their prediction on an index card and place their cards on the class graph, labeled WATER - NO WATER. (Appendix L could be used to evaluate understanding and participation).
• You do: Each student is responsible for making observations and recordings on their Science Experiment Worksheet.

• Help them answer questions, I want to find out . . . and What do you think will happen?

• After 10 days, students will write and illustrate what happened to both plants. Student Interview Form (Appendix K) could be used at this time to interview students to evaluate their understanding, reasoning, and dominant intelligence as they work independently.

To encourage Relaxed Alertness, play soothing music as students work. (Intrapersonal, Logical-Mathematical, Spatial, Linguistic, Naturalistic - Orchestrated Immersion)

• Plants will go in science center for further investigation with microscope.

Plants Need Sun Activity:

Students will observe and record how two green plants grow in two different environments.

• Show students two healthy green plants. Explain that we are going to do another science experiment. Label plants "Light & No light." (Place one plant in cupboard.)

• Tell students that for a few days one plant will get light from the sun and the other will not. Make sure
students understand that both plants will get the same amount of water.

- Ask students to predict what will happen to each plant. Have them write or draw a picture of their prediction on an index card and place their cards on the science graph, labeled LIGHT - NO LIGHT. (Appendix L assessment)

- You do: Each student is responsible for making observations and recordings on their Science Experiment Worksheet.

- Help them answer questions, I want to find out . . . and What do you think will happen?

- After 10 days, students will write and illustrate what happened to both plants. Student Interview Form (Appendix K) could be used at this time to interview students to evaluate their understanding, reasoning, and dominant intelligence as they work independently.

To encourage Relaxed Alertness, play soothing music as students work. (Intrapersonal, Logical-Mathematical, Spatial, Linguistic, Naturalistic - Orchestrated Immersion)

- Plants will go in science center for further investigation with microscope.

Plants Need Air Activity

Students will observe and record the affect of restricting pores on one green plant and not the other. Explain that
people and animals need air to live. Do plants need air too? TPR (Total Physical Response) = Thumbs up if yes, thumbs down if no.

- Divide students into four groups. Each group with magnifying glass and a leaf. Ask them to each look at the leaf and try to answer the question “How do you think plants breath?” Group agrees on one answer. Record responses on board.

- Explain that plants breath through tiny openings that are usually found on the undersides of the leaves. Ask students if they saw them when they looked at their leaves.

- Tell students that we are going to cover the undersides of the leaves on one plant not the other. Make sure they understand that both plants will get the same amount of water and the same amount of sunlight.

- Ask students to predict what will happen to each plant. Have them write or draw a picture of their prediction of an index card and place their cards on the science graph, labeled AIR - NO AIR. (Appendix L for performance assessment)

- You do: Each student is responsible for making observations and recordings on their Science Experiment Worksheet.

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• Help them answer questions, I want to find out . . .
  and What do you think will happen?
• After 10 days, students will write and illustrate what
  happened to both plants. Student Interview Form
  (Appendix K) could be used at this time to interview
  students to evaluate their understanding, reasoning,
  and dominant intelligence as they work independently.

To encourage Relaxed Alertness, play soothing music as
students work. (Intrapersonal, Logical-Mathematical,
Spatial, Linguistic, Naturalistic - Orchestrated Immersion)
• Plants will go in science center for further
  investigation with microscope
• Sing song and clap hands to "The Farmer in the Dell"
  (TPR).

Plants Will Grow
1. The plants will grow so tall, the plants will grow so
tall, when you give them water, and the plants will
grow so tall. (Students roll play with body language.)
2. The plants will grow so green, the plants will grow so
green, when you give them sunshine, the plants will
grow so green.
3. Encourage students to make up their own verses.
   (Music, Bodily Kinesthetic - Orchestrated Immersion)
Plants Need Soil Activity:

Students will observe and record the growth process of seeds placed in four different growing environments.

- Give each student a peanut in the shell.
- Explain that this is a seed from a peanut plant. We are going to conduct an experiment to find the best way to make it grow into a plant.

  a. Poke several small holes in the bottoms of three of the four cups and put them in a tray of sand.
  b. Fill the three cups two-thirds full: one with sand, one with pebbles, one with soil. Fill the fourth cup with water. Label each cup.
  c. Put two raw peanuts about 1-2" deep in each cup, drop two in the water.
  d. Place tray in window and water as needed.

Make sure that the students understand that all of the cups will get the same amount of water, the same amount of sunlight and air.

- Ask students to predict how the plants will grow in each of the four substances. Have them write or draw a picture of their prediction on an index card and place their cards on the science graph, labeled SOIL - NO SOIL. (Use Appendix L for assessment.)
- Check cups each day (The first sprout should appear within 5-7 days.) Check cards, how many predicted
correctly? "Give yourselves a big hug!"

(Interpersonal, Linguistic, Logical-Mathematical, Naturalistic, Spatial)

Plants will go in science center for further investigation with microscope. All charts and graphs will be added to the "Read the Room" center.

You do: Art Activity: Each student is responsible for completing their "What's Missing" poster. These activities should reinforce the concept of the life cycle and what plants need to grow and complete their life cycle.

- They will cut out flowerpot and glue it on construction paper, cut out the items that a plant needs to grow. Draw a picture of a plant growing out of their pot. Should have a stem and leaves, and a flower. (Intrapersonal, Linguistic, Logical-Mathematical, Spatial - Orchestrated Immersion)

- Each student will color, do writing activity, read to a buddy, and put The Little People Study Plants (Mini-book) in their Browsing Box for future. Student Interview Form (Appendix K) could be used at this time to interview students to evaluate their understanding, reasoning, and dominant intelligence as they work independently.
To encourage Relaxed Alertness, play soothing music as students work. (Linguistic, Spatial, Intrapersonal, Interpersonal - Orchestrated Immersion)

**Personal Communication Assessment:** Class observations, student interviews, and antedotal notes (Student Interview Form Appendix K) are to assess knowledge, evaluate student reasoning, and identify dominant intelligences.

**Open-Ended Questions:** Listen during brainstorming and encourage students to solve problems. Provides teacher with insight into how students are thinking.

**Scientific Investigation:** Collect information and explain results.

**Performance Assessment:** Use plus/minus check list (Appendix L) to evaluate student demonstration of science experiments and/or participation.

**Portfolio Assessment:** Provide a permanent long-term record of student's progress, reflection life-long nature of learning. This portfolio will be a living portfolio that will be added to throughout this science unit.

**Rubric for assignment**

4 = Full accomplishment: After each section, the student completes the science experiment worksheet by writing and illustrating according to instructions. Colors and reads mini-book to a buddy and completes the "What's missing"
poster (glues on seeds, soil, sun and water, and draws flower).

3 = Substantial accomplishment: After each section, the student completes the science experiment worksheet writing and illustrating according to instructions with prompting. Colors and reads mini-book to a buddy with prompting, and completes most of the what's missing poster, (glues on seeds, soil, sun and water and draws any plant) with help.

2 = Partial accomplishment: After each section, the student has difficulty completing the science experiment worksheet writing and drawing. Colors and reads mini-book to a buddy with difficulty and has difficulty drawing a plant and choosing correct elements for their What's missing poster even with prompting.

1 = Little or no progress toward accomplishment: After each section, the student cannot complete the science experiment worksheet. Colors and mini-book but cannot read to a buddy even with prompting. Does not draw a plant or choose correct elements for their What's missing poster even with prompting.

Lesson IV

Subject: SEEDS (Science, Art, Math, Language Arts, Music, Social Studies)

Objective: Students will describe the basic structure seeds and their function within plants.

I do: Use transparence to introduce different types of seeds and bulbs. Show students a real bulb and an avocado seed. Compare and contrast the two (use venn diagram). Ask if they know what plants might grow from bulbs and seeds.

We do: Shared Reading: It Started as a Seed by Dr. Alden Kelly. Using repeating text and cartoon illustrations, this book introduces structure and function of seeds, the plant to grows into, and what people can make from the plant.

• Read page 2, covering page 3, ask students to predict what is on next page. Read page 4, cover 5, predict. Continue reading and predicting until you get to the last page. Talking about a garden.

• Sing song and roll play to Here We Go Around the Mulberry Bush: (TPR)
This song reinforces the process and loving care in getting seeds to grow.
1. This is the way I dig the dirt, dig the dirt, dig the dirt. This is the way I dig the dirt all on a Monday morning. (Roll play digging with hands.)

2. This is the way I plant the seeds all on a Tuesday Morning. (Roll play planting seeds with hands.)

3. This is the way I cover the seeds all on a Wednesday Morning. (Roll play covering seeds with hands.)

4. This is the way I water the seeds all on a Thursday morning. (Roll play watering seeds.)

5. This is the way I weed the seeds all on a Friday morning. (Roll play pulling weeds.)

6. This is the way I hoe the seeds all on a Saturday morning. (Roll play hoeing ground.)

7. This is the way I watch them grow all on a Sunday morning. (Roll play looking at seeds.)

Could use Appendix L to assess participation.

(Interpersonal, Intrapersonal, Naturalistic, Linguistic, Spatial, Bodily Kinesthetic, Musical, Logical-Mathematical - Orchestrated Immersion)

Brainstorm "How Seeds Grow" poster. Ask students if they have ever seen any of these plants (pumpkin, dandelion, sunflower, pine tree, etc.)

- Ask students to bring any seeds they can find from home so we can start a seed center. (Have some seeds in an egg carton, sorted and labeled, with magnifying
glass for investigation. Have another egg carton for students to sort and label.) (Interpersonal- Intrapersonal- Naturalistic- Linguistic-Spatial - Active Processing)

Shared Reading: Seeds, Seeds, Seeds by Brian and Jillian Cutting. By using question and answer text and many colorful photographic illustrations, this book reinforces the structure and function of seeds and plants.

- Review book knowledge: cover, title page, title, author, publisher, copyright date, and focus on illustrations. ("Who can tell me what we call the person who makes the pictures, writes the words, makes the book, etc.") (Linguistic, Spatial, Interpersonal - Active Processing)

- Read to page nine (9), stop and ask students to predict what will be the next kind of seed. Continue reading.

- Compare and contrast photographs versus cartoon illustrations between this book and I Started as a Seed. "Why do you think they look different?"

Check prior knowledge: Ask students if they have ever eaten anything with seeds in it.

- Show students collection of fruits. Have students identify each one.
Explain that even though they look and taste different, they all have seeds.

Explain that many of the things we call "vegetables," (tomatoes, pumpkins, cucumbers, and green peppers) are really fruits. A scientist will tell you that a fruit is the part of the plant that holds the seed.

You do: Buddy up students and give them a plate and a fruit.

- Have students investigate their fruit size, shape, texture, smell, and color. Provide a magnifying glass for them to take a closer look. Report to class.
- Have students predict how many seeds will be in their fruit and write their number and name of fruit on a secret paper and put into a box. (Apple = 10 seeds, Green Pepper = 100 seeds, etc.)
- Have each pair of students label a plate with the name or picture of their fruit. Cut open fruits for students to examine.
- Have students carefully remove and count seeds. Students will record their seed count on a bar graph and place seeds in egg carton for collection.
- Cut fruit into small pieces. Open box and read student predictions and verify on bar graph. If student is correct, they may eat a piece of the fruit. After all predictions are read, share fruit with everyone.
Seed collection will be placed in science center with magnifying glass. Students may bring seeds from home and add to the collection.

Shared Reading: (Big book) *From Peanuts to Peanut Butter* by Gilda Berger. This book introduces a detailed description of a peanut seed and reinforces the function of this seed. “Can you guess what we eat that is made from this seed?”

- Explain the different parts of the peanut: The brown SHELL, the red SKIN, and the nut, also called the SEED. Inside every seed there is a baby plant hiding which is called the EMBRYO. “How many syllables does embryo have?”

Use TPR (Total Physical Response) to instruct students to count each sound as they touch their arm using first two fingers for each syllable and say “em-bry-o.”

- Ask students to choose a part of 1=em, 2=bry, 3=o and tell if it is 1, 2, or 3.

Have students clap the syllables of the word then write them on the board.  

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1   2   3
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Students will brainstorm structure of the seed: TPR - hold up fingers.
1. finger = SHELL - What else has a shell? (other nuts, eggs, etc.)

2. fingers = SKIN - What else has skin? (people, animals, etc)

3. fingers = SEED - What else has seeds? (all fruits, trees, flowers)

4. fingers = EMBRYO - What else has an embryo?

Tell students that all seeds make new plants. The new plants make new seeds. The new seeds make new plants. And this goes on and on and on.

Have students stand in a circle and count off by twos. All of the “ones” will be a seed and all of the “twos” will be a plant. Pretend that you are a seed or a plant. What do you feel? Start with one seed and bend down into fetal position, the next person who is a plant will stand tall and reach to the sun, next seed bend down and next plant reach up. Continue this cycle until every one has gone up or down. Next, switch rolls and go around again.

(Interpersonal, Intrapersonal, Spatial, Linguistic, Bodily-Kinesthetic, Logical-Mathematical, Naturalistic - Orchestrated Immersion)

Story Telling

History of the peanut: The slaves brought the first peanuts from Africa. Dr. George Washington Carver was the son of a slave. He was a plant scientist and first made peanut
butter over 100 years ago. He invented over 300 things using the peanut. Some are: ink, shaving cream, shampoo, ice cream, coffee, and peanut butter. Thank you, Dr. Carver.

We do: Each will investigate a peanut. Give students peanuts in its shell. Have them look, feel, and smell it. Review: What the shell is like? = Hard, rough, brown, etc. Now take the peanut out of the shell, feel the skin. What is it like? Feel the seed (peanut).

Brainstorm: = Smooth, hard, round. Break the seed open and try to find the embryo (provide magnifying glasses). Tell students that this embryo is alive. It is a baby plant ready to grow. (Linguistic, Spatial, Bodily Kinesthetic - Active Processing)

Seed Activity: Students will plant a seed and observe the growth of their plant.

a. Help students line their jar with a paper towels.

b. Slip a few shelled, raw peanuts between the glass and the paper.

c. Add about two tablespoons of water, and then cover the jar.

d. Keep in warm place for about five days. (Seeds should swell and sprout and roots will appear.)
e. Remove lid and have students fill jar with potting soil. Place in window and wait ten days to see sprouts.

f. Each group will compare and contrast their plants growth and report to class. (mine is bigger, mine has more leaves, etc.) Allow time for all students to view each plant.

- Explain that the special thing about peanuts is that they have "pegs" that grow into the ground to make more peanuts that will grow into a plant.

(Intrapersonal, Interpersonal, Linguistic, Spatial, Logical-Mathematical, Naturalistic - Orchestrated Immersion)

Plants will be placed in science center for continued observation then sent home at end of unit.

You do: Give each student a copy of the peanut plant diagram, glue, scissors.

- Have each student color plant then cut out the labels that go with the plant parts and glue them in the correct place on the diagram.

- Give each student a copy of The Seed Song (mini-book).

- Have students cut out, sequence pages, and staple pages.

This book will continue to reinforce the structure and function of seeds and plants.
Student Interview Form (Appendix K) could be used at this time to interview students to evaluate their understanding, reasoning, and dominant intelligence as they work independently. To encourage Relaxed Alertness, play soothing music as students work.

Check for understanding: Bring The Seed Song book to rug, sing and roll play the song (TPR).

"Seeds are planted deep, deep, deep."
(Push fingers down as if planting)

"In the ground they sleep, sleep, sleep."
(Close fists in lap)

"Yellow sunshine bright, bright, bright."
(Cover eyes)

"Raindrops falling light, light, light."
(Wiggle fingers while bring down hands)

"Gentle breezes blow, blow, blow."
(Blow on swaying hands)

"Seeds begin to grow, grow, grow."
(Wiggle fingers as hands go up from lap)

"And grow and grow and grow!"
(Raise arms as high as you can)

This book will go in their browsing box. (Intrapersonal, Interpersonal, Linguistic, Spatial, Logical-Mathematical, Musical - Orchestrated Immersion)
Personal Communication Assessment: Class observations, student interviews, and anecdotal notes (Student Interview Form Appendix K) are to assess knowledge, evaluate student reasoning, and identify dominant intelligences.

Open-Ended Questions: Listen during brainstorming and encourage students to solve problems. Provides teacher with insight into how students are thinking.

Scientific Investigation: Collect information and explain results.

Performance Assessment: Use plus/minus check list (Appendix L) to evaluate student demonstration of science experiment.

