The Integration of Literature and Science: Animal Life Cycles

Susan Westra

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Abstract

This project concerns the integration of literature with the teaching of science. More specifically, it involves the foundational understanding, design, and delivery of an instructional unit in a grade three classroom in which literature was integrated to support the learning of scientific concepts concerning animal life cycles. In addition, it concerns the teacher's learning regarding the value of integration when she taught the Animal Life Cycle Unit from Topic E of the Alberta Program of Studies for Science.

The project, as reported here, involves a limited study of the relevant research literature, a discussion of the advantages of integrating literature and science, a unit plan for the Animal Life Cycles Unit, and the teacher's reflections and recommendations. The research literature presents four themes: (a) increase in student achievement, concentrating on the implementation of the program and the ease in which the students understood the information; (b) improvement of students' attitudes and provision of background information, success provided the stimulus to further interest the students' studies; (c) selection and integration of high-quality literature, choosing a piece of literature that provides a link to the science curriculum; and (d) challenges integrating literature and science, highlighting the literature and need for further research in this area. Discussion of each includes examples from the teacher's classroom.

The unit plan includes all lesson plans and lists of resources. All lessons draw upon and are adapted from literature sources. The blueprint of this unit includes objectives, resources, lesson plans, and assessment tools.

In each lesson the scientific concepts are explored through literature and experimentation. Finally, the teacher's reflections include references to her learning as

the instruction proceeded and her suggestions for how her teaching colleagues might facilitate integrated instruction. The majority of her suggestions concentrate on the organization of an integrated classroom. In brief, she concludes that the integration of literature and science enhances classroom learning, helping young students to make connections among concepts and to have the language needed to express their understanding.

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Words are a lens to focus one's mind.
--Ayn Rand

Introduction

Science is an inherent part of our existence. As Fort (1970) aptly explains, "The science to which all should be exposed in all environments is uncompartmentalized; it is everywhere" (p. 23).

Science may be the key to solving the world's most acute problems and challenges: overpopulation, hunger, pollution, disease, endangered species, and uncharted territory. Perhaps, then, the best way to ensure a healthy future is to outfit our children as scientific problem solvers. My challenge is to teach young students how to look to science for changing problems to solutions. Literature-based science helps me to meet that challenge. The partnership of the two disciplines seems natural. Students are intrigued, as readers, by literature that has a scientific theme and at the same time they easily grasp the scientific concepts embedded in the texts.

Many researchers and practitioners have documented the importance of literature and science integration. A significant body of research indicates that when students participate in a literature-enriched classroom, the result is an increase in student achievement and improvement of students' attitudes (Casteel, 1994; Lapp, 1993). High quality literature-based instruction can support students' interest in science and extend their scientific knowledge. Through the integration of literature and science the literacy process skills develop. The positive effects of increased understanding have been known for some time (Casteel, 1994). Furthermore, if increased integration creates the perception that the scientific material is well known and understandable, students may approach science with interest, motivation and comprehension (Casteel, 1994).

While many efforts have been undertaken to assess the relationship between literature and science, the research literature does not indicate the teacher preparation needed to accomplish this task. This project is a compilation of information regarding the teaching of Alberta Grade Three Science Program of Studies (1996) Topic E: Animal Life Cycles and integration with a variety of forms of literature. The limitations, resources, organizational effort, and implementation of integrated instruction are questioned and illustrated within my project.

The direction I took in this project was to first discover the strongest recommendations from recent literature (1989-1999) regarding integration of literature and science in elementary classrooms, then to design a unit of instruction based upon those recommendations. I then taught the unit to my grade three class, evaluating the resources and procedures as the instructional unit proceeded. Finally, I have reflected upon my experience teaching an integrated unit in light of the research literature.

An ERIC search using "elementary literature science" as a descriptor resulted in eighty hits. The abstracts with information concerning integration or linking reading, writing, and science were read, considered and further examined. The following four prevailing themes were discovered in the literature: (a) increase in student achievement, concentrating on the implementation of the program and the ease in which the students understood the information; (b) improvement of students' attitudes and provision of background information, success providing the stimulus to further interest the students' studies; (c) selection and integration of high-quality literature, choosing a piece of literature that provides a link to the science curriculum; and (d) challenges integrating literature and science, highlighting the literature and need for further research in this area.

These four areas of research, three strengths and one pronounced challenge, are investigated and illustrated within my project.

The Animal Life Cycle unit integrates reading high quality literature and use of science resources and activities. That is, science skills and concepts are explored through literature and experimentation. This integrated thematic unit, literature and science, uses many sources of information such as children's literature, informational texts, the Internet, science texts, various experimental materials. The blueprint for integration is presented in a lesson plan format including an overview concept map. Each lesson addresses science skills in an integrated, investigative way, making use of children's literature and other language activities to confirm conceptual understanding. Lesson topics are in accordance with both the Grade Three Alberta Language Arts (1999) and Science Programs of Studies (1996).

"I have been compelled by curiosity."
-Mary Leaky

Table 1 Correspondence of unit objectives with Science and Language Arts Programs of Studies by lessons.

Lesson	Science Program of Studies Objective	Language Arts Program of Studies Objectives	Unit Objectives	Topic
Lesson One	Objective 1	Objectives 1.1, 2.2, 2.4, 4.2	1-3	Exploring Entomology
Lesson Two	Objective 2	Objectives 1.2, 3.3, 3.4, 4.2	1-3	Insects Metamorphosis
Lesson Three	Objective 3	Objectives 2.4, 3.4, 4.3	1-3	Growth and Development
Lesson Four	Objective 4	Objectives 1.2, 2.2, 3.2, 5.2	1-3	Food, Food, Food!
Lesson Five	Objective 5	Objectives 1.1, 4.1, 5.2	1-3	Do Insects have Parents?
Lesson Six	Objective 6	Objectives 1.1, 1.2, 3.1, 3.4	1-3	Majestic Migrating Butterflies
Lesson Seven	Objective 7	Objectives 1.2, 3.4, 4.2, 5.1	1-3	The Peppered Moth Experiment
Lesson Eight	Objective 8	Objectives 1.2, 2.3, 3.2, 3.3	1-3	The Last Lagoon?
Lesson Nine	Objective 9	Objectives 2.4, 3.2, 5.1, 5.2	1-3	The Lethbridge Research Center: Entomology Laboratory
Lesson Ten	Objective10	Objectives 1.2, 2.2, 3.1, 5.1	1-3	Pets
Lesson Eleven	Evaluation	Objective 1.1	4	Animal Life Cycle Quiz
Lesson Twelve	Celebration	Objectives 2.2, 3.4, 4.1, 5.2	1-4	Mini-Literacy Entomology Fair

To the young student, scientific observations are often like pieces of a jigsaw puzzle, somewhat interesting as individual bits of information, but difficult to assemble into a coherent picture. With integrated instruction, the pieces are brought together. The study of life cycles of different species helps put into perspective many aspects of development. My reflections refer to the integration as a "Hot Water Bath." Science is immersed into literature and, integration being the catalyst, the two become one. Figure 1 illustrates this metaphor. The focus of this paper includes: building an understanding of the recent literature (1990-1998); creating a unit plan that is an integrated thematic unit bringing together language, literature, and science; establishing connections to the literature, and reaching conclusions and recommendations.

