Larvae, Ladies and Learning: The Project Approach

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Abstract

A class of grade one students used the Project Approach (Katz & Chard, 2000) to explore Painted Lady Butterflies. This article briefly describes the Project Approach, outlines the students' experience, and discusses the Project Approach's compatibility with the Ontario Science and Technology Curriculum document.

Introduction

Educators who have studied and written about teaching Science to young children identify a number of features of effective science programs. These features include an emphasis on deeper understanding, opportunities for children to manipulate their environment, the use of children's current ideas and understandings as a starting point for teaching, an effort to answer children's genuine questions about the world, and a focus on developing important process skills such as observing, hypothesizing, planning, interpreting, and communicating. (Harlen, 1996; Johnson, 1996). Johnson (1996) claims that "*we seem to be on a treadmill of teaching and learning; we keep running in order to ensure content coverage, while understanding, resulting from quality exploration and investigation gets left behind*". " *We need to focus on the reality that quality learning is more important than the amount of content coverage*" (p. 31).

The breadth of the new Ontario Science and Technology Curriculum challenges teachers to provide an effective, quality Science program (Wiggins & McTighe, 1998). One feature of the new curriculum is that "some concepts and skills are introduced earlier and are given more rigorous treatment … [and] a great number of technology concepts and processes are included" (MOET, 1998). Many classroom teachers feel pressured to race through the long lists of expectations in order to cover them by the end of the year. Consequently, many concepts receive superficial treatment, which is in direct conflict with the characteristics of an effective science program. Johnson (1996) encourages teachers to plan science programs that allow children to develop deeper, more meaningful understandings of important scientific concepts.

Finding a way to present concepts so that students can manipulate, explore and understand them can be difficult in the early grades. While children appear to understand bits and pieces of specific expectations, they often have difficulty comprehending many of the complex concepts or key understandings. Children may successfully learn the facts and skills outlined in the curriculum, but they do not always connect them to the bigger picture. Wiggens and McTighe (1998) compare this type of understanding to a connect-the-dot puzzle. Students are often left with a "*number of mentally unconnected dots – [with] no clear picture of how facts, ideas, and skills come together or create meaning*" (p. 101).

The Project Approach: A Possible Solution

Teachers need to find a way to help students move their understanding of important scientific concepts to a deeper level. There are several characteristics of the Project Approach that make it an effective instructional strategy for today's curricula. Firstly, the Project Approach "*promotes children's intellectual development by engaging their minds in observation and investigation of selected aspects of their experience and environment*" (Katz & Chard, 2000). Secondly, an appealing feature of the Project Approach is the supportive role it plays to a standardized curriculum. Katz and Chard (2000) believe that "*project work should complement and enhance what young children learn from spontaneous play as well as from systematic instruction*" (p. 8). They argue that the learning of young children is strengthened when projects provide opportunities for students to practice the skills and consolidate the knowledge learned through systematic instruction. The flexibility of the Project Approach also appears to be an advantage. It can involve one, a few or many children and can take place over any period of time. Also of significant importance, is the child-centred philosophy underpinning this strategy. The purpose of a project is for children to find answers to questions they have formulated either by themselves or in cooperation with their teacher (Katz & Chard, 2000).

Chard (1998) compares a project to a

good story, with a beginning, middle, and end. When discussing effective science programs, Johnson (1996) states that, "Learning implies there is a gap between children's existing ideas and the ideas that we aim for them to develop. One of the teacher's roles is to gain access to the children's existing ideas and to make professional decisions as to how they can be developed, modified, or changed, and the gap closed" (p. 132). The first phase of the Project Approach meets this objective by beginning with the introduction of a possible topic of study and a determination of what experiences and knowledge the children have relevant to the topic. Webbing with, and without the children, is done to help formulate questions for investigation. The children are invited to represent their experiences in different ways so that they can be displayed.

Documentation is an important component of the second phase of the Project Approach. Children tend to become more engaged and confident learners when given frequent opportunities to re-examine and reflect upon work. Documentation also helps teachers determine children's current understandings and misunderstandings around a particular topic. Finally, documentation provides teachers with valuable information on children's progress that cannot typically be demonstrated by more formal methods of assessment (Edwards, Gandini, & Forman, 1998). Also in the second phase, field work and interviews with experts take place. Family and community members are invited to participate. Katz and Chard (2000) suggest that one of the key responsibilities of the teacher during this phase is to coordinate classroom activities. Throughout the project the teacher must continually monitor and assess the children's level of interest. Once interest has waned, the project must wrap up.