Portfolio Assessment: Provide a permanent long-term record of student's progress, reflection life-long nature of learning. (Plant diagram)

Rubric for assignment

4 = Full accomplishment: The student colors and completes the plant diagram and labels all six parts correctly.

3 = Substantial accomplishment: The student colors and completes the plant diagram, labels five parts correctly with prompting.

2 = Partial accomplishment: The student colors and completes most of the plant diagram with some difficulty, labels four parts correctly with some difficulty even with prompting.
1 = Little or no progress toward accomplishment: The student colors but cannot complete the plant diagram, labels most or all parts incorrectly, even with prompting. Alternative lessons for seeds are found in Newbridge Early Science Program teacher's guides and big books: Growing Pumpkins and Seeds Get Around.

Lesson V

Subject: ROOTS (Science, Art, Math, Language Arts, Music, Social Studies)

Objective: Students will continue to describe the structure of roots and their function within plants.

Materials: Root Worksheet, team Plant Log, four cups of water, white potato, sweet potato, beet and carrot with tops, green plant.

I do: Explain to students that they are going to continue to look at the stage of a plant. Ask them what stage comes after the seed as a plant grows (the roots).

Visually: Brainstorm transparency and posters (Active Processing).

Students will review prior knowledge of seeds and continue to discover other parts of plant structure and function.

- Show the students a plant. Ask them to name the parts of the plant that they can see (stem, leaves). Ask them to name the parts that they cannot see.
• Ask some students to blow on the plant like the wind. When it stays in its place. Explain that roots hold the plant steady. Explain that the root grows downward into the soil and takes in water and minerals from the soil for the plant's stems and leaves. (Linguistic, Interpersonal - Active Processing)

Roots activity: Students will work in a group to investigate, record, and report on the structure and function of roots. They will follow verbal instructions for the experiment procedure.

We do: Divide students into four groups. Give each group a clear plastic cup, four toothpicks, and one plant: sweet potato, white potato, carrot or beet with tops.

• Have students in each group pull numbers 1-5 for job assignment.
  # 1 student will put the toothpicks into the root.
  # 2 student will balance the root on the cup.
  # 3 student will fill the cup with water to cover bottom of root and check and water when needed.
  # 4 student will measure growth and report to team.
  # 5 student will record growth and change on their group "Plant Log."

• Explain that the root of the carrot and the beet now have a job of taking water up from the cup to the stems and leaves. Ask them to predict what will happen

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if the root does its job well. (The tops will continue to grow).

- Ask students to predict what will happen to the potatoes. (They will grow roots, stems, and leaves.) Place experiments in window and check daily for change and record. After ten days have groups complete their logs and share plants and logs with class. Compare and contrast different plants. (Interpersonal, Linguistic, Spatial, Logical-Mathematical, Naturalistic, Bodily Kinesthetic - Orchestrated Immersion)

Place plants in science center with magnifying glasses for further observation.

You do: Each student will demonstrate their knowledge of the structure and function by completing a roots worksheet.

- Have them color each picture. Cut out and glue correct root under corresponding plant. Student Interview Form (Appendix K) could be used at this time to interview students to evaluate their understanding, reasoning, and dominant intelligence as they work independently.

To encourage Relaxed Alertness, play soothing music as students work. (Intrapersonal, Spatial)

Check for understanding: Give students pieces of potatoes, and carrots to munch on when they come to rug to share what they learned about roots you liked best about lesson. “Did you know that you are eating roots now?” (Use Appendix L)
Personal Communication Assessment: Class observations, student interviews, and anecdotal notes (Student Interview Form Appendix K) are to assess knowledge, evaluate student reasoning, and identify dominant intelligences.

Open-Ended Questions: Listen during brainstorming and encourage students to solve problems. Provides teacher with insight into how students are thinking.

Scientific Investigation: Collect information and explain results. Students will receive a group grade and a grade for individual participation in the group.

Performance Assessment: Use plus/minus checklist (Appendix) to evaluate student demonstration of science experiment and group participation.

Portfolio Assessment: Provide a permanent long-term record of student’s progress, reflection life-long nature of learning. (Root worksheet)

Rubric for assignment

4 = Full accomplishment: The student colors and completes the root worksheet by gluing all four roots under correct plant top. Performs assigned job on group experiment.

3 = Substantial accomplishment: The student colors and completes the root worksheet by gluing three roots under correct plant top with prompting. Performs assigned job on group experiment with prompting.
2 = Partial accomplishment: The student colors and completes the root worksheet by gluing two of the roots under the correct plant top with prompting. Performs assigned job on group experiment with difficulty even with prompting.

1 = Little or no progress toward accomplishment: The student colors but cannot complete the root worksheet, glues all roots incorrectly, even with prompting. No attempt to performs assigned job on group experiment even with prompting.

Lesson VI

Subject: STALKS (Science, Art, Math, Language Arts, Music, Social Studies)

Objective: Students will continue to describe the basic structure of stalks and their function within plants.

Materials: Stalks of celery with leaves, food coloring (4 colors), 4 glasses of water, plastic knife, extra celery for snack, peanut butter, Plant Parts (mini-book).

I do: Review previous lessons: Ask students to answer riddles:

a. I am a long orange tuber. I grow under the ground. My feathery green leaves grow above ground. Bugs Bunny likes to eat me. What am I?
b. I grow under the ground. I have eyes. I am brown or red. My wide leaves grow above the ground. Kids like to eat me when I'm sliced and fried in oil. What am I?

c. I grow under the ground. My leaves and stems grow above the ground. I have flowers. I grow my seeds on the end of pegs. I came from Africa a long time ago. People like to smash me up and spread me on bread with jelly. What am I?

d. Encourage students to make up their own riddles and share with class. (Linguistic, Interpersonal - Active Processing)

Visuals: Brainstorm transparency and posters. Students will review prior knowledge of seeds and roots, and continue to discover other parts of plant structure and function.

- Explain that stems hold the plant up. Remind them that stems can be different. Brainstorm some different kinds of stems and stalks (beans/long, trees/thick woody trunks).

- Show students a celery stalk. Ask student if they have ever eaten this before. Did they like it? What did it taste like? What do they like to put on it? Explain that the stalk connects the celery plant's short stem to its leaves.

Stalks activity: Students will work in a group to investigate, record and report on the structure and
function of stalks. They will follow verbal instructions for the experiment procedure.

We do: Divide students into four groups. Give each group a clear plastic cup of water, one bottle of food coloring, and one stalk of celery.

- Tell students that they will do an experiment to see how water travels through the stem to the leaves.
- Have a student cut about one inch off of the bottom and look at the tiny holes. Explain that these are the tubes that carry the water to the leaves.
- Allow time for all students to investigate these tubes.
- Have another student place food coloring in water and another one place their stalk of celery in the plastic cup.
- Have students predict what will happen. Give each student an experiment worksheet to answer questions I want to find out ... and what I think will happen.

Put experiment in science center.

The next day have students examine their stalks discuss what happened and how or why. (Active Processing)

You do: Students will complete their experiment worksheet by writing about and illustrating what happened with their experiment. Student Interview Form (Appendix K) could be used at this time to interview students to evaluate their
understanding, reasoning, and dominant intelligence as they work independently. To encourage Relaxed Alertness, play soothing music as students work. (Linguistic, Spatial, Bodily Kinesthetic, Interpersonal, Intrapersonal - Orchestrated Immersion)

Students will follow verbal instruction for making Plant Parts (mini-book). This book continues to reinforce the observations the students have made so far about the structure and functions of plant parts.

- Model each step with students.
  1. Color both sides of the black line master of book.
  2. Fold in half, hamburger style.
  3. Fold in half again, hamburger style.
  4. Cut ONLY on the solid black lines and fold on dotted lines for flaps.

Check for understanding: Pass out extra celery filled with peanut butter as students bring books to rug and read to a buddy.

- Ask students to share what you learned and what their favorite part was? (Use Appendix L for assessment)
- Ask students if they liked eating stalks and seeds.

Books will be placed in student's browsing box for future re-reading. (Linguistic, Spatial, Interpersonal, Intrapersonal, Logical-Mathematical - Active Processing)
**Personal Communication Assessment**: Class observations, student interviews, and antedotal notes (Student Interview Form Appendix K) are to assess knowledge, evaluate student reasoning, and identify dominant intelligences.

**Open-Ended Questions**: Listen during brainstorming and encourage students to solve problems. Provides teacher with insight into how students are thinking.

**Scientific Investigation**: Collect information and explain results.

**Performance Assessment**: Use plus/minus check list (Appendix) to evaluate student demonstration of science experiment as they work in a group.

**Portfolio Assessment**: Provide a permanent long-term record of student's progress, reflection life-long nature of learning. (Science Worksheet)

**Rubric for assignment**

4 = Full accomplishment: The student completes experiment worksheet by answering both questions then writing and illustrating about results of their experiment.

3 = Substantial accomplishment: The student completes experiment worksheet by answering both questions then writing and illustrating about results of their experiment with prompting.

2 = Partial accomplishment: The student completes experiment worksheet by answering one question then
and somewhat illustrates results of their experiment with prompting.

1 = Little or no progress toward accomplishment: The student has great difficulty writing anything to answer either question, cannot write or illustrate what the results of their experiment was even with prompting.

Lesson VII

Subject: Leaves (Science, Art, Math, Language Arts, Music, Social Studies)

Objective: Students will continue to describe the basic structure of leaves and their function within plants.

Materials: How Plants Make Food Poster, collection of different kinds of green leaves, magnifying glasses, soft lead pencils, chalk, or crayons and tracing paper, Name That Leaf worksheet, glue, construction paper, scissors.

I do: Review previous lesson: Brainstorm function of stems. Pull student cards at random to ask them what they remember about why plants have stems, describe different kinds of stems, what they learned about stems, and what is on the end of these stems. (leaves)

Visual: How Plants Make Food poster.

This poster will help students discover how plants make their own food.

Brainstorm poster with students and explain that green plants are the only living things that can make their own
food because they have a special thing called chlorophyll in their leaves. This is what makes them green.

- TPR = "How many syllables are in chlorophyll?" Touch your chin to count, one finger for each syllable (Bodily Kinesthetic, Logical-Mathematical, Linguistic)

- Discuss how green (chlorophyll) plants use sunlight to make their own food for energy to grow. The process of using the sun's energy to convert carbon dioxide and water into sugars, starch, and waste oxygen is called photosynthesis. "Count the syllables in fo-to-sin-the-sis." Touch your arm to count. (Bodily Kinesthetic, Logical-Mathematical, Linguistic - Active Processing)

- Refer to poster and guide students through the process:

  - Have a student use a pointer to follow along.

1. Carbon dioxide from the air enters the plant through tiny openings in the leaves. Encourage prior knowledge about coating backs of leaves.

2. Water and minerals from the soil are carried to the leaves through the roots and the stem. Encourage prior knowledge about experiments.

3. The chlorophyll in the leaves absorbs energy from the sun.
The leaves use the sun's energy to change the carbon dioxide and water into food and oxygen. Some of the oxygen produced is released into the air. The food is carried to all parts of the plant. The plant uses some; the rest is stored. Animals use the food when they eat a plant or another animal that has eaten a plant.

The carbon dioxide is the gas that people and animals breathe OUT. Air (oxygen) is the gas the people and animals breath IN. This is called respiration. The balance between photosynthesis and respiration powers all life on earth.

We do: Roll play photosynthesis vs. respiration: Everyone breathe IN, say, "oxygen." Everyone breathe OUT, say, "carbon dioxide." Repeat several times until students get a rhythm going. Now, snap fingers on IN, and clap on OUT for A - B pattern. (Bodily Kinesthetic, Logical-Mathematical, Linguistic, Linguistic, Musical - Orchestrated Immersion)

Review what plants need. (Sun, soil, air, water, minerals.)

• Explain that we are going to look more closely at how water travels through a leaf and that they are going to go on another treasure hunt, this time for leaves.
• Take the class outside and have them collect as many different leaves as they can.
• Divide students into four groups. Give each group five different leaves and magnifying glasses.

• Have students examine the leaves and point out the veins. Explain that veins carry water into the leaf.

• Have students look at the top of their hands, and explain that they have veins too. “What is in your veins?” (Orchestrated Immersion)

Brainstorm the many different vein patterns on various leaves. Have students compare and contrast the different leaves. (Active Processing)

• Each group will choose one leaf and report what they noticed about that leaf. (Bodily Kinesthetic, Logical-Mathematical, Linguistic, Naturalistic, Interpersonal, Spatial - Orchestrated Immersion)

Leaf Activity: Each student will discover the wonders and beauty in the structure and shape of leaves.

You do: Have each student choose their favorite leaf. Place a sheet of paper over it (vein sides up) and rub lightly with a pencil, crayon, or chalk. After they have finished their rubbings, have them compare and contrast their leaves again. Have students glue rubbings on construction paper and write a sentence that describes their leaf. These pages will be laminated and made into a class big book.
• Prepare a graph for all of the leftover leaves, label: Smooth – Toothed – Lobed, and Other (pine needles or grass.)

• Have students sort leaves into groups and place them on graph. Ask them to explain where and why they are putting them on the graph. Attach with glue and hang their living graph for Read the Room Center. Have students complete “Name that Leaf” worksheet according to instructions (Dot to dot and fill in blank).

Student Interview Form (Appendix K) could be used at this time to interview students to evaluate their understanding, reasoning, and dominant intelligence as they work independently. To encourage Relaxed Alertness, play soothing music as students work. (Bodily Kinesthetic, Logical-Mathematical, Linguistic, Naturalistic, Interpersonal, Spatial – Orchestrated Immersion)

Check for understanding: Have students bring their leaf-rubbing poster to the rug and share with class why it is special to them. (Appendix L for assessment)

Place at least one of each kind of each leaf collected in science center with magnifying glasses for further investigation.

Personal Communication Assessment: Class observations, student interviews, and antidotal notes (Student Interview
Form Appendix K) are to assess knowledge, evaluate student reasoning, and identify dominant intelligences.

**Open-Ended Questions:** Listen during brainstorming and encourage students to solve problems. Provides teacher with insight into how students are thinking.

**Scientific Investigation:** Collect information and explain results.

**Performance Assessment:** Use plus/minus check list (Appendix L) to evaluate student demonstration of knowledge about leaves as they sort and graph.

**Portfolio Assessment:** Provide a permanent long-term record of student's progress, reflection life-long nature of learning. (Science worksheet)

**Rubric for assignment**

4 = Full accomplishment: The student completes worksheet neatly according to instructions. Makes leaf rubbing and writes a descriptive sentence.

3 = Substantial accomplishment: The student completes worksheet neatly according to instructions. Makes leaf rubbing and writes a descriptive sentence with prompting.

2 = Partial accomplishment: The student completes worksheet with difficulty even with prompting and attempts to make leaf rubbing. Has some difficulty writing a sentence.
Lesson VIII

Subject: FLOWERS (Science, Math, Physical Education, Art, Music, Language Arts, Social Studies)

Objective: Students will sort and classify flowers and investigate their structure and functions.

Materials: What is a Flower (poster), The Sunflower Family, collection of flowers of different sizes, shapes, and colors (daisy-like, bell-shaped, urn-shaped, lipped petals), plastic cups with water, paper plates. What are Flowers For? (mini-book), colored tissue paper, construction paper. Four or five flowers at different stages of opening and sunflower seeds.

Visual: Flower Poster. This poster introduces the students to the many different flower families

I do: Using the “Flower” poster. Explain that a flower is the blossoming part of a plant. Flowers make seeds for the plant. A plant known for its blossoms is also called a flower.

Brainstorm the different flowers and introduce the concept of families on the poster. Explain that all things belong to some kind of a family.
• Ask students what families they belong to. (lead toward human)

• Compare and contrast flower families. Have you ever seen any of these flowers where you live? Do they smell? What kind is their favorite and why. Ask them to bring some from home - sort into families later (active Processing)

Read Aloud: *The Sunflower Family* by Cherie Winner.

This book introduces the sunflower family. Using colorful photographs it shows different members and how flowers in the same family can be so different.

• Compare sunflower to daisy. What is the same? (petals and shape).

• Compare thistle and dandelion to sunflower. Tell what is different.

• Discuss seed dispersal (wind, birds, animals), habitats, (desert, mountains, marsh) flower parts, (pollen, petals, stamens) and human use (latex for rubber, dye, medicine, food, tea).