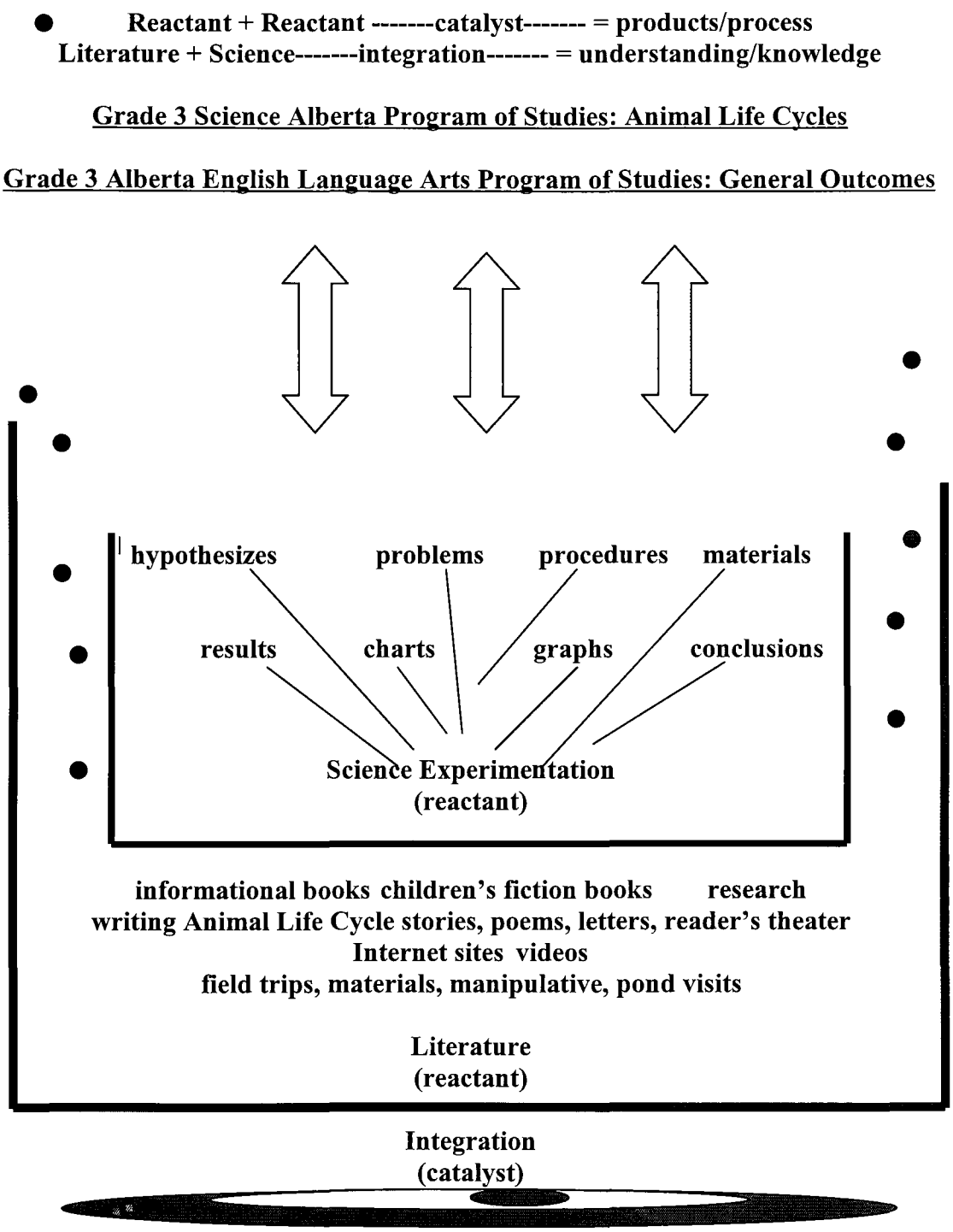


Figure 1: A hot water bath: Linkage between the literacy process and scientific understanding

Teaching is the art of assisting discovery.
--Mark van Doren

Building Understanding and Teaching Using Literature

Research literature suggests that linking language arts and science makes the understanding of science concepts more familiar and less threatening (Schroder, 1996). I now share this perception. My reflections that follow explore the influences on student's attitudes and achievement while integrating literature and science during the teaching of the Animal Life Cycle Unit in my grade three classroom. First, I will explain my perceptions of the process and show the relationship of my experiences to the research literature. Then, I will make my recommendations for change in integrated classroom instruction.

The importance of literature is expressed in the Western Canadian Protocol of Collaboration in Basic Education Common Curriculum Framework for English Language Arts and it highlights the responsibility for language that "is shared by students, parents, teachers, and the community" (p. 1). The document further states that "Students require ongoing opportunities to use language in its many forms" (p. 1). This policy supports the prominent place of literature in classrooms such as mine.

Children's literature includes a rapidly expanding array of related literature. One area of literature I found important to the integration process was non-fiction. Children's non-fiction has developed from the early 1920's, starting when the American historian Hendrik van Loon published, The Story of Mankind. This was the first significant non-fiction piece of literature that included writing that was appealing as well as informative. This book sets the example for the interesting accurate presentation of knowledge that characterizes today's best informational books. I have selected a variety of non-fiction

books to integrate into my unit. These non-fiction books are extensively illustrated and have a rich content that informs the reader about the science objectives.

Charlotte Huck has documented children's literature in the elementary classroom for many years. She defines literature as,

> Imaginative shaping of life and thought into forms and structures of language. The province of literature is the human condition, life with all its feeling, thoughts and insights. The experience of literature is always two dimensional, for it involves the book and the reader. Literature enables us to live many lives and begin to see the universality of human experience (Huck, 1997, p. 3).

Huck relates the experience of reading a book to learning how to swim. The child must splash about the water and feel comfortable with the water in order to keep his or her head up. Swimming must be fun in order to be a good swimmer and enjoy swimming. Swimming is similar to reading. The comfortable environment must be constant, and the words must have meaning and gratification.

"What book has the picture about what caterpillars eat?" "Where is that moth life cycle book?" "My vole skeleton is the same as in this book!" " I love this Eric Carle book!" "What web site has the information about frogs?" While I listened to comments made in my classroom, I heard comments that are generated by literature. The children were continuously searching for understanding and knowledge. Questions surround the learners and there is a seemingly endless need for more information.

I have developed an illustration to visualize the integration of literature and science. The supportive nature of literacy in understanding science is illustrated in Figure 1, where the science experimentation is immersed in the literature, A Hot Water Bath. I

envision literature, with all its genres, and science experimentation, with all its stages, in large and separate containers. Each discipline is separate until science is placed into the literature container. Science experimentation is immersed into literature through the process of integration. Integration stimulates the two disciplines and from this union knowledge and understanding are enhanced. In scientific terms a reactant acts in response to another and forms a product. Since I have created the metaphor of the Hot Water Bath and have implemented an integrated Animal Life Cycles program, I have developed a strong understanding of integration and the different methods through which students learn. Success of young students is highly dependent on their own achievement, attitude, and the material that they are presented.

Increased Student Achievement

Teachers, through their implementation of an integrated program, play a major role in encouraging student achievement. According to some researchers, an understanding of text structure and the ability to use it depends upon the skill of the reader (Schroder, 1996). Lapp (1993) also notes that the majority of textbooks do not provide competent information for students to interpret the nature of the scientific phenomena. Howe (1990) found that strategies and variables that have been related to increased achievement include the congruence of instructional materials, instruction and evaluation. At the elementary level, the environment of the classroom seems to have the greatest impact (Howe, 1990). The degree of teacher enthusiasm for a particular strategy designed to increase students' comprehension also is important.

Radkow and Vasquez (1998) state that children do not learn best in "artificial time blocks and they miss the broader beauty of knowledge when it is served up into bite-

sized, subject specific pieces." Further to this idea, it is contended that "because literature has a story line, children may find it easier to follow the ideas that are part of a plot than to comprehend facts as presented in a textbook" (Butzow & Butzow, p. 3).

Research indicates that students succeed when immersed in a subject with interest. When the information is presented in a manner that is uncomplicated for the students to understand, children respond and comprehend. This increase in student achievement is directly correlated with the literature presented to the child. Increasing achievement is a goal of every educator and by integrating literature into the classroom, success is promising.

Student achievement and understanding are dependent on the classroom environment. In my integrated classroom there is a plethora of literature to assist in achieving the science objectives. According to the research, children find themselves curious about science concepts when they read "easy-to-read" books (Lapp, 1993). In one example, from my classroom, I used information from a science textbook, Science Directions, (Roberts, 1991) to present information on adaptation. The students read the text about the background of the peppered moth. This text informed the students how the moths adapted throughout the Industrial Revolution and changed their color due to the pollution. Lapp (1993) discusses that most textbooks do not provide the information necessary for the students to understand the scientific concept. I also found that this textbook needed to be supplemented with more facts and the science concept of adaptation needed to be set into a different context. The students read the facts presented to them in the textbook and understood that the moths were white and the trees were white and when the moths sat on the trees they were camouflaged. They also read that,

during the Industrial Revolution, the trees turned gray and therefore if the moths were to survive and not be eaten by the birds, they needed to adapt.

To provide understanding of text the students proceeded to perform the experiment of sucking up gray and white pieces of paper with a straw in their mouths and recording the number or gray and white moths they had "eaten" (refer to lesson seven, Appendix B). However, the students wanted to know more and needed to further understand the meaning of adaptation. They needed more background information. Therefore, integrating literature into this unit provided this additional understanding. As a class, we read books that illustrated the life cycles of moths and butterflies and we browsed a web site that also looked at the life cycles of moths and butterflies.

Another source of literature that connected to the adaptation concept was the story by Kent (1982), Caterpillar and the Polliwog, where a young polliwog watches a caterpillar so he might turn into a butterfly. Each of the literature selections recognized that students learn diversely and helped them to view and understand the concept of adaptation in a different way. My experimentation of linking different forms of literature to the science objectives has developed into many in-depth and stimulating journeys.

The following is a subsequent example in which literature-based integration formed an integral part of the curriculum in my classroom. Topic four, "Food Food, and Food," links to the science specific learner expectation four; the students must identify the food needs of at least one animal from each food group and describe changes in how each animal obtains food through different stages of its life. The grade three students had studied and observed different insect eating habits and the class brainstormed ideas on what insects eat. As the students brainstormed, I strapped on the story apron and we read

The Very Hungry Caterpillar (Carle, 1991). While I was reading the story and wearing the apron, I attached each of the foods that were in the story. Following a good laugh and many inquiries for a camera, the students wrote an alphabet poem using all types of insect food (refer to lesson four, Appendix B). Students searched for different foods that insects eat to write their poems. They referred to the literature books, including The Very Hungry Caterpillar, as a resource for their writing. The literature gave a base for the children's writing. There was a comfort level with writing that can be attributed to the support the children gained from their reading. The children needed ideas for their writing and the literature filled these needs.

A further illustration of increasing achievement through the integration of literature happened when the students were dissecting owl pellets. What is an owl pellet? An owl pellet is something that an owl cannot digest and it spits out the bones, teeth, fur, and feathers in the form of a pellet (refer to lesson four, Appendix B). The students dissected the owl pellet and tried to reconstruct what the owl had eaten. Reading non-fiction literature in conjunction with the dissection processes added factual background support for the students. They referred to owl life cycle books to gain an understanding of what is an owl pellet and learn about the life cycle of an owl. The information from the literature acted as a reference point for the experiment. This owl pellet experiment related to real life concepts that were authenticated through the literature.

The high quality literature embedded within the Animal Life Cycle unit stimulated and formed a foundation for the science concepts. The literature presented science in the form of a story and let the children view the science facts personally and with familiarity. My perception is that literature connected the students to something

familiar and this support increased their achievement. Although I can make only informal comparisons based on previous teaching experiences, the integration of literature seems to have enriched all students learning and been particularly helpful to children who struggle to grasp specific concepts.