In the third and final phase of the project, the teacher helps plan a culminating event with the children to tell the story of their project. Essentially the children will present what they have learned, how they have learned it, and the procedures used in their investigations.

Getting started

The first author, a primary Science teacher, decided to implement the Project Approach in her first grade Science class. Several questions emerged. She was particularly concerned with whether the expectations of the Ontario Science and Technology Curriculum were compatible with the general goals of the Project Approach and how the Project Approach would impact the quality of the children's work?

Using the Project Approach was a divergence from the more traditional strategies used in her classroom. Due to the size of the class (32 students) a significant amount of the curriculum was covered through direct teaching with most of the new concepts being taught to the class as a whole group. Students usually consolidated and reviewed their learning in small groups or individually with the teacher.

Prior to working directly with the children, Helm and Katz (2000) recommend that the classroom teacher brainstorm and create a web around the desired topic. This helps the teacher anticipate possible directions the topic may take and whether or not the topic has sufficient depth for a project. For this study, the Ontario Curriculum documents were referenced for logical links to specific expectations for first grade children. There were a number of specific expectations from the Science and Technology, Arts, Language Arts, and Mathematics Curriculum documents that appeared relevant to a study of insects**.**

The initiating activity of a project can take a variety of forms, including reading a story, watching a video, or introducing an unusual artefact. In this project, the children were encouraged to recount a personal experience involving bugs. When all the children were seated in a circle on the carpet, the student teacher started the session by sharing her own humorous 'bug story' as a model for the children. When invited to share their stories, almost every hand went up. It took about twenty minutes to listen to half the class share their anecdotes. The remainder of the class shared the following day. During the first session, most of the students spoke to the teacher not to their peers. Other than the connections and links made by the teacher, there was very little building upon one another's ideas. The storytellers were asked to invite a few comments and questions after their story. This helped prompt more interactions among the children. Afterwards, the children were invited to either paint or draw a picture, or write a story as a visual representation of their story telling. Some children chose a combination of the options. To help stimulate interest a variety of 'new' materials, including watercolour paints, fine brushes and thin markers were provided. Some of the finished products were used to begin decorating the room while other pictures and stories were put into the children's unit portfolios.

After the two sharing sessions, the children were asked to summarize what the class knew about bugs based on the bug stories. As the children shared their ideas, the student teacher recorded their key phrases and words on pre-cut strips of construction paper. She then placed the word cards on the floor in the centre of the circle. Occasionally a prompt or a reminder about a particular bug story would help generate additional information. By the end of the discussion, she had helped the class create a visual web that consolidated what the children knew about bugs (see Figure 1). The completed web was put up on the bulletin board for the remainder of the unit.

To complete the first phase of the project, the children needed to identify a list of questions they were genuinely interested in investigating. The student teacher recorded the children's ideas on chart paper. These questions included:

- What do bugs like to eat?
- Why are some butterflies pretty and some butterflies just plain?
- What is the biggest insect in the world?
- How do spiders make webs?
- Where do bugs go in the winter?

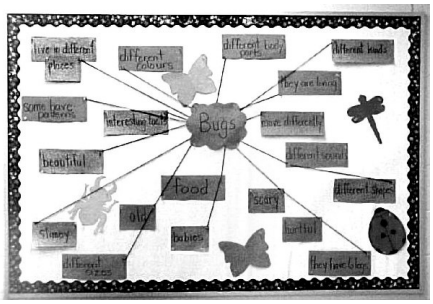

***Figure 1**. Children's topic web*

A blank piece of chart paper was left up to give the children an opportunity to add to the initial list. Over the next few days, many students added their own questions after having time to think about the topic.

Over the first few days, direct teaching on skills and strategies for using non-fiction texts effectively took place. The children had very little experience reading a table of contents, using an index, or obtaining information from a scientific diagram. Many of the children's questions about insects were answered through these structured lessons designed to help develop early research skills.