Explain that BOTANISTS (scientists that study flowers) use a variety of features to classify plants into families. Have students observe the assortment of flowers and determine how to divide them into similar, smaller groups.

TPR = Touch chin to count syllables in BOTANISTS.
Sorting Flowers Activity: Place paper plates labeled “Bell-shaped, daisy-like, urn-shaped, lipped petals” on four different tables.

• Tell students to form a line, each choose a flower from collection, and place onto the different tables until all of the flowers are gone.

• After all of the flowers are sorted, gather class around each table and discuss each group.

• Have students vote thumbs up if you agree with sorting rule, thumbs down if not and explain why. At each table ask students to think of other ways to sort the flowers into smaller groups (size, color, leaf shape).

Place sorted flowers in science with magnifying glasses.

(Linguistic, Interpersonal, Spatial, Logical-Mathematical, Naturalistic, Bodily Kinesthetic - Orchestrated Immersion)

We do: Show students 4 - 5 roses from closed bud to spent flower. Ask students how a rose might feel as it opens.

Role Play poem: Pretending: (TPR)

“I like to pretend that I am a rose.” (point to self)

“That grows and grows and grows and grows.” (hands move up and out)

“My hands are like a rosebud closed up tight.”

(close both hands together)

“With not a tiny speck of light.” (try to peep
inside hands)

"Then slowly the petals open for me." (open fingers slowly)

"And here is a rose full-blown to see!" (open hands, touching palms, fingers forming open cup)

(Musical, Bodily Kinesthetic, Linguistic, Spatial, Intrapersonal, Interpersonal, Logical-Mathematical - Orchestrated Immersion)


- Have students color both sides of page.
- With verbal instruction and modeling have students cut flaps on solid black lines and fold on dotted lines.
- Fold in half hamburger style on dotted, repeat fold and answer question on back page. Student Interview Form (Appendix K) could be used at this time to interview students to evaluate their understanding, reasoning, and dominant intelligence as they work independently.

To encourage Relaxed Alertness, play soothing music as students work. Check for understanding: Come to rug, choral read books and tell what you liked best about this lesson. (Appendix L)

Place book in Browsing Box for future buddy reading.

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Directed art lesson: Show students model of flower. Have them draw a stem and leaf on paper. Select color of tissue paper squares to be twisted and glued at top of stem for flower. Brush tissue with water. Add flower posters to bulletin board. (Bodily Kinesthetic, Linguistic, Intrapersonal, Spatial, Interpersonal, Logical-Mathematical)

Personal Communication Assessment: Class observations, student interviews, and antidotal notes (Student Interview Form Appendix K) are to assess knowledge, evaluate student reasoning, and identify dominant intelligences.

Open-Ended Questions: Listen during brainstorming and encourage students to solve problems. Provides teacher with insight into how students are thinking.

Performance Assessment: Use plus/minus check list (Appendix L) to evaluate student demonstration of knowledge about flowers as they sort and re-sort.

Rubric for assignment

4 = Full accomplishment: The student completes book and flower neatly according to instructions.

3 = Substantial accomplishment: The student completes book and flower according to instructions with prompting.

2 = Partial accomplishment: The student colors and folds book but cannot answer question even with prompting. Has difficulty with flower.
Lesson IX

Subject: TREES (Science, Math, Physical Education, Art, Music, Language Arts, Social Studies)

Objective: Students will continue to classify plants. TREES

Materials: What is a Tree (poster), Look Inside a Tree. Collection of trees parts (bark, seeds, leaves, roots, etc.) The Big tree, colored chalk, paper, Have You Seen Trees?

I do: Show the students the TREE poster.

Explain that a tree is a woody plant with one main stem called a trunk. Branches grow from this trunk. The trunk allows the plant to support itself and to grow thicker and taller than other plants. There are three (3) main groups of trees: Broad leaf, needle leaf, and palm.

Brainstorm the different kinds of trees on the poster. Ask the students if they have ever seen any of these trees and where. Point to each tree and ask students what kind of leaf they think that tree has. (Active Processing)

Read Aloud: Look Inside a Tree by Gina Ingoglia.

This book introduces trees, its parts, and functions. It reviews the life cycle and tells why trees are needed by all other living things.
• Review book knowledge. Have students predict what will be on the next page by peeking through the cutouts in each page.
• Pass out tree parts (leaves, seeds, pine needles and cones, bark) to students.
• Have them feel, smell, and describe their object, then identify it. Then place it in the correct sorting box. (Linguistic, Spatial, Interpersonal, Naturalistic, Logical-Mathematical - Orchestrated Immersion)

Place all tree parts in science center with magnifying glasses also Place book in reading center.

We do: Role-play poem: Trees.

TPR: Have students stand up and get enough personal space so they do not touch each other with arms out.

"Elm trees stretch and stretch so wide."

(Move arms up and out to side)

"Their limbs reach out on every side."

(Twist at waist around, pretend wind is blowing gently, close eyes and feel the wind.)

"Pine trees stretch and stretch so high."

(Move arms up overhead.)

"They nearly reach up to the sky."

(Pretend to feel the wind, close eyes and sway back and forth.)

"Willows droop and droop so low."
(Bend at waist, let arms hang limp.)

"The branches sweep the ground below."

(Pretend wind is moving you, see if you can touch the ground with your fingertips and you sway.)

Repeat poem several times until students get the feel, and then have them click their fingers on the rhyming words. Appendix L could be used to assess performance. (Music, Bodily Kinesthetic, Linguistic, Spatial, Interpersonal, Intrapersonal - Orchestrated Immersion)

Read Aloud. Have You Seen Trees? Joanne Oppenheim. This book of poems describes trees as they go through the four seasons. It reviews animals that live in trees and fruits from trees. It also has a section on leaf identification.

- Talk about the illustrations describe by each poem.
- Re-Read with students and have them clap on rhyming words.

Place in science center for leaf identification. (Linguistic, Spatial, Bodily Kinesthetic, Musical)

Bark Art Activity: Explain that trees have a special covering called bark that protects the roots, stems, and branches. A long time ago people used bark to make clothes, homes, and canoes. Today we use bark for many things including cough medicine and chewing gum.
• Take students outside and touch different kinds of trees. Have students describe what they feel, how is some bark different or same as others.

Model how to do a tree rubbing. (One student holds the paper against the tree while the other carefully rubs the chalk lengthwise against the paper to make an impression of the bark.)

• Give each student a paper and chalk, have students choose a buddy and let them go. Monitor and interview students as they work but do not interfere with process.

• Share rubbings with class and place on bulletin with leaf rubbings big book. Naturalistic, Interpersonal, Spatial, Bodily Kinesthetic, Linguistic)

Shared Reading: The Big Tree (Mini-Book). This book reinforces the concepts students have investigated.

• Have students color and sequence book pages. Read book to a buddy, and place in book box for later re-reading. Student Interview Form (Appendix K) could be used at this time to interview students to evaluate their understanding, reasoning, and dominant intelligence as they work independently.

To encourage Relaxed Alertness, play soothing music as students work.
Personal Communication Assessment: Class observations, student interviews, and anecdotal notes (Student Interview Form Appendix K) are to assess knowledge, evaluate student reasoning, and identify dominant intelligences.

Performance Assessment: Use plus/minus check list (Appendix L) to evaluate student demonstration of knowledge about tree parts describing and sorting.

Open-Ended Questions: Listen during brainstorming and encourage students to solve problems. Provides teacher with insight into how students are thinking.

Scientific Investigation: Collect information and explain results.

Portfolio Assessment: Provide a permanent long-term record of student's progress, reflection life-long nature of learning. (Tree rubbings)

Rubric for assignment

4 = Full accomplishment: The student completes book and tree rubbings neatly according to instructions.

3 = Substantial accomplishment: The student completes book and tree rubbings according to instructions with prompting.

2 = Partial accomplishment: The student colors and folds book but cannot answer question even with prompting. Has difficulty completing tree rubbings.
Lesson X

Subject: FRUIT (Science, Math, Physical Education, Art, Co-operative learning groups, Music, Language Arts, Social Studies)

Objective: Students will sort, classify, and investigate the function of different fruits.

Materials: What is a Fruit (poster), a variety of seeds from fruit trees, an apple, an orange, peach, a banana, olives, peanuts, dates, grapes, pineapple, paper plates, plastic knives, napkins, egg carton, magnifying glasses.

Visual: The Fruit poster. This poster will help introduce students to the different kinds of fruits and where they come from.

I do: Show the students the Fruit poster and explain that the part of a plant that develops from the flower. The fruit contains the seeds of the plant. It covers and protects the seeds. A fruit may have fleshy or dry tissue.

• Brainstorm the different kinds of fruits on the poster. Ask the students if they have ever seen or eaten any of these fruits. How many seeds in the fruit? Do all of these fruits grow on trees? (No,
grapes, strawberries, pineapple, watermelon). Where do they grow? (Active Processing)

We do: Sing and roll play Apple Poem: (TPR)

"Way up high in an apple tree." (point up)
"Ten red apples smiled at me." (hold up 10 fingers)
"I shook that tree as hard as I could."
(pretend to shake tree)
"Down came one apple." (pretend to catch one apple)
"Yum! Was it Good!" (rub tummy)

Repeat Verse with nine, eight, seven, etc. Continue counting backwards on each subsequent verse holding up appropriate number of fingers.

• Have students substitute other fruits and sing again. (Linguistic, Logical-Mathematical, Spatial, Musical, Interpersonal, Musical, Bodily Kinesthetic - Orchestrated Immersion)

Fruit Activity: Have students wash their hands and explain that it is very important not to touch food without washing hands.

• Explain that they will be working together to investigate fruit and that each person will have a job to do. Each group will report to the class.

• Divide students into four groups and give one fruit, a paper plate, a plastic knife, and a magnifying glass to each group.
#1 Person will write name of fruit on group plate.

#2 Person will feel and smell their fruit, and be ready to report to class. Before and after cutting.

#3 Person will look at their fruit with magnifying glass and be ready to report to class. Before and after cutting.

- Have group predict how many seeds they will have before cutting.

#4 Person will record prediction on their plate and be ready to report to class.

#5 Person will cut fruit, remove, count, and record seeds.

- Review fractions, draw on board what fruit might look like when cut into fractions, explain that the group must agree with cutter before they cut. Have one person cut fruit into fractions. (peach \( \frac{1}{2} \), apple \( \frac{1}{4} \), orange \( \frac{1}{8} \), banana \( \frac{1}{10} \)) and be ready to report on how their cutting went.

Check for understanding: Have number person stand and repeat what their job is. (#1's will...) Allow students time to complete each task, monitor and interview groups as they work, ask questions about their progress, assist if necessary, but do not interfere with the process.

- Rotate class to each group table and have reporters report what they found. Encourage students to ask
questions about each fruit and allow that group to answer. (Active Processing)

• Each group place their seeds in an egg carton collection labeled with their fruit. Record how many seeds there are. (banana = 0, peach = 1, apple = ?, orange = ?)

(Linguistic, Logical-Mathematic, Spatial-Interpersonal-Bodily Kinesthetic - Orchestrated Immersion)

Place collection in Science Center and encourage students to add seeds from home.

You do: Give each student a blank paper and explain that they are going to make a class book. They are to draw a picture of their favorite fruit and write, "My favorite fruit is a/an ______. I like it because it ______. It has_____seed/s. It grows on a ______." They may use any fruit that they like. Encourage students to use as many sentences as they can. Student Interview Form (Appendix K) could be used at this time to interview students to evaluate their understanding, reasoning, and dominant intelligence as they work independently. To encourage Relaxed Alertness, play soothing music as students work.

Copy each page for student portfolio. Laminate and bind the originals into class book. Do a Shared Reading then place in class library for students to read. Linguistic-Spatial-Interpersonal-Intrapersonal)
Personal Communication Assessment: Class observations, student interviews, and antidotal notes (Student Interview Form Appendix K) are to assess knowledge, evaluate student reasoning, and identify dominant intelligences.

Open-Ended Questions: Listen during brainstorming and encourage students to solve problems. Provides teacher with insight into how students are thinking.

Scientific Investigation: Collect information and explain results.

Portfolio Assessment: Provide a permanent long-term record of student's progress, reflection life-long nature of learning. (fruit page)

Performance Assessment: Use plus/minus check list to evaluate student demonstration of knowledge about fruits and group participation.

Rubric for assignment

4 = Full accomplishment: The student chooses a fruit, draws a picture of it, and neatly completes four sentences according to instructions and participates in group activity.

3 = Substantial accomplishment: The student chooses a fruit, draws a picture of it, and completes three sentences according to instructions and participates in group activity with prompting.

2 = Partial accomplishment: The student chooses a fruit, draws a picture of it, and completes two sentences
with some difficulty and prompting. Partially participates in group activity.

1 = Little or no progress toward accomplishment: The student chooses a fruit, somewhat draws a picture of it, writes one sentence with great difficulty even with prompting. Makes little attempt to participate.

Lesson XI

Subject: VEGETABLES (Science, Math, Physical Education, Art, Music, Language Arts, Social Studies)

Objective: Students will sort, classify and investigate different vegetables.

Materials: Vegetables (poster), Plant Person puppet, 5 brads per student, plastic knives, magnifying glasses, carrots, celery, lettuce, green beans, broccoli, radishes, onion, potato, ear of corn, grass seed, potting soil, junk for decorating potatoes.

Visual: Vegetable poster. This poster will help introduce students to the different kinds of vegetables and where they come from.

I do: Show the students the Vegetable poster. Explain that there are other kinds of plants that we eat. They have seeds, roots, stems, leaves, and some have flowers. Some grow above the ground and some grow under it.

We do: Sing and Role-play Vegetables song to "Old MacDonald Had a Farm" (TPR)
* Vegetables grow on a farm. E-I-E-I-O.

And on the farm we gather corn. E-I-E-I-O.

With a shuck, shuck here and a shuck, shuck there.
Here a shuck, there a shuck. Everywhere a shuck, shuck.
Vegetables grow on a farm. E-I-E-I-O.

* Encourage students to make up more verses. (turnips pretend to pull from ground, radishes - dig up, spinach - pick leaves, artichokes - snip off tops, broccoli - cut, beans - snap, etc.

(Linguistic, Spatial, Musical, Bodily Kinesthetic, Interpersonal, Intrapersonal - Orchestrated Immersion)

- Make a graph. Label ABOVE - BELOW. Brainstorm the vegetables they think grow above or below the ground.
- Show students fresh raw vegetables. Ask them to identify what part of the plant each is. Ask if they have ever eaten them before. Do they like them raw or cooked.
- Cut up vegetables and let students examine with magnifying class. Have them describe what they see inside and outside. Encourage them to taste each vegetable. Compare and contrast color, texture, size.

You do: Students will draw pictures of their favorite vegetable, write what part of the plant it is (seeds, roots, stems, leaves, or flower) and place card on the graph under “above” “below” labels.
• Show student's model of Plant Person Puppet. Have them identify parts. (Legs: carrots = roots, arms: celery = stem/stalk, body: cabbage = leaves, head: broccoli = flower)

• Give students 5 brads and copy of Plant Person to color, cut out and assemble.

• Have students volunteer to lead class and puppets in Vegetables song. (Use Appendix L for assessment)

• Ask students, What has ears but can't hear? What has eyes but can't see? (corn). What has a head but can't think? (lettuce) Encourage students to make up own jokes.

(Linguistic, Spatial, Musical, interpersonal, Bodily Kinesthetic, Intrapersonal - Active Processing)

Review the life cycle of the potato that was earlier planted in the Science Center. Give a potato to each student and have some fun with the potatoes.

Physical Education Activity:
1. Play one potato, two potato, three potato more . . . (buddies).

2. Have relay races using the potato on their head. (Teams)

3. Play catch with the potato. Buddies face each other in two lines, buddy throws potato to partner, if partner
catches it they take one step back, if not they are both out. Repeat until there is a winning pair.

Mr. Potato Head Activity: Explain that are going to make a living Mr. Potato Head. Cut top and bottom off potatoes and give to students with spoons and paper plates.

1. Students scoop out about two inches from top with plastic spoon.

2. Decorate with junk: buttons, yarn, ribbon, markers, felt, pipe cleaners giving it eyes, nose, ears, arms and place on paper plate. They may name their potato.

3. Fill the top of potato with potting soil, sprinkle in grass seeds, and spray with water.

4. Have students share their potato with class and predict what might happen to the grass seeds. How long or tall will it get? What does it need to grow? Does it look like some one they know?