Improvement in Students' Attitudes

The research suggests that students' attitudes vary in relation to the literature. Lapp (1993) shows that the use of literature to complement science textbooks can help students develop the skills and the motivation to pursue scientific inquiry with enthusiasm and success. My teaching experience supports the view that literature and student attitudes directly correlate.

Beginning to read a piece of literature the pattern is followed with connections, predictions and willful engagement. Wirag (1997) suggests that teachers can "empower" students to respect the attitude that nature is to be appreciated and explored. She believes that children are young explorers and when they share discoveries, teachers must secure that teachable moment. "Share your bench with a bug," says Wirag. The attitudes of teachers will directly influence perceptions of students. I am passionate about teaching science and combining high quality literature into my program and I believe my enthusiasm is contagious.

Cohn (1993) also noted that students see themselves as real readers and authors when the reading and writing activities are relevant and meaningful. In addition to the motivational value in literature, there is a strong skill crossover between reading and science (Cohn, 1993). There is a direct correlation between literature being relevant and easy to read and the degree of student achievement (Cohn, 1993).

In Schoder's (1996) study, grade six students wrote picture books, the purpose of which was to explain the periodic table of elements to younger children. The writing showed the grade six students had gaps in their cognition. The reading and discussing helped fill in these holes. The back and forth between reading and writing, and the thinking that accompanies each operation, helps the students create meaning for other young readers, as well as themselves. Schoder's (1996) study of grade six students that wrote picture books to explain the periodic table to younger children related directly to my activities at Burdett School.

Burdett School is located in a small community and the school has ninety students from kindergarten to grade nine. The students regularly read their writing to other grade levels in the schools. One activity in particular, in the Animal Life Cycle Unit, helped my class understand and become excited about their writing. The students were learning about recognizing adaptations of a young animal to its environment while performing the peppered moth experiment. In this experiment, mentioned previously, the students simulate birds and use straws to suck up small squares of white and gray paper. Following this experiment, the assignment was to write a story showing the changes moths go through during the process of adaptation. Their stories had to illustrate the changing colors of the moth. While writing their stories the students referred to the moth literature and formulated a story based on the literature and the experiment. Specific scientific words, such as adaptation and metamorphosis, needed to be used in their stories. When the students were writing and incorporating these words into their writing small levels of success were reached. Students wrote about butterflies and explained how butterflies change using the word metamorphosis. Upon completion of the stories the

students first read them in small groups in their classrooms and then proceeded to visit the grade one and two classroom and share their writing. The grades one and two students asked questions about the stories and the older students needed to explain what they had written. In one example a student had written a fictional story about how moths had adapted all colors of the rainbow because they landed on the rainbow. The grade three student explained to the younger student the concept of adaptation and that it was possible for a moth to change colors. Through the process of writing and explaining the concept of adaptation understanding increases. The students must use their own words and scientific thoughts to develop their own understanding.

Integration of High-Quality Literature

Quality resources spark quality questions and allow the students to see concepts in variable ways. The diversity of available resources makes the study of animal life cycles one of the best opportunities for exciting and artistic instruction. From videos to field trips to art projects, the material is there to challenge the finest of students. In fact, even instructors with many years' experience learn new information almost every day. The eagerness generated is visible. This can have a long lasting effect on an individual's learning.

Radkow and Vasquez (1998) use children's literature to enhance science learning. The literature opens the door to the integration of science instruction with other curricular areas. Radkow and Vasquez (1998) pose questions to assist teachers in selecting pertinent literature to use in meeting science objectives: "Is the book age-appropriate for the students? Is the story engaging? Is it well written? Is there a clearly defined science theme to the book? Does the author present scientifically accurate material?" (p. 20).

Lauritzen and Jaeger (1996) list questions challenging the contents of literature: "Is it a well told story? Does it attract learners at all levels? Does it have an "open" quality that fosters inquiry? Does it include important, worthwhile ideas that link learners to the world? Does it lead toward the identified goals of schooling?" (p. 405). The preceding questions are helpful in choosing a piece of literature and linking it to the curriculum.

Dillard (1974) narrates the behavior of a water strider on the surface of a creek. This enchanting piece of literature illustrates the scientific theory of surface tension and demonstrates the skill of observation. A key ingredient when selecting literature is to connect the literature with a specific science objective. I began my planning with the science objective and searched for literature that explained this concept. I believe the selection of literature is central to the integration process.

The experiences of experimenting are genuine and complex. Understanding the concepts of science lies between experimentation and interpretation and the narrative balances the science. In my grade three classroom, the students experimented with surface tension. The experiment was simple. It involved the students taking paper clips and attempting to float them in a glass of water. The students formed a hypothesis, assembled materials, developed procedures, observed, and drew conclusions. The paper clips were simulating an insect that can walk on water. To complement this experiment the class read an excerpt from Dillard (1974) where she observes a water strider walking on water. She writes,

> I saw a water strider behaving oddly. When there is nothing whatsoever to see, I watch the water striders skate over the top of the water, and I watch the six dots of

> the shade-made by their feet dimpling the waters surface slide dreamily over the bottom silt. Their motion raises tiny ripples or wavelets ahead of them over the water's surface, and I notice that they avoid each other. I figure this behavior has the effect of distributing them evenly over an area, giving them each a better chance at whatever it is they eat. But one day I was staring idly at the water when something out of the ordinary triggered my attention. A strider was skating across the creek purposefully instead of randomly. Instead of heading away from the ripples made by another insect, it was racing towards them. At the center of the ripples I saw that some sort of small fly's frantic efforts, following it across the creek and back again, inching closer and closer like Eskimos stalking caribou. The fly could not escape the surface tension. Its efforts were diminishing to an occasional buzz; it floated against the bank, and the strider pursued it there but I could not see what happened, because over-hanging grasses concealed the spot. (Dillard, 1974, p. 189)

The class discussed this piece of literature and attempted to make connections between the water striders and the paper clip. Following the experimentation phase, the students referred back to the literature and began their own writing on the meaning of surface tension. This process followed a pattern: read, experiment, read, and write. Each stage builds upon the other and result is understanding, knowledge, and success for the student. Lauritzen and Jaeger (1996) ask many questions challenging the contexts of literature and those questions have helped me with my questions when I searched for literature connections. Connecting a piece of literature to a science objective or concept is a key goal of integration.

Education is not the filling of the pail, but the lighting of a fire.
--William Butler Yeats

Final Reflections and Recommendations

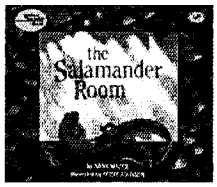
Science is a subject that many teachers are uncomfortable teaching. They often feel a sense of insecurity about science content as well as the integration of literature and science. Teachers have incorporated children's literature in their science programs in many different ways. The examples cited here demonstrate the many possibilities for and benefits of integrating science with literature, and perhaps may inspire numerous teaching ideas. Upon the basis of this experience, I can make four recommendations to structure an integrated classroom: (1) title each science objective in such a way that children recognize the intended learning; (2) designate an area in the classroom for each topic where the literature is placed; (3) create a method of record keeping that connects the literature-based resources with the science objectives; and (4) encourage teachers to collaborate with colleagues to share resources and ideas.

Many exemplary units and interesting investigations are assembled from what appear as minor ideas. This holds true with my recommendation of formulating a topic to connect literature to a science objective. I found that labeling each objective with an unforgettable title connects the students as well as the teacher to the objective. For example, Exploring Entomology connects to observing characteristics of animals, collecting insects corresponds to observing the growth and development of animals, Growth and Development joins with predicting stages of growth and development, Food, Food, and Food! The proceeding topic title refers to one objective and the literature that is analogous with the topic.

Secondly, teaching alternative units without integration as the foundation lacks the support and excitement of teaching science with the literature. Where would a teacher or students turn when they are searching for the background information on a theme? The additional information must be functional to the students and allow them to have a reference point to confirm their knowledge. In my classroom there are tables for theme books. These reference books are categorized for each objective. Therefore the students would know if they were researching food for the insects to go to table four, if they wanted to write an adaptation story to go to table seven. There is a separate table or area for each objective and the resources are arranged accordingly. The concept of integration can be interwoven carefully and precisely into your classroom. My classroom is a labyrinth of material that must be accessible to the students and myself.

Teaching methods and strategies are as diverse as people are. Each teacher has a reservoir of ideas, which allows each moment to be unique and fulfilling. Through my professional reflection I have made constant alterations. My recommendation is to have created an organized record keeping technique that is needed to directly link the science objectives to each individual reference. What specific objective is linked to what source of literature? A chart containing the objectives and direct quotes from the literature and the pages would benefit the educator (Table 2). This charting method would need to be simple and flexible because the literature sources would constantly be updated.

Table 2 Linking literature with science: Example of a charting method

Science Objective	Reference	Quotation from literature
Observe and describe the growth and development of at least one living animal as the animal develops from early to more advanced stages.	Soutter-Perrot, Andrienne. Gnat. Creative Education, 1993. Discusses the physical characteristics, life cycles and usefulness of gnats.	"On its small, round head are two huge eyes, two antennae, and a long tube, the proboscis."
Recognize that habitat preservation can help maintain animal populations, and identify ways that student actions can assist habitat preservation.	Mazer, Anne. Salamander Room. 1991. A young boy finds a salamander and thinks of as many things he can do to make a perfect home for it. 	"I will build a tree for the birds to roost in, and make ponds for the frogs."