After the direct instruction on non-fiction texts the children returned to the original list of questions and highlighted the ones that remained unanswered. Jake's question: *"How do caterpillars turn into butterflies?"* was one of them . The children were particularly interested in the topic because the classroom caterpillars would soon be forming their cocoons. Jake confirmed that he was still interested in answering his question. Many children volunteered to help him. Khalid, Meg and Svetlana were chosen to join Jake because they contributed a variety of strengths.

Investigating and documenting

During the second phase of the project, the children were actively involved in investigating the answers to their questions and representing their learning in one form or another. With a very limited budget, the fieldwork, an important component of this phase, had to take place close to school. The importance of fieldwork is to provide the children with the opportunity to study some aspect of their environment more closely (Chard, 1998). A 'trip' to our school playground and the adjacent field was planned. The children were encouraged to think about what they might see and what questions they might be able to answer during the excursion. A small amount of preparation was required. The students needed tools for recording observations. They anticipated finding different insects, so they requested containers to hold their bugs and bring them back to the classroom. They also recognized a need for magnifying glasses to help with their investigation.

In small groups, the entire class arrived at the playground. The children were instructed to place their group's hula-hoop anywhere on the ground and to list everything they found within the circle. One group member was the secretary**.** Another group member carried the 'bug jar' and held on to any living creatures that the group wanted to show the rest of the class. To help with the observations, one group member looked after the magnifying glass, ensuring everyone had a chance to use it. Upon returning to the classroom, the children had the opportunity to discuss, write, and draw what they saw. The children sorted their discoveries into living and non-living things and discussed the attributes of both groups.

The indoor butterfly habitat also provided additional fieldwork for the small group (Svetlana, Jake, Khalid and Meg) so that they could carefully observe the caterpillars and the process of metamorphosis. They watched these living creatures every day and occasionally they were able to gently touch the caterpillars, cocoons and butterflies. They discussed their observations with one another and posed questions about what they saw. While they focused on their project the rest of the class worked in small groups at centre-based activities about insects. These activities were teacher designed and directed.

The teacher asked Svetlana, Jake, Khalid and Meg what might help them remember what they saw and discovered so that they could share their observations and learning with the rest of the class. Khalid commented that the group would need to watch the caterpillars closely every day. Svetlana added that they might forget things and should write down what they saw. The teacher gave the children notebooks to use as 'Science' journals. Each day, the children drew detailed drawings and wrote short entries, describing what they observed. The journal entries became more detailed and complex as the project continued (see Figure 2).

Several times during the project, the children made models of what they saw. For example, Svetlana noticed a web-type thread coming from the end of her caterpillar as it wiggled its way towards the top of the container. Using plastic cups, fine wool and pipe cleaners, the children created delightful models of the day's 'discovery'.

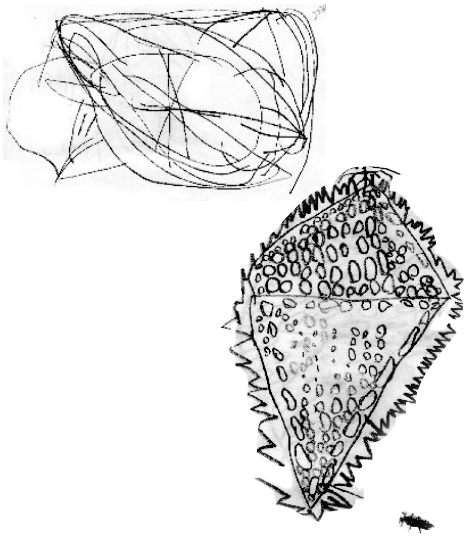

***Figure 2**. Jake's cocoon illustrations from May 11 (left) and May 16 (right).*

The children also constructed detailed plasticine models of the adult Painted Lady butterflies after they began emerging from their cocoons (see Figure 3).

Secondary sources were added throughout the project. The children frequently selected books from the classroom library to confirm an idea or seek answers to current questions. More formal information books like *The Kids Canadian Bug Book* (1996) allowed the children to explore some of the features of non-fiction texts such as tables of contents and indexes. Books from the Rookie Read-About Science series, such as *It's A Good Thing There Are Insects* (1990) and *Spiders Are Not Insects* (1996), were great resources as these books provided information at a mid-to-late grade one reading level. Bright, accurately illustrated books like *Monarch Butterfly* by Gail Gibbons (1989) were very helpful to the children. Videos also provided valuable information, including a few from the Magic School Bus series such as "Butterflies! A Flurry of Exciting Winged Activity" and "Spins A Web - The Special Ways of Spiders".