- Have students make accordion book and title it Mr. ______ (name of potato) by _____ (name of student). Draw picture of potato on cover. Student Interview Form (Appendix K) could be used at this time to interview students to evaluate their understanding, reasoning, and dominant intelligence as they work independently. To encourage Relaxed Alertness, play soothing music as students work.

- Put potatoes in window and water daily.
• After three days (or when some grass is showing), return potatoes to students. Have them get out their books, put date at the top of page one and write, “The grass is _______ inches long.”

• Students will measure length to grass with ruler, record on page one, and draw a picture of their potato.

• About every three days continue this process until all pages are completed. On the back draw last picture and compare and contrast cover picture with back.

• Share potatoes and books with class.

Put book in browsing box and take potato home. (Linguistic, Logical-Mathematical, Spatial, Interpersonal, Intrapersonal, Bodily Kinesthetic - Orchestrated Immersion)

Personal Communication Assessment: Class observations, student interviews, and antidotal notes (Student Interview Form Appendix K) are to assess knowledge, evaluate student reasoning, and identify dominant intelligences.

Open-Ended Questions: Listen during brainstorming and encourage students to solve problems. Provides teacher with insight into how students are thinking.

Scientific Investigation: Collect information and explain results.
Portfolio Assessment: Provide a permanent long-term record of student's progress, reflection life-long nature of learning. (Mr. Potato Book)

Performance Assessment: Use plus/minus checklist (Appendix L) to evaluate student demonstration of knowledge and class participation.

Rubric for assignment

4 = Full accomplishment: The student makes Mr. Potato Head, neatly completes book, draws pictures, dates pages, writes sentence, measures and records grass growth each day according to instructions.

3 = Substantial accomplishment: The student makes Mr. Potato Head, completes book, draws pictures, dates pages, writes sentence, measures and records grass growth each day with prompting.

2 = Partial accomplishment: The student makes Mr. Potato Head, makes book, draws some pictures, has difficulty dating pages, writing sentences measuring and recording grass growth even with prompting.

1 = Little or no progress toward accomplishment: The student makes Mr. Potato Head with some difficulty, makes book, has great difficulty drawing pictures, dating pages, writing sentences, measuring, and recording grass growth even with prompting. Cannot complete book according to instructions.
Lesson XII

Subject: Plants and Animals (Science, Art, Math, Language Arts, Social Studies)

Objective: Students will compare the similarities and differences of plants and animals.

Materials: Venn Diagram for each student.

I do: Review previous lesson: Using felt board, have students relate characteristics of plants. They are: living things, they have leaves, stems, roots, flowers, they cannot move around by themselves, they help keep our air clean.

- Take students outside. Ask students to observe: How many different plants can they find? Which one is the tallest or shortest? How many different colors of plants do you see? (Record responses for later discussion.)

- Have students take a deep breath and tell them that plants make the air we breathe.

(Linguistic, Spatial, Bodily Kinesthetic, Intrapersonal, Naturalistic, Logical-Mathematical - Orchestrated Immersion)

We Do: Students compare and contrast plants and animals. Brainstorm characteristics of animals and plants: (Active Processing)
<table>
<thead>
<tr>
<th>Plants</th>
<th>Both</th>
<th>Animals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannot move around.</td>
<td>Can move around.</td>
<td></td>
</tr>
<tr>
<td>Have: leaves, roots, flowers, stems</td>
<td>Need: air, water, sun, food</td>
<td>Have: feathers, fur, scales, skin</td>
</tr>
<tr>
<td>Make own food.</td>
<td>Grow</td>
<td>Cannot make own food</td>
</tr>
</tbody>
</table>

- Have students fill in own Venn Diagram. Choose a plant or animal, illustrate it, and write a sentence describing it. “I am bigger than a ______. A ______ is very tiny.” (leaf, dog, bug, rose, etc.) or “I am not as big as a __________. A ______ is much bigger than I.” (tree, sunflower, horse, dinosaur, etc.) Student Interview Form (Appendix K) could be used at this time to interview students to evaluate their understanding, reasoning, and dominant intelligence as they work independently. To encourage Relaxed Alertness, play soothing music as students work.

Check for understanding: Come to rug and share your sentences and pictures. (Spatial, Linguistic, Intrapersonal, Interpersonal, Logical-Mathematical - Orchestrated Immersion)

**Personal Communication Assessment:** Class observations, student interviews, and antidotal notes (Student Interview Form Appendix K) are to assess knowledge, evaluate student reasoning, and identify dominant intelligences.
Open-Ended Questions: Listen during brainstorming and encourage students to solve problems. Provides teacher with insight into how students are thinking.

Portfolio Assessment: Provide a permanent long-term record of student's progress, reflection life-long nature of learning. (Venn diagram and story)

Performance Assessment: Use plus/minus check list (Appendix L) to evaluate student demonstration of knowledge and outside activity participation.

Rubric for assignment

4 = Full accomplishment: Student completes Venn Diagram. Chooses a plant or animal, illustrates, and writes four sentences. Reads to a buddy.

3 = Substantial accomplishment: Student completes Venn Diagram. Chooses a plant or animal, illustrates, and writes three sentences. Reads to a buddy with prompting.

2 = Partial accomplishment: Student attempts to make Venn Diagram. Chooses and illustrates a plant or animal writes two sentences with some difficulty. Reads to a buddy with prompting.

1 = Little or no progress toward accomplishment: Student chooses plant or animal with great difficulty, but cannot write sentence or make Venn Diagram according to instructions, even with prompting.
Lesson XIII

Subject: ALL LIVING THINGS. (Drama, Art, Social Studies, Language Arts, Math)

Objective: Students will describe, illustrate, and model how living things depend on each other.


I do: Review previous lesson. Ask students WHY is it important to know about plants. What do they do for us and what can we do for them?

• Brainstorm Plants transparency. Let's look at the things we get from plants. (vegetables, fruits, grains, wood). Explain that we eat or use products from all of these things everyday. Ask students for some examples. (Active Processing)

Shared Reading: Be a Friend to Trees by Patricia Lauber. This book reinforces the concept of how other living thing depend on each other and gives examples of animal dependence on trees at different levels. It shows products that people use made of wood and how animals could not
survive without trees and it's products, including oxygen, paper, sap, fruits, and more.

• Review book knowledge and have students reflect on each page. Make predictions from cover. Ask how the illustrations make them feel about trees.

• Brainstorm personal experiences with trees. (swing in tree, read under tree, etc.) How trees make them feel. Explain that EVERYTHING that is made of wood was once a part of a tree.

• Have students find objects in classroom that are made of wood and bring to the rug. Talk about each object (pencil, paper, ruler, table, blocks), write on board and initial.

Discuss life in classroom without wood.

• Remind students that trees are green plants and are the only living things that can make their own food. All other living things need green plants for food. Some eat the plants, some eat the plant eaters, and some eat both. Can you name any?

Discuss the animals that make their homes in trees. How air is made of oxygen and all animals need oxygen to breath.

Review photosynthesis.

• Ask students how we can help trees. (use less paper, recycle, plant trees)
This could lead into lessons on environment, ecology, conservation, etc. (Linguistic, Spatial, Interpersonal - Active Processing)

Shared reading: A Tree is a home.

This book reinforces fact that animals need trees and trees need animals.

- Brainstorm the different creatures that need trees for a home.

Could lead to future lessons on the Rain Forests, Deserts, and Woodlands.

Activity: Students will make A Tree in A Home (mini-flip book) that illustrates insects and animals homes. Have students color both sides, cut on solid lines and fold on dotted lines to make book. Student Interview Form (Appendix K) could be used at this time to interview students to evaluate their understanding, reasoning, reading strategies, comprehension skills and dominant intelligence as they work independently. To encourage Relaxed Alertness, play soothing music as students work.

Coral read: Lift up flaps to find secret answers. Read to a buddy. Place in Browsing Box. (Linguistic, Logical-Mathematical, Spatial, Interpersonal, Bodily Kinesthetic - Orchestrated Immersion)

Review transparency again: Let's talk about more products from plants. Also refer to fruit poster.
Brainstorm WHY other living things need FRUITS. Who eats them (don't forget nuts).

Review where fruits come from (trees, vines, plants). List favorite fruits on chart paper. Have students initial their favorite. Graph (most/least)

Review transparency again: There are more products from plants. Also refer to vegetable poster.

Brainstorm WHY other living things need VEGETABLES. Who eats them.

Review where vegetables come from (above or below ground).

Make a Graph TITLE: Above Ground-Below Ground-Cooked-Raw

Brainstorm favorite vegetables on board.

Have students write favorite vegetable on one index card and draw a picture of same vegetable on another, and initial both cards.

Have students place pictures and name cards on graph and explain. (Use Appendix L to assess understanding)

Review transparency again: Lets talk about GRAIN products from plants. What are some kinds of grains? (wheat, rice, oats) Review where they come from? (seeds).

Brainstorm WHY other living things need GRAINS. Who eats them?
• Explain that grains are the most important plant for people because to be healthy, we must eat more products made from grains than any other.

Nutrition Activities: This activity introduces human nutrition and reinforces the fact that humans need plants to survive.

1. Give students a Food Guide Pyramid puzzle and brainstorm the different foods we eat made from grains (bread, cereal, rice pasta crackers).

Discuss the different food groups and number of servings we should eat everyday. Have students color, cut out, and glue puzzle pieces where they belong on the pyramid.

2. Give each student a paper plate and some old magazines.

Using the food pyramid, have students find, cut out and glue pictures of a balanced meal on the plate.

• Students share plates with class. Display plates on bulletin board. Later place both in portfolio. Student Interview Form (Appendix K) could be used at this time to interview students to evaluate their understanding, reasoning, and dominant intelligence as they work independently.

To encourage Relaxed Alertness, play soothing music as students work. (Linguistic, Logical-Mathematical, Spatial,
Interpersonal, Intrapersonal, Bodily Kinesthetic - Orchestrated Immersion

Could lead to lesson on HEALTH and NUTRITION. Use big book You Are What You Eat and teaching guide from Newbridge science collection.

Shared reading: Communities by John Parsons.

This book introduces the idea of plants and animals living together as one unit and depending on each other for different things.

• Brainstorm what a community is. (cities, towns, farms, neighborhoods. Explain that in communities everyone needs others in that community. We all depend on each other for different things.

• Explain that a plant is the center of a community. Discuss what living things live below plants (worms/ants), above plants (bees, butterflies, birds), around plants (snails, spiders, lizards), on plants (aphids, ladybugs, grasshoppers) and how they need each other.

• Have students pretend that they are one of these living things. Write: I am a ______. I live ______ (above) this ______. (flower) I need this flower because ______. It needs me because ____.

• Draw a picture of you and your plant. Show where you are. Student Interview Form (Appendix K) could be used at this time to interview students to evaluate their
understanding, reasoning, and dominant intelligence as they work independently. To encourage Relaxed Alertness, play soothing music as students work. Share story with class. Put in portfolio. (Linguistic, Logical-Mathematical, Spatial, Interpersonal, Intrapersonal - Orchestrated Immersion)

Could lead to lessons on Communities, Insects and Metamorphous (frogs, butterflies). Use any of Eric Carle's books. This could lead into an author study lesson. Read Aloud: Sundew Stranglers: Plants that eat Insects. This book, with its beautiful illustrations, gives the students a different view of nature and how it works with the environment.

- Explain that there are plants that eat meat (insects). Sundews are carnivorous plants with leaves that sparkle like dew in the sun, but are very sticky and that is how they catch their food.

- Compare and contrast the beautiful photographs with the other books illustrations. How are they different or the same?

- Explain the carnivorous means to eat meat. TPR = Touch your chin to count the syllables in carnivorous.

- Explain that vegetarians do not eat meat or meat products.
• Brainstorm other living things that are also carnivorous and what kind of meat they eat.

Make a Venn diagram on chart paper.

<table>
<thead>
<tr>
<th>Vegetarian</th>
<th>Both</th>
<th>Carnivorous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pandas</td>
<td>people</td>
<td>cats, dogs</td>
</tr>
<tr>
<td>Sheep, cows</td>
<td>fish</td>
<td>lions, tigers</td>
</tr>
<tr>
<td>Giraffes</td>
<td>insects</td>
<td>plants</td>
</tr>
<tr>
<td>deer, pigs</td>
<td>bears, birds</td>
<td></td>
</tr>
</tbody>
</table>

Challenge students to research more living things and add to the chart. This could lead to a lesson about the Food Chain, prey and predator, camouflage. (Linguistic, Logical-Mathematical, Spatial, Interpersonal - Active Processing)

Shared Reading: *The Little Red Hen*. (big book) Discuss the seed to harvest cycle. What happened to the wheat seeds after they were planted? What the Little Red Hen did to care for her plants. Discuss moral of story. What are friends for? How could it have ended differently.

• Divide students into four (4) groups. Give two groups a script with traditional story and stuffed animals or props to match their role. (hen, duck, cat, dog, narrator)

• Have two groups change script and words so that all or some of the characters get to share to bread at the end. Provide props. Use Appendix L to assess participation.
(Linguistic, Spatial, Bodily Kinesthetic, Interpersonal, Intrapersonal – Orchestrated Immersion)

Personal Communication Assessment: Class observations, student interviews, and antidotal notes (Student Interview Form Appendix K) are to assess knowledge, evaluate student reasoning, and identify dominant intelligences.

Open-Ended Questions: Listen during brainstorming and encourage students to solve problems. Provides teacher with insight into how students are thinking.

Scientific Investigation: Collect information and explain results.

Portfolio Assessment: Provide a permanent-long-term record of student's progress, reflection life-long nature of learning. (community paper)

Performance Assessment: Use plus/minus checklist (Appendix L) to evaluate student demonstration of knowledge and performance in play.

Rubric for assignment

4 = Full accomplishment: The student completes flipbook, nutrition activities and community story neatly according it instructions. Full participation in play.

3 = Substantial accomplishment: The student completes flipbook, nutrition activities and community story neatly according it instructions and some participation in play with prompting.
2 = Partial accomplishment: The student has difficulty completing flipbook, nutrition activities and community story even with prompting. Little participation in play.

1 = Little or no progress toward accomplishment: The student cannot complete flipbook, nutrition activities, community story, and does not participate in play, even with prompting.
APPENDIX B: METAMORPHOSIS

Lesson I

**Subject:** Metamorphosis (Science/Math/Art/Drama/Language Arts)

**Objective:** Students will enhance vocabulary with days of the week, number, colors, and fruit words. Practice predicting and story sequencing.

**Materials:** The Very Hungry Caterpillar, by Eric Carl. Story Time Props and craft stick (for sequencing), crayons, scissors, and glue.

*I do:* Shared Reading. Introduce book: Review book knowledge cover, title page, title, author, publisher and date. “Who can tell me what we call the person who writes the words, draws the pictures, makes the book, etc.” (Linguistic)

- Read to page three (3), Stop and ask students to predict what will happen next (day, fruit, amount). Stop at each page until end.

- Check prior knowledge: In 1969 Eric Carl used the word cocoon to describe the chrysalis. (See if anyone catches it.) - Bring this to their attention. (Spatial)

*We do:* Choral Reading. Re-read story with students. Have them clap the number of fruit each day. Role play tummy ache, hide in chrysalis, spread wings as butterfly. Student
Interview Form (Appendix K) could be used at this time to interview students to evaluate their understanding, reasoning, and dominant intelligence as they work independently. To encourage Relaxed Alertness, play soothing music as students work.

(Linguistic, Bodily Kinesthetic, Spatial, Logical-Mathematical, Musical - Orchestrated Immersion)

Brainstorm: (Active Procession)

1. Have you ever eaten too much and had a stomachache?
2. What do you think it feels like to be closed inside some thing for two weeks (no food, light, etc.)?
3. Have you ever wanted to fly like a butterfly? (Spatial, Intrapersonal)

You do: Choose Story Prop. (fruit, caterpillar, etc.)

Color, cut out, and glue your choice to craft sticks. Roll play getting in order of story sequence. Check for understanding: “What is your prop? Where do you go?” (Use Appendix to assess comprehension)

Clean up. (Interpersonal)

Close: “Let’s do it!” - Read story as students act out and sequence their props. (Spatial, Logical-Mathematical, Interpersonal, Linguistic, Bodily Kinesthetic - Orchestrated Immersion)

Skills Practice: listening skills, following directions, fine motor skills, eye-hand coordination, sequencing,
reading, building vocabulary, problem solving, compare/contrast, predicting, communication and co-operation (social) skills.