In respect to the strong and weak readers, I found that a child must read at the grade three level to benefit and thrive in an integrated grade three environment. Students must understand where and why they are looking for supplementary information. The strong readers can find books and skim through the literature for details and key words to assist them in their work. When searching for information on the pupa stage, for example, a student must know that he/she must look in a life cycle book and skim for the word pupa. The literature acts as a support for the students' work and students need to be aware of the benefits of more information. The weaker readers struggle with their own writing and reading and find it difficult to refer to the literature they have read. Sometimes when books have been read in class weaker students associated a word in a book with a science concept. To be able to find this information as a writing reference, the teacher or another student is required suggest a specific book. Strong readers succeed in all classrooms although in an integrated classroom strong readers learn and read and write with increased interest and knowledge.

I believe that gender is not a factor within the Animal Life Cycle unit. I found there were no more significant differences between boys and girls than among the individual motivation levels of individual students. If a student is fascinated by animals and life cycles and motivated to learn about this topic their chance for success heightens.

The success of integration is dependent upon the motivation level and the interest level of individual students. Students who are highly motivated noticeably have a greater success rate. It takes time and effort to refer to a piece of literature and students, with the knowledge to retain the concepts and knowledge of where to find the information, had the greatest level of success. I have a straightforward checklist that I use with students to

gauge students' attitudes towards the Animal Life Cycle Unit (Table 3). A student must score above twenty to begin this unit without me being concerned. My class scored with an average of nineteen. With this score just on the borderline of success my initial activities needed to spark the interest level of the students. I completed the first lesson and resurveyed the students. The class average on the Animal Life Cycle Interest Questionnaire increased and I continued to assess the students periodically to check their interest levels.

Table 3 Animal Life Cycle Interest Questionnaire

	Questions	Mark Disagree Agree
1	I like animals.	1 2 3 4 5
2	I want to learn about animals.	1 2 3 4 5
3	I want to read about animals.	1 2 3 4 5
4	I want to write about animals.	1 2 3 4 5
5	I love reading!	1 2 3 4 5
		Total /25

As illustrated in Figure 1, through my experiences I have discovered that integration is the catalyst. The catalyst modifies the reaction and helps create the understanding and knowledge of the language and science objectives. Casteel (1994) emphasizes this point by claiming that as learners become increasingly adept at critical comprehension and effective communication they begin to understand. Students are

better able to read, write, think, and express themselves in such a way as to become more absorbed in scientific study and problem solving.

Integration of literature and science is a rewarding process for students and teachers. Using good non-fiction literature helps grade three students make sense of science and to connect science to the world. It also allows the teacher and the students connect to science, in a way just using textbooks doesn't allow. Grounding each science objective in the literature, and the language arts objectives in science, contributes to the organization and learning of the information and skills. I feel integration organized my teaching and also more deeply connected the students to both the literature and science. My final observation is that I found good literature gave a reference point and a model for the students'writing. Students had literature resources to guide their learning and as a consequence they used scientific words in their writing.

Conclusion

My inquiry into the integration of literature and science has been an investigative expedition. Educational research suggests that students learn best when they are involved in meaningful activities that are interesting, and allow them to create their own knowledge (Cohn, 1993). This philosophy is reflected in my integrated instruction. My observations have invited numerous questions concerning methods for integration of literature and science as generated in my classroom. As an educator, my theories have been broadened and through the reading and teaching with literature I have reinforced my practice and gained new insight. I have compiled an Animal Life Cycles unit plan that is designed to meet the objectives of the Alberta Language and Science Programs of Studies. Each science objective has a unique title that is formulated according to that objective. The Animal Life Cycle unit was integrated in my classroom and my

observations were recorded on students' perceptions, accomplishments and understanding.

My perceptions of the advantages of integration became more focused through the development and teaching of the specific unit and I have visualized the integration process of science immersed in literature as shown in Figure 1, Hot Water Bath. This has aided me in discussing the concept of integration with colleagues and coming to an understanding of the concept of integration myself. As demonstrated in Figure 1, literature is the foundation for the students in my classroom. Science is embedded within literature and the integration process resulted in understanding and knowledge of science concepts. Students' achievement and students' attitudes improved, and high-quality literature was used in the implementation of the Animal Life Cycles unit. My future challenge will be to document the literature links to the specific science objectives. Although I have developed methods of documenting that connect literature and science, my process needs to be fine-tuned in order to implement the unit as efficiently as possible.

My project, Integration of Literature and Science: Animal Life Cycles, has been a learning experience and has encouraged me to further develop alternative units in science. The strengths of this approach are now documented; students better understand the science concepts and loved learning throughout this integrated unit. Literature is embedded in our everyday classroom life. When students learn in an integrated setting, they experience schooling as they experience life. Learning is personally meaningful. Integration is a significant concept to explore in the classroom and deserves further attention from teacher-researchers.

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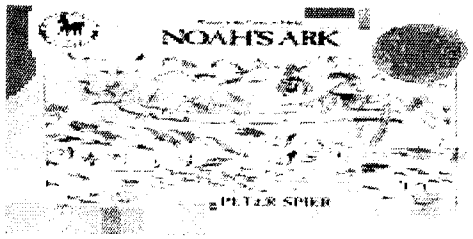
Appendix A
Unit Plan

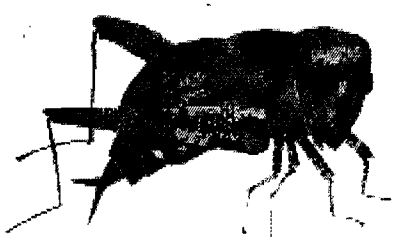
An integrated thematic unit bringing together
language, literature, and science

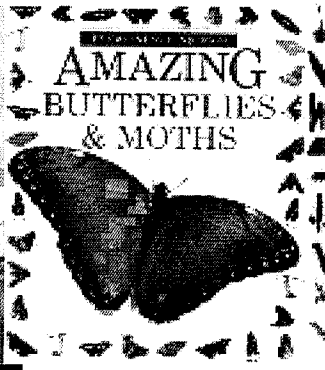


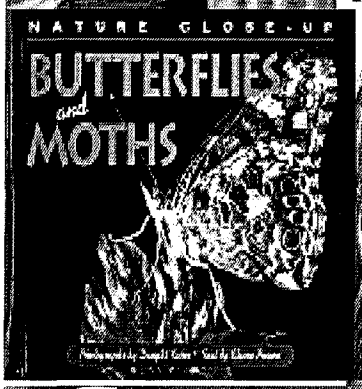
The Grouchy Ladybug
Eric Carle

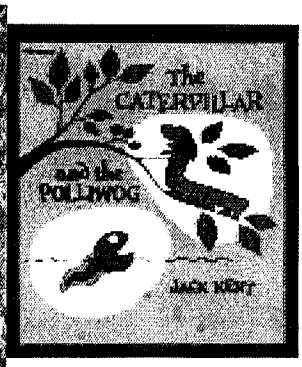
A House for Hermit Crab

Eric Carle The Very Quiet Cricket









Life Cycles Unit Plan: Grade Three

Overview

This curricular thematic unit plan has been designed to assist students and teachers in the study of the grade three science unit, Animal Life Cycles. The Animal Life Cycles unit is part of the Grade three Alberta Science Program of Studies (1996). This unit integrates reading high quality literature with science resources and discovery activities. The plan for this unit is presented in a lesson plan format including an overview concept map. Science skills and concepts are explored through literature and experimentation with continual cross-reference between the literature and science activities.

The learning activities include the following: reading and writing activities, including creating a word wall, an author study, word study activities, independent and group research; field trips; science experiments and art activities. The principle experiment details the Peppered Moth experiment. In this experiment the students research information about adaptation, camouflage, and moths. This lesson is based on Kettlewell's (1991) observations of moths during Industrial times. The students simulate birds and use straws as beaks to suck up small squares of colored paper. Refer to lesson seven for more details. Eric Carle is the subject of the author study. In this study different books written by Eric Carle are read and discussed with specific scientific questions in mind. The stories are told with the aid of an apron made of felt with different props to tell the Carle stories, refer to lesson four, Appendix B. The Animal Life Cycle unit plan is an outline of a science unit with literature connections. This plan is designed to guide a teacher through suggested resources and activities.

Rationale

The Animal Life Cycle unit provides many opportunities for students to relate school learning to the real world. By performing these activities students will learn that all living things are born, grow and change, consume water and food and die.

To the young student, these observations are often like pieces of a jigsaw puzzle, somewhat interesting as individual bits of information, but difficult to assemble into a coherent picture. With integrated instruction, the pieces are brought together. The study of life cycles of different species helps put into perspective many aspects of development.

This is an integrated thematic unit, literature and science, which uses many sources of information such as children's literature, informational texts, the Internet, various materials and science texts. It also attempts to integrate as many curricular areas as possible with specific connections to language arts, art and music.