**Performance Assessment**: Use plus/minus checklist to (Appendix L) evaluate student demonstration of sequencing story.

**Personal Communication Assessment**: Class observations, student interviews, and antidotal notes (Student Interview Form Appendix K) are to assess knowledge, evaluate student reasoning, and identify dominant intelligences.

**Open-Ended Questions**: Listen during brainstorming and encourage students to solve problems. Provides teacher with insight into how students are thinking.

**Rubric for art props and sequencing**:

4 = Full accomplishment: Student chooses, colors, cuts out and glues prop onto craft stick neatly and acts out story in correct sequence.

3 = Substantial accomplishment: Student chooses, colors, cuts out and glues prop onto craft stick with some difficulty and acts out story in correct sequence.

2 = Partial accomplishment: Student chooses, colors, cuts out and glues prop onto craft stick with some difficulty and acts out story in correct sequence with prompting.
Little or no progress toward accomplishment: Student chooses, colors, cuts out and glues prop onto craft stick with great difficulty and cannot act out story in correct sequence even with prompting.

Lesson II
Subject: Metamorphosis (Science/Math/Art/Language Arts)
Objective: Students will write days of the week, numbers and number words, color fruit and assemble a Mini Book of The Very Hungry Caterpillar, Cut, match and glue caterpillar puzzle in back. Re-tell story to buddy.
Materials: The Very Hungry Caterpillar, by Eric Carl. Crayons, scissors, yarn, single hole punch, construction paper, Mini Books and caterpillar puzzles (place value, 1's & 10's).

- Re-read The Very Hungry Caterpillar. Review vocabulary. (Linguistic)
- Color and cut out booklet pages. (Spatial)
- Trace the numbers and number words on each booklet page. (Linguistic, Logical-Mathematical)
- Write days of the week with appropriate number and fruit. (Linguistic, Logical-Mathematical)
- Punch out all the holes on each page. Assemble the booklet in numerical order. (Spatial, Logical-Mathematical)
• Cut construction paper to make Mini Book cover, punch holes in side.
• Tie the booklet with yarn through the left-hand side holes. (Spatial)
• Write My Caterpillar Book, by: (student name) on cover. (Linguistic)

Once the book is completely assembled, you will see uniform holes through all the fruits on each of the pages.
• Cut, match, and glue the caterpillar place value puzzle inside back cover. Student Interview Form (Appendix K) could be used at this time to interview students to evaluate their understanding, reasoning, and dominant intelligence as they work independently.

To encourage Relaxed Alertness, play soothing music as students work. (Spatial, Logical-Mathematical - Orchestrated Immersion)

Clean up. (Interpersonal)

Close: Pretend the caterpillar ate through all the fruits. Read your book to a friend or the class. (Interpersonal, Linguistic, Spatial)

Check for understanding: Share what you learned, what was your favorite part. (Interpersonal - Active Processing) Use Appendix to assess understanding.

Skills- Practice: listening skills, following directions, fine motor skills, eye-hand coordination, sequencing,
reading, expanding vocabulary, problem solving, compare/contrast, predicting, communication and cooperation (social) skills, writing, re-telling story.

Performance Assessment: Use work samples (book) to evaluate student demonstration of sequencing days of week and story.

Personal Communication Assessment: Class observations, student interviews, and antidotal notes (Student Interview Form Appendix K) are to assess knowledge, evaluate student reasoning, and identify dominant intelligences.

Open-Ended Questions: Encourage students to collect, organize, display information and to solve math problems.

Portfolio Assessment: Provide a permanent long-term record of student's progress, reflecting life-long nature of learning.

Rubric sequencing pages, math puzzle, and reading book:

4 = Full accomplishment: Student neatly colors, cuts out and sequences pages of book, correctly completes and inserts math puzzle, and reads story to a buddy.

3 = Substantial accomplishment: Student colors, cuts out and sequences pages of book, inserts math puzzle, and reads story to a buddy with prompting.

2 = Partial accomplishment: Student colors, cuts out and sequences pages of book and inserts math puzzle with some difficulty. Reads story to a buddy with prompting.
1 = Little or no progress toward accomplishment: Student colors, cuts out and sequences pages of book with great difficulty. Cannot complete math puzzle or read book to a buddy even with prompting.

Lesson III

Subject: Metamorphosis (Science/Math/Art/Drama/Language Arts/Music)

Objective: Students will enhance vocabulary. Practice predicting and story sequencing. Compare and contrast illustrations, fact and fiction. Learn life cycle of butterfly. Copy poem and put on caterpillar puppet.


Review: lesson on The Hungry Caterpillar. "What do you remember?" (story, vocabulary, pictures, etc.).

Shared Reading: (Science Big Book) A Butterfly Is Born

- Practice book knowledge, What does the author, illustrator, etc. do?
- Practice predicting, What will happen next?
- Compare and contrast two books.
Brainstorm: pictures and facts. “Did you notice anything different about the two books?” (big/little, illustrations/photos, cocoon/chrysalis, fact/fiction,)

Brainstorm Stages: TPR (hold up fingers)

ONE finger = EGG - What else starts as an egg?
(bird, fish, snake)

TWO fingers = CATERPILLAR - Have you ever seen one?

THREE fingers = CHRYSALIS/PUPA - What do you think it feels like?

FOUR fingers = BUTTERFLY - Would you touch it, why?
(respect life)

Check for understanding: 1, 2, 3, 4 Repeat stages
(Spatial, Linguistic, Bodily Kinesthetic, Interpersonal, Intarpersonal, Naturalist - Orchestrated Immersion) Use Appendix to assess for understanding.

Shared Reading: poem together from transparency, show puppet model, and explain/model project. (Linguistic, Interpersonal)

Model: Writing poem on caterpillar body parts, give out materials.

1. Copy poem on caterpillar's body, Don't forget: Write, Proof (buddy/alone), Edit, Publish. (raise hand for publishing pen) (Linguistic, Interpersonal, Intarpersonal)

2. Color body and head neatly. (Spatial)
3. Cut out head, antennae, and three body parts.  
   (Spatial)


Student Interview Form (Appendix K) could be used at this time to interview students to evaluate their understanding, reasoning, and dominant intelligence as they work independently. To encourage Relaxed Alertness, play soothing music as students work. (Spatial, Logical-Mathematical, Linguistic – Orchestrated Immersion)

Finish early: Clean up – Buddy up – Read and roll play poem. (Interpersonal, Linguistic, Musical, Bodily Kinesthetic)

Clean up. (Interpersonal)

Close: Read and roll play your puppet poem to a friend or the class. Save puppets for scenery in play – culminating activity. (Interpersonal, Linguistic, Musical, Bodily Kinesthetic)

Check for understanding: Share what you learned, what was your favorite part. (Interpersonal, Linguistic)

Skills Practice: Listening skills, following directions, fine motor skills, eye-hand coordination, sequencing, reading, writing process, building vocabulary, problem solving, compare/contrast, predicting, communication and co-operation (social) skills, and rhyming.
Performance Assessment: Use plus/minus checklist (Appendix L) to evaluate student demonstration TPR of four stages of life cycle.

Personal Communication Assessment: Class observations, student interviews, and antidotal notes (Student Interview Form Appendix K) are to assess knowledge, evaluate student reasoning, and identify dominant intelligences.

Open-Ended Questions: Provide openness to diverse responses to classroom questioning and discussion.

Portfolio Assessment: Place puppet poem in portfolio to provide a permanent long-term record of student's progress, and use for scenery for play.

Rubric: Puppet construction, poem sequencing, role-playing
4 = Full accomplishment: Student neatly writes poem, colors, cuts out and sequences caterpillar body parts on paper bag, and role plays with a buddy.
3 = Substantial accomplishment: Student neatly writes poem, colors, cuts out and sequences caterpillar body parts on paper bag, and role plays with a buddy but needs prompting.
2 = Partial accomplishment: Student writes poem, colors, cuts out and sequences caterpillar body parts on paper bag with some difficulty and role plays with a buddy with prompting.
Lesson IV

Subject: Metamorphosis (Science/Math/Art/Language Arts/Music)

Objective: Students will enhance vocabulary. Practice sequencing life cycle of butterfly. Sing and Roll play poem.


Review lesson on A Butterfly Is Born "What do you remember?" Do a picture walk for review (life cycle, vocabulary, pictures, etc.).

(Spatial, Linguistic, Naturalist, Interpersonal)

Brainstorm Stages: Thought Web METAMORPHOSIS on board - count syllables - touch finger to arm. (Bodily Kinesthetic, Interpersonal, Logical Mathematical)

First stage = EGG - count syllables - touch finger to arm.

a. Many shapes, sizes, very small (size of dot to 1/8 inch across).

b. Is laid on a leaf by another butterfly.
TPR - pretend you are inside that egg. (Bodily Kinesthetic, Intrapersonal, Spatial)

**Second stage** = CATERPILLAR - count syllables - touch finger to arm.

a. Comes out of egg in a few days.

b. Is very hungry and eats eggshell

c. Still very hungry and eats many leaves and grows bigger.

Explain molting, Color stays the same.

**Brainstorm:** What other animals molt (snakes)

**Role Play:** TPR - pretend you are coming out of eggshell.

(Bodily Kinesthetic, Intarpersonal, Spatial)

**Third stage** = PUPA - count syllables - touch finger to arm.

(Bodily Kinesthetic, Interpersonal, Logical-Mathematical)

a. Get ready to change again, caterpillar hangs from a branch.

b. It hangs upside down.

c. Forms a tight covering around itself called a chrysalis that looks like a green leaf. This is called camouflage Challenge students to think of other animals that use camouflage to survive. (Spatial, Naturalist)
Fourth stage = BUTTERFLY—count syllables - touch finger to arm. (Bodily Kinesthetic, Interpersonal, Logical-Mathematical)

Explain: The butterfly's wings are wet and crumpled as it comes our.

a. It hangs by the chrysalis (pupa) dry.

b. In about 30 minutes the 4 wings are dry and strong enough to fly.

c. It lives from a few weeks to 18 months.

Challenge students to predict what happens next. (eat nectar, migrate, pollinating flowers)

Brainstorm:

a. What other animals eat nectar? (many different birds, humming birds)

b. What other animals migrate? (many different birds)

c. What other insects pollinate flowers? (bees, bats, hummingbirds) (Bodily Kinesthetic, Interpersonal, Intarpersonal, Spatial, Naturalist, Logical-Mathematical - Active Processing)

Check for understanding: Role-play stages. Use Appendix L to assess for understanding. (Bodily Kinesthetic, Interpersonal, Intarpersonal, Spatial, Naturalist, Logical-Mathematical - Orchestrated Immersion)

Read, Sing and Role play: (TPR)

I spin and spin my chrysalis. (Circle fingers on palm.)
Then go inside to rest. (Close fingers and rest hand on palm.)
When I come out, I've changed indeed... (Open fingers slowly.)
Look! I'm a butterfly! (Fly fingers away.) (Linguistic, Bodily Kinesthetic, Interpersonal, Intarpersonal, Spatial, Naturalist, Logical-Mathematical, Musical - Orchestrated Immersion)
Pass out Butterfly Life Cycle Sequence Activity sheet and construction paper:
• Color, cut, and glue the pictures in the correct order on Life Cycle Poster.
• Tell a story about each picture, and write sentences using Thought Web. Student Interview Form (Appendix K) could be used at this time to interview students to evaluate their understanding, reasoning, and dominant intelligence as they work independently.
To encourage Relaxed Alertness, play soothing music as students work. (Linguistic, Spatial, Naturalist, Logical-Mathematical, Musical, Interpersonal - Orchestrated Immersion)
Clean up: (Interpersonal)
Close: Read Life Cycle Poster to a friend or share with the class. (Linguistic, Spatial, Naturalist, Logical-Mathematical, Interpersonal)
Check for understanding: Share what you have learned and what was your favorite part. (Interpersonal, Linguistic)

Skills practiced: Listening skills, following directions, fine motor skills, eye-hand coordination, sequencing, reading, writing, building vocabulary, problem solving, compare/contrast, predicting, communication and cooperation (social) skills, and rhyming.

Performance Assessment: Use life cycle poster to evaluate student demonstration and understanding of four stages of life cycle.

Personal Communication Assessment: Class observations, student interviews, and antidotal notes (Student Interview Form Appendix K) are to assess knowledge, evaluate student reasoning, and identify dominant intelligences.

Open-Ended Questions: Ask students to clarify and express individualized thinking.

Portfolio Assessment: Place poster in portfolio to provide a permanent long-term record of student's understanding of four stages.

Scientific Investigation: Collect information, produce a quality product and explain results.

Rubric for life cycle poster, sequencing stages:

4 = Full accomplishment: Student neatly colors, cuts out and numbers stages of metamorphosis. Glues on poster in correct order and tells story about each stage.
3 = Substantial accomplishment: Student neatly colors, cuts out and numbers stages of metamorphosis. Glues on poster in correct order and tells story about each stage but needs some prompting.

2 = Partial accomplishment: Student colors, cuts out stages of metamorphosis and glues on poster in with some difficulty (not all in correct order), tells story about each stage but needs a great deal of some prompting.

1 = Little or no progress toward accomplishment: Student colors, cuts out stages of metamorphosis and glues on poster in with great difficulty (not in any order), cannot tell story about each stage even with prompting.

Lesson V

Subject: Metamorphosis (Science/Art/Drama/Language Arts/Music)

Objective: Students will enhance vocabulary. Compare and contrast butterfly and moth using a Venn Diagram, Make antennae headband, Sing and Roll play poem.

Materials: (Science Big Book) A Butterfly Is Born, tape, clay, over head transparency of poem, construction paper headband, pipe cleaners (two per student).

Brainstorm: Venn Diagram on board to compare and contrast butterfly and moth.
<table>
<thead>
<tr>
<th>Moth</th>
<th>Both</th>
<th>Butterfly</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Spins a cocoon</td>
<td>-Are insects</td>
<td>-Spins a Chrysalis</td>
</tr>
<tr>
<td>-Feathery antennae</td>
<td>-Two antennae</td>
<td>-Has straight antennae</td>
</tr>
<tr>
<td>antennae without knobs</td>
<td></td>
<td>with knobby</td>
</tr>
<tr>
<td>-Rests with wings</td>
<td>-Live anywhere</td>
<td>-Rests with wings</td>
</tr>
<tr>
<td>flat</td>
<td></td>
<td>straight up</td>
</tr>
<tr>
<td>-Sleep during day, come out at night</td>
<td>-Lay eggs</td>
<td>-Awake during day, sleep at night</td>
</tr>
<tr>
<td>-Bodies are thick</td>
<td></td>
<td>-Bodies are thin</td>
</tr>
</tbody>
</table>

(Spatial, Naturalist, Linguistic, Interpersonal - Active Processing)

**Brainstorm:** ANTENNAE - count syllables - touch fingers to arm. (Bodily Kinesthetic, Interpersonal)

- Can detect scents of flowers and other butterflies up to 2 miles away.
- Help butterflies to taste and feel.

**Model:** assembly of antennae headband.

- Students work in pairs to make antennae (one moth - one butterfly). Provide each student with pipe cleaners, paper headband, clay, and feathers.

(Spatial, Naturalist, Linguistic, Interpersonal, Bodily Kinesthetic - Orchestrated Immersion)

**Clean up:** (Interpersonal)
Close: **Role Play**, Butterfly vs. Moth facts poem. Provide each student with a script. 
Buddies reading and chanting back and forth.
“I am a butterfly, I spin a Chrysalis.”
“I am a moth, I spin a cocoon.”
   Repeat two times.
“We both have antennae.”
   Repeat two times.
(Butterflies)
“I am awake during the day and sleep at night.”
(Moths)
“I awake at night and sleep during the day.”
   Repeat two times.
(Butterflies)
“I rest with my wings straight up.”
(Moths)
“I rest with my wings flat.”
   Repeat two times.
“I am a butterfly.”
“I am a Moth.”
Repeat as many times as students like, then switch rolls and repeat. (Spatial, Naturalist, Linguistic, Interpersonal, Musical, Bodily Kinesthetic - Orchestrated Immersion)
Check for understanding: Share what you learned, what was your favorite part. Use Appendix L to assess for participation. (Linguistic, Interpersonal)

Skills practiced: Listening skills, following directions, fine motor skills, eye-hand coordination, sequencing, reading, building vocabulary, problem solving, compare/contrast, predicting, communication and cooperation (social) skills, and rhyming.