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Internet sites

3-Dimensional Insect Show: Awesome 3-D shots

http://www.ento.vt.edu/~sharov/3d/3dinsect.html

Children's Butterfly site: A collection of 19 of the most frequently asked questions. Humorous

http://www.mesc.usgs.gov/butterfly-faq.html

The Butterfly and Moth Life Cycle: black and white drawing put to color

http://www.mesc.usgs.gov/butterfly-life-cycle.html

Butterflies of North America: Painted Lady: Clear pictures and valuable information

http://npwrc.usgs.gov/resource/distr/lepid/bflyusa/usa/774.html

Life Cycle of a Frog: Different stage of the Life Cycle

http://indigo.ie/~ipcc/lifecycle.html

A Thousand Friends of Frogs: Awesome information and photos

http://egge.hamline.edu/frogs/index.html

Frog Quiz: National Geographic quiz about frogs, check your own answers

http://www.nationalgeographic.com/media/world/amfacts/frog_q1.html

Smithsonian's National Museum of Natural History: gifted site

http://photo2.si.edu/bfly/bflyhome.html

Internet Resource titles to use in the search engines:

"Experience Entomology"

"Virtual Entomology Teaching Library"

"Using Live Insects in the Elementary Classroom"

"The Center for Insect Science: University of Arizona"

Videos

All videos are ordered by means of:

Southern Alberta Learning Resource Catalogue 1998-1999

Box 120, 909 - 3rd Avenue North

Lethbridge, AB T1H 0H5

Phone: (403) 320-7807

Fax: (403) 320-7817

An Alphabet of Insects.....VA2612

The Benefit of Insects.....VA1967

Backyard Bugs.....VA1965

Bill Nye The Science Guy: Insects.....VA3846

Creepy CrawlersNEW.....VA4143**

Eyewitness: Insects.....VA4027

Insects: Body Structure and Function.....VA1172

The Monarch Butterfly Story.....VA0776

Secrets of Science: The Life Around Us.....VA3502

Don't the Metamorphosis of the Monarch Butterfly.....VA2445

Reading Rainbow 47: Bugs.....VA1691

Metamorphosis: Life Story of a Wasp.....(film).....MP0756

Resource Text

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Children's Fiction Literature Books

Carle, Eric. The Grouchy Ladybug. 1977.

A braggart becomes a better-behaved bug as it learns something about getting along with others.

Carle, Eric. House For Hermit Crab. 1987.

A hermit crab that has outgrown his old shell moves into a new one, which he decorates and enhances with various sea creatures he meets in his travels.

Carle, Eric. The Very Hungry Caterpillar. 1991.

This is an interactive book that travels through the life of a hungry caterpillar.

Carle, Eric. The Very Quiet Cricket. 1990.

A very quiet cricket that wants to rub his wings together and make a sound, as do so many other animals finally achieves his wish (sound at the end of the book).

Kent, Jack. Caterpillar and The Polliwog. 1982.

A young polliwog watches a caterpillar so that he too might learn how to turn into a beautiful butterfly.

Lobel, Arnold. Days with Toad and Frog. 1979.

Frog and Toad are at it again flying kites, having birthdays and being friends.

An I Can Read Book.

Lobel, Arnold. Frog and Toad All Year. 1976.

Five stories of Frog and Toad, one per season and a Christmas story.

Mazer, Anne. Salamander Room. 1991.

A young boy finds a salamander and thinks of as many things he can do to make a perfect home for it.

Merrill, Jean. Girl Who Loved Caterpillars. 1992.

In this retelling of an anonymous Twelfth century Japanese story, the young woman Izumi resists social and family pressures as she befriends caterpillars and other socially unacceptable creatures.

Spier, Peter. Noah's Ark. 1977.

Retells in pictures how a pair of every manner of creature climbed on board Noah's ark and survived the flood. Caldecott Medal Book.

Suess, Dr. Horton Hatches the Egg. 1940.

When a lazy bird hatching an egg wants a vacation, she asks Horton, the elephant, to sit on her egg -- which he does through all sorts of hazards until he is rewarded for doing what he said he would.

West, Colin. "Buzz, Buzz, Buzz," Went Bumblebee. 1996.

Bumblebee buzzes around bothering everyone until he comes to a gentle butterfly that understands that the busy bee is looking for someone to be his friend.

Wildsmith, Brian. Wild Animals. 1976.

Superb color painting accompanies the group names for many kinds of wild animals.

Wyllie, Stephen. Flea in the Ear. 1996.

A Comic tale of trust and justice in which a fox tricks a flea-ridden guard dog to leave the hens for a cure, and how the dog later outfoxes him.

Children's Non-fiction Literature

Ciewe, Sabrina. The Spider. Raintree, Steck-Vaughn, 1998.

The Spider is a guideline to the understanding of the life cycle of some spiders, in juvenile text, commonly referring to the Black Widow and Mexican Red Kneed Tarantula.

Goor, Nancy. Insect Metamorphosis. Macmillan, 1990.

Explains how insects grow, describing the various stages of incomplete and complete metamorphosis.

Lepthien, Emille. Monarch Butterflies. 1992.

Describes the physical characteristics and habits of the Monarch, the only butterfly to migrate for the winter.

Llamas, Andreu. Ants a Great Community. 1996.

Provides detailed descriptions of the physical characteristics and behaviors of ants.

Mound, Lawrence. Amazing Insects. 1993.

Amazing facts about butterflies that taste with their feet and aphids that reproduce without mating.

Mound, Lawrence. Insect. 1990.

Photographs and text explore the world of insects. an Eyewitness book.

Pascoe, Elaine. Butterflies and Moths. 1997.

Investigate the physical characteristics reproductive processes, habitats and metamorphosis of butterflies and moths through projects.

Rayston, Angela. Life Cycles of a Butterfly. 1998.

Introduces the life of a Monarch butterfly from its beginning as a tiny egg laid on a milkweed leaf through its metamorphosis from a caterpillar to an adult butterfly.

Ryder, Johanna. Where Butterflies Grow. 1989.

Describes what it feels like to change from a caterpillar into a butterfly. Includes gardening tips to attract butterflies.

Soutter-Perrot, Andrienne. Earthworm. 1993.

An introduction to the physical characteristics, habits, natural environment, and the importance of the earthworm.

Soutter-Perrot, Andrienne. Gnat. 1993.

Discusses the physical characteristics, life cycles and usefulness of gnats.

Still, John. Amazing Butterflies and Moths. 1991.

Photographic guide that illustrates life cycles.

Unit Objectives

1. Upon completion of this unit the students will be able to, refer directly to the literature studied to facilitate and enhance their writing.
2. Upon completion of this unit the students will, investigate experimentally and relate to the literature to draw conclusions.
3. Upon completion of this unit the students will, make personal connections to and gain an understanding and knowledge the objectives, through high-quality literature and science experimentation.
4. Upon completion of this unit the students will, conceptualize learning language and science as one unified process.

English Language Arts-Grade 3 Alberta Program of Studies (1998-1999)

General Outcome 1: To explore thoughts, ideas, feelings and experience.

1.1 Discover and explore

Express ideas and develop understanding

connect prior knowledge and personal experience with new ideas and information in oral, print and other media texts

Experiment with language and forms

choose appropriate forms for communication and sharing ideas with others

choose and share in particular areas of interest

1.2 Clarify and Extend

Consider other ideas, combine ideas, and extend understanding

experiment with arranging and recording ideas and information in a variety of ways

ask questions to clarify information and ensure understanding

General Outcome 2: To comprehend and respond personally and critically to oral, print and other media texts.

2.2 Use Strategies and Cues

Use prior knowledge and comprehension strategies

share ideas developed through interests, experiences and discussion that are related to new ideas and information

extend sight vocabulary

2.2 Respond to Texts

Experience various texts, construct meaning from texts, and appreciate the artistry of texts

identify types of literature

discuss, represent or write about ideas in texts and relate them to own ideas and classroom experiences

develop own opinions

identify how authors use comparisons and explain how they create mental images

2.3 Understanding Forms, Elements and Techniques

Understand forms, genres, techniques, elements and experiment with language

identify ways that messages are enhanced by use of specific techniques

2.4 Create Original Text

Generate ideas, elaborate on the expression of ideas and structure texts

experiment with ways of generating and organizing ideas prior to creating

General Outcome 3: To manage ideas and information

3.1 Plan and Focus

Focus attention, determine informational needs and plan to gather information

use self-questioning to identify information needed to supplement personal knowledge on a topic

contribute ideas for developing a class plan to access and gather ideas and information

3.2 Select and Process

Use a variety of sources, access information and evaluate sources

find information to answer research questions using a variety of sources

3.3 Organize, Record and Evaluate

list significant ideas and information from oral, print and other media texts

3.4 Share and Review

Share ideas and information and review research process

organize and share idea

General Outcome 4: Enhance the clarity and artistry of communication

4.1 Enhance and Improve

Appraise own and others' work, revise and edit, enhance legibility, expand knowledge of language and enhance artistry

share and identify strengths and ideas for improvement

use keyboard skills to compose, revise and print text

4.2 Attend to Conventions

Attend to grammar and usage, spelling, capitalization and punctuation

identify a variety of sentence types, and use in own writing

identify generalizations that assist with spelling of unfamiliar words

identify frequently misspelled words, and develop strategies for learning to spell them correctly in own writing

use capital letters appropriately in titles of books and stories

4.3 Present and Share

Present information, enhance presentation, use effective oral and visual communication and demonstrate attentive listening and viewing

use print and non-print aids to illustrate ideas and information

speak or present oral reading with fluency, rhythm, pace, and with appropriate intonation to emphasize key ideas

General Outcome 5: Respect, support and collaborate with others

5.1 Respect Others and Strengthen Community

Appreciate diversity, relate texts to culture, celebrate accomplishments and events, and use language to show respect

describe similarities between experiences and traditions encountered in daily life and those portrayed in oral, print and other media texts

identify and discuss similar ideas or topics within stories from texts from various communities

use appropriate language to acknowledge and celebrate individual and class accomplishments

5.2 Work Within a Group

Cooperate with others, work in-groups, and evaluate group process

work cooperatively with others in small groups on structured tasks

contribute ideas and information on topics to develop a common knowledge base in the group

ask others for their ideas, and express interest in their contribution

Science-Grade Three Alberta Program of Studies (1996)

Specific Learner Expectation: One

Classify a variety of animals based on observable characteristics.