Performance Assessment: Use plus/minus checklist (Appendix L) to evaluate student demonstration and understanding for comparing and contrasting the butterfly versus the moth role-playing differences.

Personal Communication Assessment: Class observations, student interviews, and antidotal notes (Student Interview Form Appendix K) are to assess knowledge, evaluate student reasoning, and identify dominant intelligences.

Open-Ended Questions: Allow students to work in cooperative group to make antennae headbands and practice poem chant.

Rubric for antennae headbands and compare/contrast chant:

4 = Full accomplishment: Student chooses to be a moth or a butterfly then assembles appropriate antennae headband, then performs chant with partner of opposite choice.

3 = Substantial accomplishment: Student chooses to be a moth or a butterfly and assembles appropriate antennae
headband with some difficulty, then performs chant with partner of opposite choice with some prompting.

2 = Partial accomplishment: Student chooses to be a moth or a butterfly and assembles appropriate antennae headband with some a great deal of difficulty, then performs chant with partner of opposite choice with a great deal of prompting.

1 = Little or no progress toward accomplishment: Student chooses to be a moth or a butterfly cannot assemble appropriate antennae headband or cannot performs chant with partner of opposite choice even with a great deal of prompting.

Lesson VI

Subject: Metamorphosis (Science/Art/Drama/Language Arts/Math)

Objective: Students will enhance vocabulary. Compare and contrast color, patterns, and texture. Roll play poem, learn about butterfly wings.

Materials: (Science Big Book) A Butterfly Is Born, overhead transparency of poem, black construction paper, paint, brushes, scissors, craft sticks.

Coral Read: TPR: Let students create own bodily movements to reflect words of poem (Unknown author).

Up and down the air you float
Like a little fairy boat;
I should like to sail the sky,
Gliding like a butterfly!

(Spatial, Naturalist, Linguistic, Bodily Kinesthetic, Interpersonal, Musical)

Brains storm: butterfly wings

a. Size, and shape, different, same, color.

b. Butterflies fly in different ways depending on the size and shape of their wings.

- Close your eyes - Pretend you can fly. You have round wings. Large rounded wings flap slowly and glide smoothly on air currents.

- Close your eyes again. You have small pointed wings beat fast to stay in the air. You can fly very fast, but for short distances. If scared, (600 times a minute, going as fast as 30 miles an hour.

- Close eyes again. You have pointed wings. Your have rows of tiny overlapping scales that reflect light and give the wings their color. Provide photographs of wing scales.

(Intrapersonal, Spatial - Orchestrated Immersion)

Brainstorm: What kind of bird you might be (Linguistic)

Explain: Shape and color patterns on wings have symmetry. Count syllables on fingers. (Logical-Mathematical, Bodily Kinesthetic, Linguistic, Spatial)

Students investigate half wings with mirrors, then try to match wings with other half. Provide mirror and pictures
of different kinds of butterflies, cut in half. (Bodily Kinesthetic)

**Brainstorm:** other symmetry in nature (animal bodies, leaves, and faces). (Spatial, Naturalist, Linguistic, Interpersonal, Musical, Logical-Mathematical, Bodily Kinesthetic, Linguistic - Active Processing)

**Directed art lesson:** Fold construction in half, draw outline of butterfly on one side, then cut it out, open and paint one side, fold together, press, open to see symmetry, tape on craft stick. Save butterflies for scenery in play - culminating activity. (Spatial, Naturalist, Linguistic, Interpersonal, Logical-Mathematical - Orchestrated Immersion)

**Clean up:** (Interpersonal)

**Close:** Recite and Role Play poem. TPR (Spatial, Naturalist, Linguistic, Interpersonal, Musical, Logical-Mathematical, Bodily Kinesthetic, Linguistic - Orchestrated Immersion)

**Check for understanding:** Share what you learned, what was your favorite part. Use Appendix L. (Linguistic, Interpersonal)

**Skills Practiced:** Listening skills, following directions, fine motor skills, eye-hand coordination, symmetry, sequencing, reading, building vocabulary, problem solving,
compare/contrast, predicting, communication and cooperation (social) skills, and rhyming.

**Performance Assessment:** Use butterfly art to evaluate student demonstration and understanding of comparing/contrasting colors, patterns and symmetry.

**Personal Communication Assessment:** Class observations, student interviews, and anecdotal notes (Student Interview Form Appendix K) are to assess knowledge, evaluate student reasoning, and identify dominant intelligences.

**Open-Ended Questions:** Ask students to solve problems in many ways.

**Portfolio Assessment:** Place butterfly art in portfolio to provide a long-term record of student's understanding of comparing/contrasting color, patterns and symmetry (save of scenery in play).

**Scientific Investigation:** Collect information, produce a quality product and look for patterns.

**Rubric for butterfly art project:**

4 = Full accomplishment: Student follows directions in creation of butterfly art project. Neatly folds, draws shape, cuts out, opens and paints one side, folds together then opens to see symmetry, glue on craft stick and role play poem.

3 = Substantial accomplishment: Student somewhat follows directions in creation of butterfly art project. Fold,
draw, cut out, open, paint one side, fold together
then open to see symmetry, glue on craft stick with
some difficulty, and role-play poem.

2 = Partial accomplishment: Student somewhat follows
directions in construction of butterfly art project.
Fold, draw, cut out, open, paint one side, fold
together then open to see some symmetry, glue on craft
stick with a deal of difficulty, and role-play poem
great deal of some prompting.

1 = Little or no progress toward accomplishment: Student
cannot follow directions in creation of butterfly art
project. Cannot fold, draw, cut out, correctly, opens
to find TWO separate sheets of paper, paints one side,
fold together then opens to see very little symmetry,
(have to tape wings together in order to) glue on
craft stick with great deal of difficulty, and cannot
role play poem even with prompting.

For final project, students perform a play that
reflects the life cycle of a butterfly. Students create
scenery by painting different kinds of flowers on large
sheets of paper, then student butterfly art and puppets
could be displayed. Students create costumes, some
caterpillars and butterflies to roll play the metamorphous.
Practicing rolls using a tape recorder might help students
to learn their parts and hear what they will sound like.
APPENDIX C: METAPHOR

As a part of Brain-based learning, Caine and Caine (1991) believe that metaphors are intrinsic to the construction of new knowledge and are at the heart of the acquisition of felt meaning. Because metaphor has interested philosophers for many years, more and more educators have become interested and have used them as an instructional framework. Metaphors have been used to explain emotional states or social events in which experiences encompass much more that the actual physical events that describe them. Caine and Caine emphasize that educators should use metaphors intentionally in every subject and make a deliberate attempt to articulate and make better use of complex relationships that underline mapping as they become means to coherently engage all the systems of the brain/mind.

Sam Crowell, associate professor of education at California State University, San Bernardino and director of the Center for Research in Integrative Learning and Teaching, presents the theme of "teachers as artists", then invites his students to gain insight into themselves. He stresses that by living the metaphor, teachers benefit by being able to access many roles: and "living" the metaphor opens the door to discovering one's ability to perceive and
persistence of themes, create expression, and seeing life in different ways.

I chose a metaphor based on the facts, beliefs, and ingredients surrounding the elements involved with bread making. Bread is a staple of life and has been around for a long time. The first bread was made in the Neolithic era, about 12,000 years ago. Around 2600 B.C., the Egyptians, discovered that bread would rise when left to ferment. The baker's art was held in high regard. The Greeks learned the secrets of bread making from the Egyptians. They passed it on to the Romans in 100 A.D. By the middle ages, almost every town, village and city had at least one bakery. Today, bread, in one form or another, is the most common food in the world.

In comparison, education as been around forever and can be considered a necessity for continuing life as we know it. In the beginning, parents and communities passed down their everyday knowledge and skills needed for survival. Later, as the needs of the communities changed, craftsman taught selected young people the tools of their trade. The teacher's art was held in high regard. As societies changed even more, schools became a formal way of teaching even more children the necessary knowledge and skills needed to survive and prosper. The demands and standards of society are changing everyday and it falls to
the classroom teacher to impart the knowledge and build the basic skills needed to function in that society. All bread is composed of any number of grains that have been ground and sifted into flour. I like to think of this flour as the student. Each coming from a different background and each having different experiences, which is the foundation of their prior knowledge.

**Gluten** is an elastic, sticky substance that helps make dough rise. It forms when proteins in flour are moistened in dough. The raise and expansion depends on the temperature and humidity to which it is exposed. I see an understanding parent as the most important element in helping their child to learn and grow. The growth depends on the home environment, quality time, and exposure to many meaningful experiences.

**Yeast** is a leavening agent, that when heated, works with the gluten and makes the dough rise. The logical component for this ingredient would be the teachers. The ones that have a heated "love of learning" philosophy can't help but get a rise out of any student. The size of the rise could depend upon the evolvement of the parent.

**Liquids** determine the texture of the loaf and could increase its nutritional value. Liquid must be warm to activate the yeast. The choice of teaching strategies determines the impact of how students will learn and retain
information and experiences in the classroom. These strategies must be functional, flexible, and fun to increase their educational value.

Sugar helps the yeast to rise, adds flavor, and forms a brown crust. A safe classroom environment helps the teacher and student to learn and grow with confidence. It adds a sense of community and acceptance among peers. It provides safe place for practicing social skill and building self-esteem.

Salt controls the action of the yeast, strengthens the gluten, and adds flavor, just as state and district curriculum controls the subjects and time frames of the teacher, reassures the parents of consistency, and adds materials.

Shortening lubricates the gluten so the dough will rise easily and keeps it soft. Good communication between students, parents, teachers and administrators facilitates a harmonious atmosphere in which the students can thrive and expand their knowledge.

Eggs can be added for flavor, color, tenderness, and extra nutrition. Manipulatives, hands-on experiences, student level acceptance, brainstorming, peer tutoring, small group and individual instruction, etc., add to and enhance the learning styles of each student.
Other ingredients can add exotic flavors to the bread. To bring out the best learning in students we must teach them in the way they learn best. Therefore, many different forms of art, music, plays, poetry, movement, speaking, reading and writing, etc., must be integrated into all lessons when ever possible. When all is said and done a truly special and unique person will emerge prepared for the challenges of future learning.

Picture the classroom as a bakery with many different kinds of breads. It is the responsibility of the teacher to mix and bake all the above ingredients into the many different loaves. Each student is unique and will have individual personalities, abilities and needs. All of these factors will then be reflected in the personality of the class. The baker's art is to put it all together and make it work. Only then, will the teacher's art be held in high regard.

Don't be afraid to take that first step. Start by orchestrating the environment of the classroom. Chose a metaphor that will provide the most productive environment for human learners, try a comfortable organized model where everyone can feel successful. And remember, metaphors can change as you grow.
APPENDIX D: ASSUMPTIONS

Crowell, Caine and Caine (1998) explain the in education as in the rest of culture; our practice is driven by assumptions about our world. They are more than just beliefs or philosophies; they represent the inner models we use to construct our reality. "It is because they are such an integral part of us that they are so difficult to be aware of, much less change. We take for granted that the world is as it seems to us... If we perceive the world as connected in fundamental ways, if we view action as self-generating within context and we understand process and self-organization, then our curricular and instructional decisions will be very different. We need teacher who reflect it" (Re-Enchantment of Learning, p.22).

It is beneficial to identify our personal assumptions about teaching and learning. Teaching has to be more than just a job. Where there love of learning and love for learners there is commitment, compassion, and dedication. Teaching is a vocation where all assumptions should be thought out, put to paper, analyzed, evaluated, then repeat the process. I encourage all teachers to look to their assumptions. Here are some of mine.
All students can learn.

It is important to remember this, especially at times of frustration and self-doubt, particularly when working with "at risk" students. Every caring teacher has had their doubts at one time or the other, but in reality, all students can learn something. When in doubt, I review the students work from the beginning of the year and compare it to their current work and there is always improvement in some area. Students and parents are always impressed to see just how much the student has learned.

All students learn in different ways.

"A major goal in our educational system should be to create school learning environments that allow all students to learn basic skills that are applicable to real life situations, proceed at a rate that is achievable for them, makes no unfair comparisons with the progress of others, assures positive reinforcement and provides curriculum, instruction and assessment procedures that reflect the many different ways students learn and process information. To reach this goal the educational community should consider Dr. Howard Gardner's research on the educational implications of the Theory of Multiple Intelligences, as well as Dr. Thomas Armstrong's (1993, 1994) and Dr. Teele's (1995) research on practical classroom applications of the multiple intelligences. Dr. Gardner (1983, 1993) ...
discovered that all individuals are capable of at least seven different ways of learning. Their methods for processing information may be identified by specific intelligence profiles... Traditionally the educational system has focused generally only on two intelligences, linguistic and logical-mathematical. Tests, class assignments and teaching methodologies all support the linguistic and logical-mathematical intelligences and often miss the unique talents, gifts and abilities of many students who are stronger in the other five intelligences. Students are often not able to develop their own unique gifts and talents and leave their schooling experience with a sense of frustration and defeat. If we are to create an educational system that provides opportunities for all students to succeed, then we need to consider redesigning the curriculum, instruction and assessment process to better meet the individual need of every student.”

(Re redesigning the Educational System to Enable All Students to Learn by Dr. Sue Teele.)

The ability to teach and learn is the most unique part of being human.

Humans have the greatest gift in the animal kingdom. The ability to think cognitively, articulate vocabulary, process and retain information enables us to learn and teach at any age. Teachers are learners and learners are
teachers. Understanding the twelve brain-based principles has given me a clearer view of how the brain works and how I can improve my attitude, teaching stragglers, and awareness to the needs of all students. "Education must come the terms with the multifaceted nature of the human learner." More educators must recognize: that the brain is a complex adaptive system, it is a social brain, the search for meaning is innate, the search for meaning occurs though patterning, emotions are critical to patterning, every brain simultaneously perceives and creates parts and wholes, learning involves focused attention and peripheral perception, learning always involves conscious and unconscious processes, we have at least two ways of organizing memory, learning is developmental, complex learning is enhanced by challenge and inhibited by threat, every brain is uniquely organized. "Our aim is to address the systemic challenges in education today and deal with the nature of meaning, creativity, self-efficacy, and dynamical knowledge." To put these principles into practice, it is helpful to use "relaxed alertness" by creating an environment that has an absence of threat but a presence of challenge. Practicing "orchestrated immersion" is important because it allows students to see the connections between the big picture and the minute parts. "Active processing" is the way we learn from our
experiences, how we reflect on what we learn, and making meaning from what we learn (Crowell, Caine and Caine, 1998).

A new paradigm of continuous learning and improvement is a slow but necessary change in the educational process.

The restraints of some school districts curriculum, time demands, and assessment procedures are reflective of the old paradigm of teaching and testing. It not only sets the students up for failure but also limits the creativity of the teacher. Where as, the post-modern challenge "is to design a curriculum that both accommodates and stretches; a curriculum that... has the essential tension between disequilibrium and equilibrium so that a new, more comprehensive and transforative reequilibration emerges."

And, where the goals of the curriculum are "general and generative, allowing for and encouraging creative, interactive transformations" not only in the students but in the teacher as well. (A Post-Modern Perspective on Curriculum, Crowell and London CSUSB class)

Each teacher will have his or her own classroom for the entire year.

Every workshop, every class, and every thing I have ever read stressed the importance of a safe, familiar, and stable environment to develop the comfort level, self confidence, and learning of the students. This is important
in all primary grades but it is critical in kindergarten and first grade. In these grades the classroom is used as a learning tool to teach reading, writing, spelling, math, comprehension, vocabulary, and basic life skills, etc. The educational system has ignored all research supporting this element in educating students. Instead, many school districts have opted to go to a four track, all year school schedule. This means that every teacher will have to rotate the students, materials, everything in the room every nine weeks (4 - 5 times in a school year) depending on the track. Or some teachers stay in their rooms while others rove into rooms of “off track” teachers every three weeks (12 - 13 times in a school year). Trying to teach under these conditions causes a great deal of stress. “Any time we are placed under stress that involves some degree of helplessness, we tend to do only what needs to be done. What is also critical is that under these conditions we tend to be much less motivated... What we experience is distress. This debilitating form of stress weakens our physiology, particularly our immune system. Over time, this type of stress reaction also affects our moods, patience, ability to demonstrate affection, and other behaviors” (Caine, Cain and Crowell, 1994).