Specific Learner Expectation: Two

Observe and describe the growth and development of at least one living animals as the animal develops from early to more advanced stages. The animals should be of one or more of the following groups: mammals, birds, fish, reptiles, amphibians, insects.

Specific Learner Expectation: Three

Predict next stages in the growth and development of at least one animal.

Specific Learner Expectations: Four

Identify the food needs of at least one animal from each group and describe changes in how each animal obtains food through different stages of its life.

Specific Learner Expectations: Five

Demonstrate awareness the parental care is characteristic of some animals and not of others, and identify examples of different forms of parental care.

Specific Learner Expectations: Six

Demonstrate awareness that animals require different habitats in order to meet their basic needs of food, water, shelter and space.

Specific Learner Expectation: Seven

Recognize adaptations of a young animal to its environment, identify changes in its relationship to its environment as it goes through life.

Specific Learner Expectation: Eight

Identify examples of environmental conditions that may threaten animal survival, and identify examples of extinct survival.

Specific Learner Expectation: Nine

Recognize that habitat preservation can help maintain animal populations, and identify ways that student actions can assist habitat preservation.

Specific Learner Expectation: Ten

Demonstrate knowledge of the needs of animals studied, and demonstrate skills for their care.

I'd like to be a Butterfly

by Charles Ghigna

I'd like to be a butterfly
So beautiful and free
Flying high into the sky
Above each cloud and tree.

I'd like to be a grasshopper
And bounce from place to place
But every time I try to jump,
I fall flat on my face.

I'd like to be a silver snake,
Handsome, long and lean,
But every time I try to stretch,
I'm still too short and green.

I'd like to race my friend the worm,
And finally be a winner,
But both of us just might become
A bluebird's two-course dinner.

I'd like to be so many things,
A hero and a thriller,
I'd like to be a butterfly --
But I'm just a caterpillar.

Grade 3 Animal Life Cycles: Concept Web

Word Wall
metamorphosis
care
butterfly
parental
pupa
habitat
caterpillar
food
egg
water
characteristics
shelter
growth
space
development
relationship
vertebrate
identify
invertebrate

Word Wall
threaten
stage
extinct
life cycle
survival
environment
preservation
mammal
larva
bird
animal
fish
helpful
reptile
harmful
amphibian
changes
insect
adaptations

Reading Activities
- Read aloud non-fiction
- Read aloud "theme" books
- Students read their own writing
- Use the internet to view specific web-sites (given by the teacher).
- Related **Novel Studies**: How to Eat Fried Worms, Thomas Rockwell and Charlotte's Web, E.B. White.
- Insect chant
- Reading poetry
- Presenting research

Writing Activities
- Write a reading log entry
- Retell a story
- Write an 11 line Reader's Theater
- Write letters to World Wildlife Federation etc. to understand the preservation of animals and their habitats
- Semantic Mapping
- Venn Diagrams
- Poems: acrostic, ABC, limerick, haiku
- Create a communication journal between students and teacher.
- Write quiz
- Write an Insect Alphabet

Field Trips
- Lethbridge Research Center Entomology Department
- Watch the movie "A Bug's Life"

Animal Life Cycles
Grade Three Science:
Curriculum Connections

Author Study
- Eric Carle
- Books:
- The Very Hungry Caterpillar
- The Very Quiet Cricket
- The Grouchy Lady Bug
- A House for the Hermit Crab

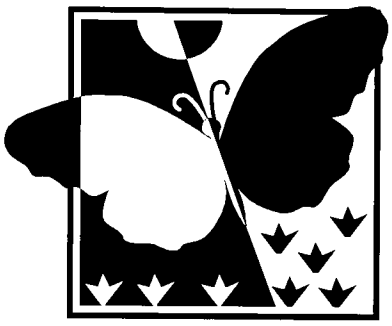
Word Study Activities
- Word collage poster
- Alphabetical words
- Helpful or harmful page
- Synonyms and antonyms
- Crossword puzzles
- Word search
- Unscramble words
- Capitalization
- Compound, homonyms
- Explode words: adapt, harm, survive
- Rhyme Time
- Long and short vowels: aphid, locust, hornet, pupa,

Mini Lessons:
- Big Book Apron story - The Very Hungry Caterpillar
- How to read a non-fiction book?
- Insect or Non-Insect?
- How insects eat?

Research
- Study a specific insect
- Study a career: Entomology
- Research an extinct animal
- Study different habitats
- Study how animals adapt
- Research food in the stages

Art Activities
- symmetrical butterflies
- collecting insects
- dragonflies

Dissecting and Reconstruction
- Owl pellets
- Archeologist dig (Cookies)
- Wooden insects



Appendix B
Lesson Plans

Appendix B

Lesson Plans

"I have been compelled by curiosity."
-Mary Leaky

Lesson Plans
Topic E: Animal Life Cycles

Overview

Activities for an Animal Life Cycles Unit are diverse and just about endless. Be creative and open. Study in-groups or as individuals. Research topics in the classroom, explore the great outdoors, and visit your local research center.

The following lessons are open activities that are linked to literature. Each lesson addresses science skills in an integrated, investigative way, making additional use of children's literature and other language activities. The lessons are directly in accordance to the Grade Three Science Alberta Program of Studies (1996) and the Specific Learner Expectations.

Lesson One: Exploring Entomology
Specific Learner Expectation: 1
Classify a variety of animals based on observable characteristics.

Resources

Internet sites

Children's Butterfly site: A collection of 19 of the most frequently asked questions. Humorous
http://www.mesc.usgs.gov/butterfly-faq.html

Literature
Wildsmith, Brian. Wild Animals. 1976.
Superb color painting accompanies the group names for many kinds of wild animals.

Spier, Peter. Noah's Ark. 1977.
Retells in pictures how a pair of every manner of creature climbed on board Noah's ark and survived the flood. Caldecott Medal Book.

Suess, Dr. Horton Hatches The Egg. 1940.
When a lazy bird hatching an egg wants a vacation, she asks Horton, the elephant, to sit on her egg -- which he does through all sorts of hazards until he is rewarded for doing what he said he would.

Activities

Classifying Activity
1. Collect picture of animals from poster, cards, encyclopedias, and resource books
   Use the following groups: mammals, birds, fish, reptiles, amphibians, insects.
2. Record the characteristics
3. Classify into color-coded groups

Learning Logs
One way of evaluating the learning process is to encourage students to keep learning logs. The students can monitor their own progress and discuss ideas with other students. Recording thoughts, ideas, questions, comments, and feeling encourage student to develop their own learning. These four questions a base point (modeling is a must):
1. What do I already know?
2. What do I want/need to know?
3. How can I find out?
4. How can I be certain I've done my best work?

Lesson Two: Metamorphosis - Collecting Insects
Specific Learner Expectation: 2
Observe and describe the growth and development of at least one living animals as the animals develops from early to more advanced stages. The animals should be of one or more of the following groups: mammals, birds, fish, reptiles, amphibians, insects.

Resources

Internet Sites

A Thousand Friends of Frogs: Awesome information and photos
http://egge.hamline.edu/frogs/index.html

3-Dimensional Insect Show: Awesome 3-D shots
http://www.ento.vt.edu/~sharov/3d/3dinsect.html

Literature

Soutter-Perrot, Andrienne. Gnat. Creative Education, 1993.
Discusses the physical characteristics, life cycles and usefulness of gnats.

Mazer, Anne. Salamander Room. 1991.
A young boy finds a salamander and thinks of as many things he can do to make a perfect home for it.

West, Colin. "Buzz, Buzz, Buzz," Went Bumblebee. 1996.
Bumblebee buzzes around bothering everyone until he comes to a gentle butterfly that understands that the busy bee is looking for someone to be his friend.

Ciewe, Sabrina. The Spider. Raintree, Steck-Vaughn, 1998.
The Spider is a guideline to the understanding of the life cycle of some spiders, in juvenile text, commonly referring to the Black Widow and Mexican Red Kneed Tarantula.

Activities

Butterfly Characteristic Research
Use the following site:
Children's Butterfly site: A collection of 19 of the most frequently asked questions. Humorous
http://www.mesc.usgs.gov/butterfly-faq.html
Have the students browse through this web site and write down the characteristics of butterflies. Have each student chart the characteristics on large poster paper and present this to the class.

Animal characteristics
Have the students read "I'd like to be a Butterfly". List all the animals in the poem and break the students into groups to research one animal. Use the following chart to assist in their research, brainstorm for other characteristics.

Animal	Physical Features	Number of legs	Color and Texture	Method of Transportation

Lesson Three: Growth and Development
Specific Learner Expectation: 3
Predict next stages in the growth and development of at least one animal.

Resources

Internet sites

The Butterfly and Moth Life Cycle: black and white drawing put to color
http://www.mesc.usgs.gov/butterfly-life-cycle.html

Children's Butterfly site: A collection of 19 of the most frequently asked questions. Humorous
http://www.mesc.usgs.gov/butterfly-faq.html

Literature

Kent, Jack. Caterpillar and The Polliwog. 1982.
A young polliwog watches a caterpillar so that he too might learn how to turn into a beautiful butterfly.

Ciewe, Sabrina. The Spider. Raintree, Steck-Vaughn, 1998.
The Spider is a guideline to the understanding of the life cycle of some spiders, in juvenile text, commonly referring to the Black Widow and Mexican Red Kneed Tarantula.

Rayston, Angela. Life Cycles of a Butterfly. Heinemann Library, 1998.
Introduces the life of a Monarch butterfly from its beginning as a tiny egg laid on a milkweed leaf through its metamorphosis from a caterpillar to an adult butterfly.

Goor, Nancy. Insect Metamorphosis. Macmillan, 1990.
Explains how insects grow, describing the various stages of incomplete and complete metamorphosis.

Still, John. Amazing Butterflies and Moths. 1991.
Photographic guide that illustrates life cycles.

Activity

Collecting
Set a terrarium in your classroom and collect an insect and watch it progress through the stages, a caterpillar is a perfect example. Use "Using Live Insects in the Elementary Classroom" to search for information on the Internet.

Lesson Four: Food, Food, and Food!
Specific Learner Expectations: 4
Identify the food needs of at least one animal from each group and describe changes in how each animal obtains food through different stages of its life.

Resources

Internet sites

3-Dimensional Insect Show: Awesome 3-d shots
http://www.ento.vt.edu/~sharov/3d/3dinsect.html

Literature

Mazer, Anne. Salamander Room. 1991.
A young boy finds a salamander and thinks of as many things he can do to make a perfect home for it.

Carle, Eric. House For Hermit Crab. 1987.
A hermit crab that has outgrown his old shell moves into a new one, which he decorates and enhances with various sea creatures he meets in his travels.

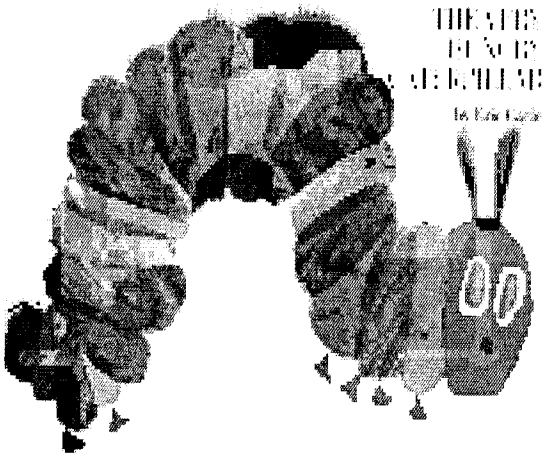
Spier, Peter. Noah's Ark. 1977.
Retells in pictures how a pair of every manner of creature climbed on board Noah's ark and survived the flood. Caldecott Medal Book.

Wyllie, Stephen. Flea in the Ear. 1996.
A Comic tale of trust and justice in which a fox tricks a flea-ridden guard dog to leave the hens for a cure, and how the dog later outfoxes him.

Activities

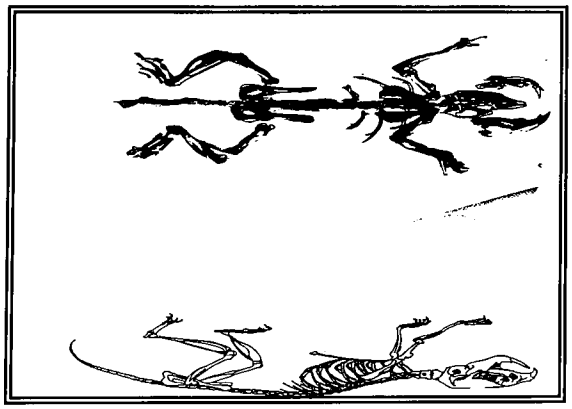
Apron Story

The Very Hungry Caterpillar, 1969
This all-time favorite not only follows the Very Hungry Caterpillar as it grows from egg to cocoon to beautiful butterfly, but also teaches the days of the week, counting, good nutrition and more. Remarkable pictures and die-cut pages offer interactive fun.



Owl pellets

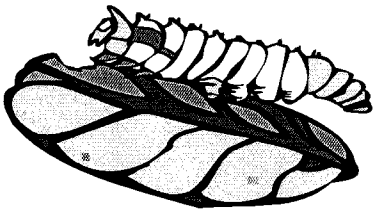
Assemble wooden skeletons of insects and dissect owl pellets. What's an owl pellet? An owl pellet is something that an owl can't digest after he eats. It eats things that it can't digest, like bones, teeth, fur, and feathers. After the owl digests, he spits out the owl pellet with those things in it.



Graphing leaves

Find out how much of a leaf a caterpillar can eat in one day. Find a leaf and place it one the graph. Count the original leaf and place it in the terrarium. After the day has passed take the leaf out of the terrarium and put the leaf back on the graph. Count how many square centimeters the caterpillar ate.

Graph Food of the Caterpillar



How many squares does the original leaf cover? _____

How many squares will the caterpillar eat? _____

How many squares does the leaf cover? _____

Lesson Five: Do Insects have Parents?
Specific Learner Expectations: 5
Demonstrate awareness that parental care is characteristic of some animals and not of others, and identify examples of different forms of parental care.

Resources

Internet sites

Frog Quiz: National Geographic quiz about frogs, check your own answers
http://www.nationalgeographic.com/media/world/amfacts/frog_q1.html

Literature

Merrill, Jean. Girl Who Loved Caterpillars. 1992.
In this retelling of an anonymous Twelfth century Japanese story, the young woman Izumi resists social and family pressures as she befriends caterpillars and other socially unacceptable creatures.

Lobel, Arnold. Days with Toad and Frog. 1979.
Frog and Toad are at it again flying kites, having birthdays and being friends.
An I Can Read Book.

Suess, Dr. Horton Hatches the Egg. 1940.
When a lazy bird hatching an egg wants a vacation, she asks Horton, the elephant, to sit on her egg -- which he does through all sorts of hazards until he is rewarded for doing what he said he would.

Activities

ABC poem

Write a poem that starts with each letter of the alphabet. Brainstorm words from the Animal Life Cycles unit before the class writes the poem.

Alphabet Poem

A	**N**
B	**O**
C	**P**
D	**Q**
E	**R**
F	**S**
G	**T**
H	**U**
I	**V**
J	**W**
K	**X**
L	**Y**
M	**Z**

Lesson Six: Majestic Migrating Butterflies
Specific Learner Expectations: 6
Demonstrate awareness that animals require different habitats in order to meet their basic needs of food, water, shelter and space.

Resources

Internet sites

Butterflies of North America: Painted Lady: Clear pictures and valuable information
http://npwrc.usgs.gov/resource/distr/lepid/bflyusa/usa/774.html

Children's Butterfly site: A collection of 19 of the most frequently asked questions. Humorous
http://www.mesc.usgs.gov/butterfly-faq.html

Literature

Ryder, Johanna. Where Butterflies Grow. Library of Congress, 1989.
Describes what it feels like to change from a caterpillar into a butterfly. Includes gardening tips to attract butterflies.

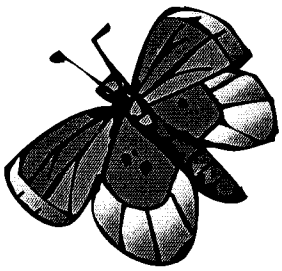
Mound, Lawrence. Amazing Insects. 1993.
Amazing facts about butterflies that taste with their feet and aphids that reproduce without mating.

Lepthien, Emille. Monarch Butterflies. 1992.
Describes the physical characteristics and habits of the Monarch, the only butterfly to migrate for the winter.

Activities

Art
Take an outline of a butterfly and cut many squares of tissue paper. Paste the tissue paper on the outline of the butterfly. Once the butterfly is covered with tissue paper give the art project a final coat of glue.

Poetry
Write an acrostic poem and brainstorm words. Demonstrate the example Majestic Butterfly



M	
A	
J	
E	
S	
T	
I	
C	
B	
U	
T	
T	
E	
R	
F	
L	
Y	

Lesson Seven: Peppered Moth Experiment
Specific Learner Expectation: 7
Recognize adaptations of a young animal to its environment, identify changes in its relationship to its environment as it goes through life.

Resources

Internet sites

The Butterfly and Moth Life Cycle: black and white drawing put to color
http://www.mesc.usgs.gov/butterfly-life-cycle.html

Literature

Still, John. Amazing Butterflies and Moths. 1991.
Photographic guide that illustrates life cycles.

Pascoe, Elaine. Butterflies and Moths. Blackbirch Press, 1997.
Investigate the physical characteristics reproductive processes, habitats and metamorphosis of butterflies and moths through projects.

Kent, Jack. Caterpillar and The Polliwog. 1982.
A young polliwog watches a caterpillar so that he too might learn how to turn into a beautiful butterfly.

Activities

The Case of the Peppered Moth
The activity is based on real-life events. Before 1848, every moth that zoologist had observed had light colored-wings. After 1848, people started to notice that there was a dark-colored moth. A scientist named Kettlewell hypothesized the dark-colored moths were adapted better to the industrial environment. Against a dark tree trunk, a dark moth is camouflaged and a light moth stands out. Against a light trunk the opposite is true. Birds rely on vision to obtain their food and the light-colored moths were being eaten and the dark-colored moths were camouflaged.

Experiment:

Write on the board, discuss, and relate back to literature.
Problem: How might a predator affect a population of prey?

Materials:
25 squares of white paper (2cm by 2cm)
25 squares of black paper (2cm by 2cm)
straw
large sheet of white paper
large sheet of black paper
timer
dish

Procedure:

1. The students work in pairs. Using the white paper as the background (tree) and placing all 50 square of black and white paper randomly on the white paper. White Squares are white moths; the black are black moths

2. The student "bird" places the straw "beak" in their mouth and is ready to start sucking up paper "moths".

3. Thirty seconds is on the clock

4. Count the number of white and Black Square left. Record your results.

	White Moths	Black Moths
Trial 1		
Trial 2		
Trial 3		
Trial 4		
Total		
Average		

5. Record your observations and reverse background.

6. State conclusion as a class and record class results.
Extensions: Research Kettlewell, moths or adaptations

Lesson Eight: The Last Lagoon?
Specific Learner Expectation: Eight
Identify examples of environmental conditions that may threaten animal survival, and identify examples of extinct animals.