Finances, high enrollment, and politics have influenced the administration to disregard the welfare of
the teachers and the students. How can we get them to realize that this situation is not an acceptable alternative to overcrowding and is definitely not conducive to quality teaching or beneficial to learning?
APPENDIX E: REFLECTIONS

Crowell, Cain and Cain (1998) want us to know that the reflective processes provide ways to consider where you are going, what your purpose is, what you are learning or teaching, and how can you make it better. This process can be applied to teaching as you jot down notes on how a lesson went. Was it good, just o.k., was it great, what could I change to make it be better, did the student learn something meaningful? Keeping notes can make it easy to remember the things you saw, heard, and felt during your lesson. Taking time to reflect on assumptions, strategies, and student reactions to situations could influence your next lesson. I have to admit it did mine.

Pre-test

The first attempt to give the pre-test was a disaster. After giving verbal directions, providing a place holder, and modeling each question and how to circle only one answer “Y” or “N” for each question, I gave up after only five questions. I could feel the anxiety of the students and my frustration was building. Even when I provided one-to-one assistance, they were having a difficult time getting the right answer. I collected the test and we went outside for physical education.
I re-examined what I thought would be an easy task for kindergarten and 1st grader students. I realized that the problem was not with the students but with the test format. They were having difficulty matching the correct Y/N with the question asked. So, I drew an orange arrow from the end of each question to the answer columns. We had a much better time of it the next day, without my frustration and their anxiety. Back to relaxed alertness.

Lesson 1

Students were excited to learn that we were going to do science and learn about plants. They were so excited that I could not get them to snap their fingers only three times for living and clap their hands once for non-living things. So I went with the flow and let them clap and snap for each thing until I gave the “time out” signal. (two hands modeling “T”). Then, had different students respond to why they thought the item was living or non-living. Every student had to think of one thing (not in the collection) that was living or non-living and the class had to respond (thumbs up/down).

Dividing students into four groups by counting 1 - 4 was interesting because it was the first time for this Kindergarten and first grade class. They did much better at.
staying in their groups than I thought they would when we were outside.

Once back inside, they were excited to share their treasures. Each group described their living and non-living things to the class. In general, they showed good speaking and listening skills for this part of the lesson, and took an active part in voting as each item was classified and sorted into the "Living" & "Non-Living" boxes for the science center.

The assembly of the mini-book was slow but went well. Only a few students had difficulty following verbal instructions, even with modeling. I interview the students as they colored and read their books to a buddy. Timing was perfect and when we finished, the class did a choral reading. I graded their books using the rubric and taped them to their cubby doors, to be shared while "reading the room" (portfolio assessment).

I feel as a community of learners, we experienced relaxed alertness because of the low threat elements in this lesson and the challenge of collecting and presenting data to their peers. I could also see sparks of intrinsic motivation when several students continued to bring in more objects that they gathered at their recesses to be placed in the class collection boxes. They also wanted to bring things from home. And did.
It would seem that we have taken our first step toward orchestrated immersion as students ask questions, engage in critical thinking and share their opinions. As we make more sense of this experience by describing objects and relating them to our real lives, we give each more meaning and begin to practice active processing.

NOTE: To enhance “relaxed alertness”, music is always played during the student interview and work time.

Lesson 2

As we reviewed the previous lesson, students were eager to share with peers what they had told their parents about living and non-living things. While brainstorming the plant transparency, they discussed what they knew about the different plants, where they had seen them, and how they had interacted with them. How they had climbed a tree, was stuck by a cactus, eaten sunflower seeds, and one girl told us of moss growing in her grandmothers back yard, (she is going to bring us some). Each student could tell of at least one plant and were it grew or what it tasted like. They felt safe and challenged to be next to show off their knowledge.

As the students sorted, on the felt board, by observable characteristics the different the plants, flowers, or trees, I use a “+/−” assessment form to record
their understanding of classifying plants. Most students did well and the game of "thumbs up - thumbs down" makes it O.K. to goof and fix it.

The students were all on task (immersed) making their plant poster while I interviewed them. They really liked sharing their posters with the class and telling about their favorite plants. (portfolio assessment)

Unfortunately, I had to put science on hold due to district math testing. Kinder. And 1st. math instruction and testing have to share the same time block with science in order for the kindergarten students to be included in the science lessons. They go home at noon.

Lesson 3

The students were enthused to share their book knowledge, with first graders showing off and many kindergarten students catching on quickly during our shared reading of From Seeds to Plants.

As we did the exercise in roll playing, (pretending they were plants), they started to get a little out of hand. I only have to put 1 or 2 on a short "time out" to get them back on task. Once they understood that plants do not move, they were willing to stay in one place and continue the roll playing activity. This was also very good exercise (physical education).
Next, we brainstormed "Why plants need water."
Explaining that we were going to do some science experiments, I watered the plant labeled "water" and put the plant labeled "no water" in the window with no water.

Due to time limitations I chose not to use the index prediction cards and graph. We did one "science Experiment Worksheet" and I am re-evaluating its value (after each experiment) because of the limited writing ability of these students. It may not be developmentally appropriate at this time.

We brainstormed, "Why plants need sun." Put one plant in window and one in cupboard. Brainstormed, "Why plants need air," put one plant in window and covered one with petroleum jelly on back of leaves. Brainstormed, "Why plants need soil." Gathering students close as I put one seed in gravel, one in sand, one in water, and one in soil. It was interesting to see how verbal they were as I did this. And, how emphatic they each were about their predictions.

Oops out of time - Have to have a Valentine Party.

After brainstorming previous experiments, the students were totally immersed in watching "Sunflowers", a cartoon movie about what seeds need to grow. They enjoyed singing and clapping the "Growing plants" song. The students did
much better recording what they learned on the “flower pot” poster. (portfolio assessment) Very concrete, spatial and developmentally appropriate. This may be a better way to go to get a true rating of their understanding of context. Students colored and read mini-book to a buddy as I did the one to one interviews. We choral read the books with the class and put them into the browsing boxes for reading centers later.

Oops, again. Science goes on hold to get ready for student-led conferences.

Students-led conference. I could see evidence of Brain Based learning as I watched the students with their parents in the science center. They were excited to show the parents all that they had learned about the plants and examine each plant through the magnifying glasses and microscope. The parents were asking question and the students were intrinsically motivated to answer. It was clear that the students had processed and made sense of this science experience (immersion and active processing). There was an overall climate of orderliness as the students took turns moving from one center to another (relaxed alertness) even interacting with the parents and siblings of other students. This was a true community of learners. They were enjoying this experience so much that many did not want to leave and stayed for their whole two hour
block. Several parents said, as they came in, "O.K. where are all of these plants you have been telling me about?"

Lesson 4

Guided Reading took longer today so Lesson 4 was introduced by a Shared Reading of It Started as a Seed. Students did a good job with predictions. Every one could describe some plant that they had eaten and some talked about their gardens at home.

Students gathered on the floor to sing and roll play the seed song from the sentence strips in the pocket chart. Most knew music to "Here We Go Around the Mulberry Bush," and could read the days of the week, so they caught on to the seed song quickly and we sang it several times.

(Principle #7)

Next, we turned out the lights and the students were much better with the overhead transparency this time. Perhaps due to a parent sitting with us. We brainstormed the difference between bulbs and seeds. They were excited to learn that bulbs have babies and seeds come from the flowers and fruits. We discussed the poster about how different seeds grow and what they grow into (cotton = shirts, oak tree = chairs, apple = food, corn = pop corn, wheat = bread, etc.).
After reviewing book knowledge and a Shared Reading of *Seed, Seeds, Seeds*, we explored the collection of seeds I had prepared. They had to guess what kind of seed it was and what kind of plant it would be. It was exciting to see them get so involved. Students volunteered to bring more seeds from home for our collection in the science center.

As I had each student feel an avocado, I asked if they knew what it was. Several knew it was green inside and some said you make guacamole from it, but only one kinder. Said an avocado. Then, each table had to predict and agree on how many seeds it had. (Only one table said one and they received a treat.) I cut it in half and showed them how to remove the big seed, then every one tried a small taste and discussed it. The students then cut out, assembled, colored and choral read the mini-seed songbook.

I added first grade anthology story, *From Seeds to Zucchinis*. During Social Studies. We ate and discussed the feel, smell, texture, and taste of the zucchini as we read the story in reading circle. (Active processing)

It is time to look at our plants from the Lesson 3. We brainstormed what had happened to each pair of plants. The students agreed that the one with NO WATER had suffered the most because it was dried up and dead. Each table then, chose a pair of the plants and illustrated what had happened to them.
After students investigated and predicted number of seeds in their fruit, we cut the fruit and the students counted the seeds. They worked intensely with their partner to extract all the seeds and to count and record them. Apple, pear, tangerine, lemon, green and red bell pepper, string bean, all worked well but next time I will replace the tomato with a grape and make sure the orange has seeds. This one did not so I have to explain why. (You know the exception to the rule or oops, teacher goofed.) They enjoyed eating the fruits, even the lemon and peppers and everyone was very helpful in cleaning up. What a great community of learners! There was a lot of active processing going on.

We reviewed the practice (lima bean, pinto bean, peanut, sunflower, and bush bean) seeds we had planted two weeks ago and the class decided that we should use the bush bean seed for our class project because it had a lot of roots, a stem, and the start of a flower. We replaced the paper towel with soil, watered it, and placed it in the window. Here we go. I explained that they would all be planting their own seed soon. After we brainstormed the history of the peanut, Dr. George Washington Carver and his inventions, the students asked if our first president was a slave. (We had just learned about the presidents' birthdays) AHH - a teaching moment! We clarified who was
who and discussed who the slaves were, where they came from, and how they are thought to have introduced peanuts to this country. Our Shared Reading went well, the students loved the big book and added "Table of Contents and Index" to their book knowledge. We practiced the T.P.R. (total physical response) finger count of peanut parts. (Principle # 4) Student helpers passed out peanuts, paper towels, and magnifying glasses to all. The students explored the feel, smell, and taste of the shell. (Principle 12) Then we opened it and talked about the skin, then the seed, and finally they broke open the seed and when they could show me the embryo I said they could eat it. They wanted more, some ate the extra peanuts but most wanted to take them home and show their parents. (Principle # 10). This was FUN for all. I will do it again. (Principle #5)

We began by singing and roll playing our seed song. Next we did a choral reading of our plant book. Then we reviewed how we examined and counted the seeds of the different fruits. Next, I gave oral directions and modeled how they were to plant their own seed, assigned helpers to pass out the numbered cups, seeds, and paper towels. I asked students from each table to repeat the instructions to make sure that at least one person at each table could be the helper for that table. After they had folded the
paper towels, put them in the cup, and placed two seeds between the paper and the side of the cup, they measured and counted two tablespoons of water in their cup. Earlier finishers helped the ones that were having difficulty getting the seeds in the proper position. This went better than I had expected. I will do it again.

When all of the seeds were planted I did a Read Aloud of *From Peanuts to Peanut Butter* as a review for their worksheet. As they did the worksheet, I call each one to the back for their interview and gave them a cracker with peanut butter. This was a great incentive for "on task" behavior as they soon caught on that I was calling those who were quietly working. We will come back to the seed day for more activities.

When grading the worksheet, I realized that I needed to change the presentation because the results only validated those students who were dominant in the linguistic intelligence. To be fair to those who are more spatial, I will give the directions to include, coloring the parts of the plants, writing the first letter of the labels on the board, and then have students label each part to show comprehension not just reading ability.

The students viewed previously planted seeds and could see no change. They brainstormed the planting procedure and
filled in their “Plant Log” sheet by putting the date and sequencing the planting procedure they had used.

Lesson 5

We brainstormed the function of roots using a poster of how water travels from the roots to the leaves. Several students asked if we could do our P. E. exercise to show seeds - roots - stems - leaves - flowers, so we did under the leadership of three students (the ones who suggested it). Sometimes I get so caught up in getting the lessons going that I forget to let the students take the lead and have more fun.

I gave each group a root (carrot, potato, beet, onion, yam), toothpicks, and a jar. After touching, smelling, and feeling their plant, they all did their assigned tasks as directed. We then discussed what would happen to the plants in the jars of water. They asked if they could keep their roots on their tables and make it their team name. GOOD IDEA! They then voted on which plant they liked to eat the most using tally marks on the board. Carrots won (I thought it might) so I had extra cut up carrots for them to eat and they voted again on how they liked them “cooked” or “raw”. Raw won, of course. This was a lot of fun and we all had a great time with lots of good dialog and thinking.
going on. Students colored, cut and glued the correct roots on to the correct plants on the "Roots Test".

We finished just in time for the "Smile-n-Style" lady to come in and teach us about brushing, flossing, and the weekly fluoride treatments they would be receiving. We labeled and passed out toothbrushes and went over procedures for daily brushings and the care of their brushes.

Lesson 6

To review, the students acted out the parts of a plant and how the water flows from the roots up. We brainstormed where the water goes after the roots. They decided the stem came next. They loved the riddles about what has eyes, the long orange tuber, and pegs. After discussing the poster of different plants, they learned that different plants have different kinds of stems (trees, flowers, celery). Each table received a cup of water, food coloring, and a stalk of celery. After placing the celery into the water and adding the coloring, each group correctly predicted what would happen to the color. I passed out celery sticks with peanut butter. As they ate we talked about what they were eating. Some remembered about the peanut plant. Others compared how the stalk was different from the root that they had eaten before.
The students were surprised and pleased to see how the color had been "sucked" all the way up to the leaves over night. It would appear that most students now know the function of the stems. An experiment is worth a thousand words. We will leave the roots and stalks on the desks for further investigation.

Students viewed their seeds and to their delight, all had grown some roots and a small stalk. They were very interested in taking the next step of adding the soil to their cups. Each completed the next area on their "Plant Log" sheet by noting the date and writing, "Today I added some soil." When they finished their log they got in line to put soil in their cup. Then they returned to their desks and illustrated their experiment.

We brainstormed when the seeds were planted and how many days it had taken them to grow roots. They predicted how long it might take for the stalk to grow leaves. Every one had a good time and it was not as messy as I had feared.

Lesson 7

Anti-Immersion alert - We will have to put off Lesson 4-D (Leaves) due to district Math testing and Social Studies (Irish Folk Tails and immigration & potato history)
and art activities (leprechaun puppet) to get ready for Saint Patrick's Day.

During recess we gathered around an elm tree, reviewed where the roots were and their function. One student volunteered the fact that the tree trunk was its stem and the branches were too because they had the leaves on them. We all felt the bark and moved to a pine tree, felt the bark (rough) and compared it the smooth bark of the elm. We also gathered elm leaves and pine needles from the trees (to be added to collection) and moved to a juniper bush, compared its leaves to the trees.

We returned to the classroom where I had a collection of leaves from Trees, Plants, and Flowers. We brainstormed why animals need plants for food and how plants help us breath. Using the "How Plants Make Food" poster. We discussed how chlorophyll is the green stuff in the leaves veins that makes leaves green, sequenced the process of photosynthesis, and touch counted the syllables of each big word. We discussed difference between oxygen and carbon dioxide and did a breathing exercise imitating the oxygen versus respiration function of plants, then animals.

I explained that we were going to feel, smell, and compare leaves from different trees, plants, and flower and that they were to notice how they were different or the same. They noticed that there were three different shapes
to all of the leaves, smooth, (magnolia), toothed (maple), and lobed (elm). They didn't understand "lobed" so I told them to feel their ear lobe and compare it to the shape of the leaves. They each took one tree leaf of each kind (elm, magnolia, maple, apple, lemon, pear, peach, plum, etc) to feel, smell and examine with their magnifying glass. They were so excited when they found the veins and identify which of the three shapes they had. Next we examined the flower leaves (daisy, rose, geranium), then the plant leaves (mint, camphor, philodendron, fichus, etc.) The students sorted their leaves by smooth, toothed, or lobed. Each student shared his or her favorite leaf. "I liked the lemon because it smelled good". "I liked the mint because we can make tea - I like that kind of gum." "I picked the camphor because it smells like the medicine my mom puts on me when I'm sick - It feels soft like fur." They all had interesting observations and enjoyed the hands-on and took the extra leaves home to share with parents.