Resources

Internet sites

Endangered Species
http://www.nceet.snre.umich.edu/EndSpp/Endangered.html
Extinction
Frequently Asked Questions

Literature

Wildsmith, Brian. Wild Animals. 1976.
Superb color painting accompanies the group names for many kinds of wild animals.

Spier, Peter. Noah's Ark. 1977.
Retells in pictures how a pair of every manner of creature climbed on board Noah's ark and survived the flood. Caldecott Medal Book.

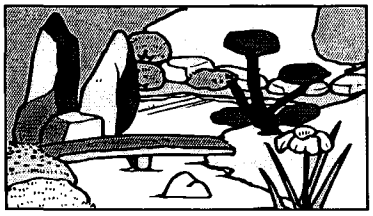
Activities

Reader's Theaters
Write a reader's theatre poem on an endangered Canadian animal.

Title: _____

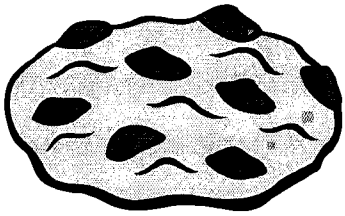
1	
2	
1	
2	
1	
2	
1	
2	
1	
2	
1 & 2	

Visit a pond



Travel to a pond nearest your school. Collect samples of pond life using nets, buckets and a variety of materials. When you arrive back at the school disperse the samples in egg cartons. Invite a local entomologist to help with the identification of species. Request other classes to inspect your samples.

Archeologist Dig



Bake chocolate chip cookies at home or at school and have the students dig out the chocolate chips with toothpicks. Explain and research the career of an archeologist.

Lesson Nine: Entomology Laboratory
Specific Learner Expectation: Nine
Recognize that habitat preservation can help maintain animal populations, and identify ways that student actions can assist habitat preservation.

Resources

Internet sites

Smithsonian's National Museum of Natural History: gifted site
ht.//photo2.si.edu/bfly/bflyhome.html

Literature

Carle, Eric. House For Hermit Crab. 1987.
A hermit crab that has outgrown his old shell moves into a new one, which he decorates and enhances with various sea creatures he meets in his travels.

Mazer, Anne. Salamander Room. 1991.
A young boy finds a salamander and thinks of as many things he can do to make a perfect home for it.

Merrill, Jean. Girl Who Loved Caterpillars. 1992.
In this retelling of an anonymous Twelfth century Japanese story, the young woman Izumi resists social and family pressures as she befriends caterpillars and other socially unacceptable creatures.

Activities

Visit to the Lethbridge Research Center
For more information, contact
Dr. Steve Morgan Jones
Director
Lethbridge Research Center
Agriculture and Agri-Food Canada
Box 3000
Lethbridge, Alberta T1J 4B1
Phone: (403) 327-4561
FAX: (403) 382-3156

Research wildlife preservation:
Contact the following places:
World Wildlife Fund
http://www.wwfcanada.org/
Known worldwide by its panda logo, WWF is the world's largest and experienced independent conservation organization with 4.7 million supporters and global network active in some 100 countries. WWF's mission is to protect nature and the biological diversity that we all need to survive.

Or if you wish to reach WWF by more traditional means:
WWF Canada
245 Eglinton Avenue East, Suite 410
Toronto, Ontario
Canada
M4P 3J1
1-800-26-PANDA

Adopt-a-Loon
http://www.adopt-a-loon.org/
We have created an adoption program for commonloons (Gavia immer), which are piscivorous (fish-eating) birds.

International Fund for Animal Welfare
http://www.ifaw.org/

Home Page of The Nature Conservancy - Help Protect Endangered Species
http://www.tnc.org/
The Nature Conservancy: Among environmental organizations, we fill a unique niche: preserving habitats and species by buying the lands and waters they need to survive

Essay on preservation of animals
Prompt:
Humans have created problems that affect nature. One problem is extinction of endangered animals.

Lesson Ten: Pets
Specific Learner Expectation: Ten
Demonstrate knowledge of the needs of animals studied, and demonstrate skills for their care.

Resources

Internet sites

Smithsonian's National Museum of Natural History: gifted site
http://photo2.si.edu/bfly/bflyhome.html

The AES Bug Club for Young Entomologists
http://www.ex.ac.uk/bugclub/main.html
How do I keep a praying mantis as a pet?
How do I keep crickets as a pet?
How do I keep a tarantula as a pet?
What use are insects?

Literature

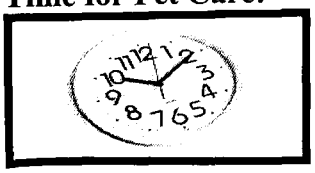
Merrill, Jean. Girl Who Loved Caterpillars. 1992.
In this retelling of an anonymous Twelfth century Japanese story, the young woman Izumi resists social and family pressures as she befriends caterpillars and other socially unacceptable creatures.

Mazer, Anne. Salamander Room. 1991.
A young boy finds a salamander and thinks of as many things he can do to make a perfect home for it.

Activities

Bring in students' pets
Have students brainstorm types of pets and invite students to bring in their pets.

Poster
Assignment: Make a poster that includes the care that animals need. Create a slogan to summarize your poster.
Time for Pet Care!



Lesson: Eleven
Mini-Literacy Entomology Fair
In the gym of your school, set up a fair. This is a place where students will display their work over the Animal Life Cycles Unit. The entire school will visit.

Mini-Entomology Literacy Fair

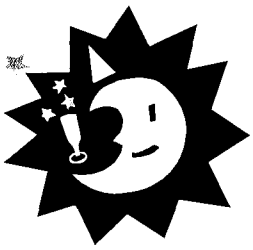


Table	Activities
Word activity table	Puzzles Word searches Alphabetical words
Writing Table	Poetry Stories, books Reader's Theater Venn Diagrams Research
Literature Table	Non-fiction books Fiction books Apron Story Novels
Experiment Table	Peppered-Moth Graphing leaf eating Caterpillar cycle
Field Trip Table	Places Pamphlets Pictures Samples Addresses
Art Table	Life cycles Owl pellets Painting Clay figures Fossils

Appendix C
Resource Materials and Assessment Tools

Appendix C

Assessment Tools

"You have to drill through mud and water to get oil, you have to sift through sand and silt to get gold, you have to chop and hack through stone to get diamonds--so why do so many people feel that the treasure of ideas should come to them with little or no effort?"
-Sydney J. Harris

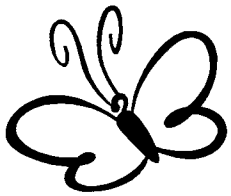
Evaluation Plan

Lesson 1	**Individual Observations, Group Work Assessment**
Lesson 2	**Attitude Assessment, Group Work Assessment**
Lesson 3	**Individual Observations**
Lesson 4	**Science Problem Solving Checklist**
Lesson 5	**Individual Observations, Group Work Assessment**
Lesson 6	**Attitude Assessment, Individual Observations**
Lesson 7	**Science Problem Solving Checklist, Individual Observations**
Lesson 8	**Group Work Assessment**
Lesson 9	**Attitude Assessment, Science Problem Solving Checklist**
Lesson 10	**Attitude Assessment**
Mini-Fair	**Group Work Assessment**
Final Evaluation	**Animal Life Cycle Quiz**

Attitude Assessment

Name:_____ **Date:**_____

	Rarely	Sometimes	Frequently
Perseveres at tasks			
Ask questions			
Completes tasks			
Shows confidence-risk taker			
Tries alternative methods			
Works individually			
Works in a pair			
Works in a group			
Shows independent thinking			
Appreciates the value of literature			
Appreciates the value of science			
Enjoys the challenge of the unknown			
Is curious			



Science Problem Solving Checklist

Name: _____ Dates: _____

	Rarely	Sometimes	Frequently
Understands the scientific problem			
Formulates a hypothesis			
Thinks of a plan			
Understands the procedure			
Identifies the correct materials			
Complete and detailed observations			
Neat and accurate charts and/or graphs			
Draws precise conclusions			
Comments:			

_____
_____
_____
_____
_____
_____
_____
_____
_____

Individual Observations

Name: _____ **Dates:** _____

Observation Notes:

Action Required:

Action Taken:

Group Work Assessment

Group Members:

_____

_____

Activity:_____

Dates:_____

	Rarely	Sometimes	Frequently
Makes a plan for the task before acting			
Revises procedure when necessary			
Explains ideas			
Active role in the group			
Listens to others			
Becomes involved			
Offers assistance to others			
Organizes and interprets data/observations			
Uses time effectively			
Uses needed materials appropriately			
Records results			
Summaries results into a conclusion			

Animal Life Cycle
Unit Test
Grade 3

Name: _____
Date: _____

1. Why is a spider not classified as an insect?

/2

2. What is the word that describes a moth changing into a butterfly?

/1

3. List four ways insects move?

/4 _____ _____
_____ _____

4. Insects are _____, which means they have no backbones.

/2

5. List four ways insects eat?

/4 _____ _____
_____ _____

6. What insect feeds on blood?

/1

7. What are two ways insects avoid enemies?

/2

8. What does the wasp, bee and the ant have in common?
/1
9. Describe the exoskeleton?

/2

10. Name two helpful insects and briefly describe why they are helpful?

/2

11. Describe why insects can be helpful or harmful.

/2

12. Name two kinds of spiders.

/2

13. Why do we "not" want to destroy spiders?

/2

14. What are three things we can all do to preserve our ecosystem?

/3

Total /30
Percent %