Next I gave a guided art lesson on leaf tracing. Demonstrated the procedure then had them choose their favorite leaf to trace on tissue paper. I assisted a few but most did very well on their own. I will mount and laminate their leaf tracing for a permanent record of this experience. This is so COOL! They were working together, helping each other, and really learning about the leaves.
I showed them their leaf posters and they were proud of their tracing. We reviewed the three kinds of leaves and then they did a dot-to-dot paper, following the number to trace the shape of the leaf and match it to the tree it came from. Students who finished early colored their leaves so there was no stress in finishing or later early.

After explaining the rules for using rulers, we practiced finding where each inch mark was and then each \( \frac{1}{4} \) inch mark. To check for comprehension, I asked students to repeat the measurement as I pointed to them on the board (big ruler). I passed out the cups with their seeds (now plants) and their “Plant Log” from before. We filled in the date and wrote, “It is _____ inches tall” in the second square. I modeled how to measure their plant and fill in the blank. They measured and then illustrated it. We brainstormed how long from the last investigation (3-15) how their seed had changed. They said that it had been 7 days and some of their plants had grown up to 6 inches. When I asked them to explain, they repeated elements from previous lessons. “They needed more time to grow. They needed more air and sun. We had to give them water.” Some even remember about chlorophyll and photosynthesis, and they wanted to do the breathing exercise again—so we did.

Returned student's leaf tracing and a leaf shaped paper with lines for writing a cinquian poem. Brainstormed
each line on board and they filled in the blanks, then they sorted themselves according to the edge on their leaf (toothed, smooth, lobed) and wrote it on the last line of their poem. I mounted poem and tracing on green construction paper, laminated it in book form and submitted their work as a class science book to the district “Writing Celebration” contest. Our Class Book won a Red Ribbon in the Science category from the district competition and students received a Writer Pin for their participation.

Sent their bean plants home with instructions for care and homework assignment to be returned in 3 weeks for observation, measurement and last recording on their “Plant Log.” Those who return them will receive extra credit.

Students were excited when we auctioned off other class plants (water/no water, air/ no air, light/ no light, experimental seeds) to go home. We did a scientific investigation of their group roots in water. Each table reported. The onion had very long roots and had grown a three-inch stem. The beet had lots for hairy roots and had replaced the leaves that died with 6 new ones. The carrot had fuzzy new roots and had also grown new leaves. The potato had small white roots in the water and several eyes out of water. The yam had not done much of anything. Our class avocado seed still looked the same. Students did a clockwise tour of each table to get a better look with
magnifying glasses and discussing the changes, and then predicted what the roots would look like in three weeks. I placed them in the sink and the custodian said he would check them every week for water.

Lesson 8

Review parts of plant, what plants need and do then introduced FLOWERS poster. Read aloud flower book and brainstormed four different types of pedals and how “Botanists” (TPR syllables) classify flowers. Discussed parts of flower and function of insects. Passed out selection of flowers to each group, they sorted according to pedal shape and reported to class. Observed stages of rose development (bud to spent). Took pedals off of spent roses and investigated inside.

AHH—another unplanned teaching moment. What looked like a mess, with flowers and pedals all over tables, one student asked if they could take them home. The idea of having them make “potpourri” came to mind. I had them feel, and smell all the mixed pedals and asked if this reminded them of anything. One said, “That stuff you put in your house to make it smell good.” I explained how potpourri was made and said they could take pedals home and make their own. I gave them each a baggie and they were really excited to show their parents how to make what they could do with
the pedals that I was going to throw away. Kids are truly the teachers at times.

Students colored and cut mini-books *What are Flowers for?* They were surprised to find out that flowers have eggs inside them. We discussed bees and pollen and how pollen goes in the egg and makes a seed. Choral read book as a class then answered question “What are flowers for?” Fill in the blank, flowers can make a seed on last page.

Directed art lesson on how to make tissue paper, 3-dimensional flowers with four different shaped pedals. The students were so excited about doing art they were all on task and helping each other. It went better than I expected with this age group. I was amazed at the creativity, sharing of ideas, and cooperation that was going on in each group. (I wore a blouse or outfit with different kinds of flowers and pedal shapes each day this week. The students were challenged to name the flower and classify the pedal shape. They all did very well by the end of the week.)

The students and staff at Date Elementary School were treated to a stage presentation by this kindergarten and first grade combination class where they showed off all of their newfound knowledge about plants. They did a great job and I was very proud of them. I will forever treasure the videotape of that performance.
I hope that these reflections will inspire others to reflect on the different elements that need to be considered when teaching any lesson and how these factors affect the learning of each student. It is truly rewarding to go back and review one's methods, ideas, and strategies, and to revise them when necessary.
APPENDIX F: SUMMATION

It is important to question the meaningfulness of the lessons for the students. I feel confident that these units were not only meaningful for the students but judging by their high interest, enthusiasm, and evolvement that this unit gave them a greater understanding and appreciation for not only plants and insects but for all living things in general with relationship to their place in their world.

Children are very honest and display their feelings about things that they like and do not like openly. The students were very excited each time they did their science lessons. They were fascinated by how the seeds they planted turned into plants and wondered at the plants growth each week. They couldn't wait to record their findings in their plant logs. They beamed with pride when pictures were taken of group projects and activities. The hands-on experiments proved to be their favorite activities. Collecting and classifying living and non-living things, looking at leaf veins through a magnifying glass, counting and sorting seeds from fruits, making and reading mini-books, growing plants from seeds and roots, gave the students a thirst to learn more.

The parents confirmed my belief that this unit was meaningful by telling me that the lessons were the main
topic of conversation at home and at "student-led" conferences. Parents stated that they had to become more involved because their students wanted to do more science things at home.

The students appeared to be intrinsically motivated during this unit. I would say that the rational is that the proof is in the doing and I will definitely do this unit again with a few modifications as stated in the reflections.

The students were actively involved in their education because, by focusing on the fact that all students learned in different ways, this unit was created in a manner that enhanced learning for each of them in their dominant intelligence. To reach this goal I followed the guidelines set forth by Dr. Howard Gardner's research on the implications of the Theory of Multiple Intelligence, as well as Dr. Thomas Armstrong's research on it's practical classroom applications, and the principles of Brain-Based learning. Dr. Sue Teele's class at UCR help refine my understand of hands-on techniques in the classroom and I used her TIMI test to pinpoint the students' intelligences.

It is all to clear that our preset educational system has focused generally only on two intelligences, linguistic and logical-mathematical. The majority of my kindergartners and first graders were high in spatial, bodily kinesthetic,
and musical intelligence, in this order, which is typical for this age group.

This forced me to incorporate overheads, posters, felt boards, videos, picture mini-books drawing objects, and read aloud, for the spatial learners. Poems, rhymes, and pattern raps for the musical learners. Body gestures with poems and raps, count and touch syllables, hands-on experiments, outside activities, and dramatization for the bodily kinesthetic. This was in addition to many other activities for the other intelligences. The students were engaged, on task and excited about learning science. The rational behind the curriculum, instruction, and assessment was designed to better meet the individual need of every student so that they could actively succeed in their education.

Orchestrated immersion, relaxed alertness, and active processing were an important factor in the success of this unit. It would seem that brain-based teaching is a frame of one’s mind and a very different way of looking at everything. There is more depth to teaching and learning. It is like the icing on the thematic cake. I firmly believe that the elements of brain-based learning go hand in hand with the practices of multiple intelligences in the classroom. Understanding the twelve brain-based principles has given me a clearer view of how the brain works and how
I can adapt my attitude, teaching strategies, and awareness to the needs of all students. To put these principles into practice, it is helpful to use "relaxed alertness" by creating an environment that had an absence of threat but a presence of challenge. Practicing "orchestrated immersion" is important because it allows students to see the connections between the big picture and the smaller part. "Active processing" is the way we learn from our experience, how we reflect on what we learn, and making meaning from what we learn.

There was relaxed alertness and intrinsic motivation in all of the students when they were on task and enjoying what they were learning. Some times they worked on their own, with a buddy, in cooperative groups, and other times they were a community of learners, helping each other. Often many students would bring things from home to add to the class collections. A variety of assessments were used to reduce stress, and calming music was played during interviews and some activities. They took pride in the environment by showing off their books, posters, and other projects. There was routine and order to their day and they knew what to expect at any given time. As a community of learners we tried to encourage a mutual respect for the class rules, property of others, and each other. Our
classroom reflected a safe, warm, welcoming, environment. So much so, students didn't want to go home.

Orchestrated immersion was another main focus in presenting this unit because the brain is continuously trying to make sense of every experience. In each lesson there was some element for each of the different learners and their dominant intelligence. Book and poems were read about plants, students sorted and classified plants. They touched, smelled, and ate plants. They roll-played and did exercises to songs and poems, made plant books, planted seeds then wrote and illustrated plant experiments, colored posters and made three-dimensional flowers. They brainstormed plant posters and overheads. They enriched their vocabulary, understanding, and comprehension using interviews, cooperative learning, and a variety of assessments. They made connections in every lesson that each student could relate with in their every day life. At times the students took the lead and a "teaching moment" would just happen. There was constant evaluation and feedback from the students. They were truly immersed in the lessons and learning process.

Active processing is a natural extension that grows out of orchestrated immersion. The entire realm of exploration and analysis is what is meant by active processing. The fact that the students are internalizing
the information in a way that is both personally meaningful and conceptually coherent to them is most important. Therefore, the key to perceiving patterns and making sense of experiences is active processing. Each lesson was designed to encourage active processing in every student, by keeping in mind their learning styles.

"Orchestrated immersion, relaxed alertness, and active processing are not used in a linear way they are interactive and each contains some aspects of the others" (Mindshifts, p.226).

In order to implement this unit into what might be considered a hostile situation (limited time, district requirements, limited space, and roving), it was necessary to balance the math curriculum with the science unit and work the math concepts into the science curriculum. By combining language arts, science, and art skill into several lessons the students made a class book of leaf rubbings and cinquain poems. Their class book won a red ribbon at the district writer's competition. The students preformed all of their songs and poems at a school wide assembly. The principle approved of using every means available to reach and teach all students.
Each student gained knowledge, better self-esteem, and a healthier attitude toward learning by experiencing life science in their classroom and in their world.
APPENDIX G: PRE-TEST PLANTS

(Selected Response Assessment)

Circle the letter in the correct column for each statement.

1. Plants have three (3) parts: root, stem, and carbon dioxide. Y N
2. Plants can live without water. Y N
3. Roots hold a plant in the ground. Y N
4. Plants and animals produce their own food. Y N
5. Stems carry water from roots to the leaves. Y N
6. Food is made in the leaves of green plants. Y N
7. All leaves look alike. Y N
8. Green plants need sunlight. Y N
9. All plants have chlorophyll. Y N
10. Seeds store food. Y N
11. Flowering plants produce fruit. Y N

Rubric for Final Unit Assessment

4 = Full accomplishment: Student answers 11 out of 11 questions and correctly solves riddle.

3 = Substantial accomplishment: Student answers 7 out of 11 correctly.

2 = Partial accomplishment: Student answers 5 out of 11 correctly.

1 = Little or no progress toward accomplishment: Student answers 1 - 4 correct.
APPENDIX H: POST-TEST PLANTS

(Selected Response Assessment)

Circle the letter in the correct column for each statement.

1. Plants have three (3) parts: root, stem, and carbon dioxide. True False
   H Y
2. Plants can live without water. I O
3. Roots hold a plant in the ground. U L
4. Plants and animals produce their own food. O H
5. Stems carry water from roots to the leaves. A G
6. Food is made in the leaves of green plants. V F
7. All leaves look alike. R E
8. Green plants need sunlight. E C
9. All plants have chlorophyll. S A
10. Seeds store food. R S
11. Flowering plants produce fruit. S D

What do you and a corn plant have in common?
To find out, fill in the letters you circled above on the lines over the question numbers below.

1 2 3 4 5 6 7 8 9 10 11
(Answer: YOU HAVE EARS)

Rubric for Final Unit Assessment
4 = Full accomplishment: Student answers 11 out of 11 questions and correctly solves riddle.
3 = Substantial accomplishment: Student answers 7 out of 11 correctly.
2 = Partial accomplishment: Student answers 5 out of 11 correctly.
1 = Little or no progress toward accomplishment: Answers 1 - 4 correct.
APPENDIX I: FINAL TEST METAMORPHOSIS

(Selected Response Assessment)

1. Number the stages of the butterfly in correct order:
   1-4
   Chrysalis/pupa ________
   Egg __________
   Butterfly ________
   Caterpillar ________

2. Draw a picture below of each stage

   Stage 1 Stage 2 Stage 3 Stage 4

   Check True or False:

3. Caterpillars have four (4) parts to their bodies.
   True__ False___

4. Butterflies and moths are the same.
   True__ False___

5. Caterpillars eat their eggshells.
   True__ False___

6. The Chrysalis is a form of camouflage.
   True__ False___

   True__ False___

8. A butterfly spins a cocoon.
   True__ False___

9. Butterflies have straight antennae with knobby ends.
   True__ False___

10. Butterfly wings have symmetry.
    True__ False___

Rubric for Final Unit Assessment
4 = Full accomplishment: Student answers 10 out of 10 questions correctly.
3 = Substantial accomplishment: Student answers 7 out of 10 correctly.
2 = Partial accomplishment: Student answers 5 out of 10 correctly.
1 = Little or no progress toward accomplishment: Answers 1 to 4 correct.
## APPENDIX J: STUDENT ASSESSMENT FORM

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### APPENDIX K: STUDENT INTERVIEW FORM

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### APPENDIX M: MULTIPLE INTELLIGENCE INVENTORY FORM

1= Linguistic  2= Logical Mathematical  3= Intrapersonal  
4= Spatial       5= Musical       6= Bodily Kinesthetic  
7= Interpersonal

Letter A - T = Students in Class

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# Grade K Standards

## Life Science

### National Standards

(Major Topics and Program Goals)

Students demonstrate their knowledge of basic skills, conceptual understanding, and problem solving as they relate to:

1. **Life Science**
   - The student knows and understands the characteristics and structure of living things, the processes of life and how living things interact with each other and their environment.

### Essential Learnings

(Things Students Must Learn)

- Living things can be distinguished from non-living things.
- Living things have observable characteristics.
- Living things interact with each other and their environment.

### Performance Indicators

(Things We Measure and Test)

- Identify a particular thing as living or non-living.
- Sort and group things as living or non-living.
- Identify basic needs of living organisms.
- Begin to describe and sequence the life cycle of plants and animals.
- Observe and describe characteristics of plants and animals.
- Sort and group organisms according to their characteristics.
- Begin to describe basic structures of plants and animals and their function (i.e. wings/fly, roots/absorb).
- Describe how living things depend on each other.
- Describe how living things use resources from their environment to live and grow.

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Fontana Unified School District
May 11, 1998

(over)
# APPENDIX O: FIRST GRADE STANDARDS

**FIRST GRADE STANDARD 1**  
**LIFE SCIENCE**

<table>
<thead>
<tr>
<th>NATIONAL STANDARDS (Major Topics and Program Goals)</th>
<th>ESSENTIAL LEARNINGS (Things Students Must Learn)</th>
<th>PERFORMANCE INDICATORS (Things We Measure and Test)</th>
<th>ASSESSMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students demonstrate their knowledge of basic skills, conceptual understanding, and problem solving as they relate to:</td>
<td></td>
<td></td>
<td>Mandatory:</td>
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<tr>
<td><strong>LIFE SCIENCE</strong></td>
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<td>Recommended:</td>
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</tbody>
</table>
| The student knows and understands the characteristics and structure of living things, the processes of life and how living things interact with each other and their environment. | * Living things have observable characteristics. | * sort and group organisms according to their characteristics  
* compare the similarities and differences of plants and animals  
* describe basic structures of plants and animals and their function (i.e. wings/fly, roots/absorb)  
* begin to classify animals (i.e. mammals, birds, reptiles, fish) | |
| | * Living things grow and change. | * describe and illustrate the life cycle of plants and animals  
* sequence the stages of growth for an animal or plant  
* recognize human growth and development patterns  
* begin to identify requirements for healthy human growth and development (i.e. nutrition, exercise) | |
| | * Living things interact with each other and their environment. | * describe, illustrate, and/or model how living things depend on each other  
* describe, illustrate, and/or model how living things use resources from their environment to live and grow  
* begin to describe and/or illustrate the similarities and differences between the needs of plants and animals | |

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APPENDIX P: PLANT PROJECT UNIT REFERENCES


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