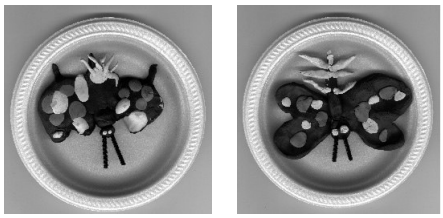

***Figure 3**. Plasticine models of adult butterfly created by Meg (left) and Khalid (right).*

The puppet show

There are two key events in the third phase of a project (Chard, 1998). First, it is important for students to share their learning with others. This could include the rest of the class, other children in the school, or possibly the parents. The work from the project is reviewed and the most meaningful items are selected for presentation. This sharing can take a wide range of forms, including a piece of artwork, a dramatic activity, a personal story, or poetry. As well, the students need time and opportunities to assimilate the new information and make it their own.

It was not necessary to convince the children of the importance of sharing their learning with their classmates. Svetlana, Jake, Khalid and Meg were all extremely eager to present what they had discovered during their studies to the rest of the class. They began sharing some of their most memorable discoveries. Since most of their memories were recent, the teacher asked them to begin reading through their journals to refresh their memories. As they spoke with each other about their experiences, they compiled a list of ten highlights or key observations. The highlights were:

1. the very small size of the caterpillars when they first arrived at school
2. the increase in size in just a week
3. noticing the web
4. the formation of the cocoon
5. observing the gold spots on the cocoon
6. seeing the fur ball attached to the cocoon by a small thread
7. observing the spikes around the cocoon
8. using the magnifying glass to observe the small spots
9. the swinging cocoon, just before it became a butterfly
10. the hatching of the butterfly

Their discussion then focussed on the format of the presentation that would be the culminating event for their project. Svetlana wanted to put all the journal pages together and tell the rest of the class what they did in a lecture-style format. Meg suggested that they read from their own journals or do a puppet show. Jake proposed that each person share the parts that they actually discovered, like when he noticed the little black dots on the cocoon. Svetlana suggested that they could make a rap about the cocoon and a rap about butterflies. She wanted to have the group sing a song. Jake quickly vetoed that idea and Meg seconded it as she confessed she was not a very good singer. Khalid was in agreement. Svetlana felt very strongly about the raps and had expanded the possible number to three by adding a rap about the caterpillar. The teacher suggested making copies of the best pictures from the journals for the overhead projector and the group could talk about their drawings. She also put forth the idea of making a class book.

Eventually, the possible formats the group discussed were written down and the children were asked to vote for their choice. Clearly, they all wanted some type of oral presentation. Jake, Khalid and Meg quickly voted against the rap since they felt uncomfortable with a musical format. After some discussion around the pros and cons of the puppet show and journal reading the teacher suggested combining the two ideas. This part of the planning took approximately 30 minutes. Some of the discoveries were similar so a few were combined to make a total of eight. This way, each child would share two concepts. The script was based on their journal entries. A few grammatical changes had to be made since the story was told through the eyes of the cocoon, caterpillar and butterfly. When the children read through the script, they recognized their words or their observations within the text. The children were encouraged to add or take away anything they wished. It was surprising how easily they divided the parts. Everyone appeared happy and excited with her or his role. The revisions and delegation process took about 25 minutes.

The children compiled a list of materials they thought they needed for their puppets. Once the children had their materials and a plan, they worked on their puppets independently. After approximately 45 minutes, the puppets were complete.

As the children practised the play, they read through the script a couple of times without using the puppets. It became apparent that it was too difficult for the children to handle both the puppets and

the scripts. The children agreed to tape the script. The children enjoyed listening to themselves and were happy to use the tape in their presentations. The total rehearsal time was about 30 minutes.

Personalizing New Knowledge

It has been suggested (Katz & Chard, 2000) that children need time to reflect on new learning so that they can understand it more completely. Katz and Chard (2000) also argue that imaginative activities such as creating stories and drama really help children personalize new information (see Figure 4). The Painted Ladies project lasted several weeks and the children personalized new knowledge in a number of ways. For example, Svetlana named her caterpillar Junior because he was little but renamed him Senior when he emerged as an adult butterfly. Jake named his caterpillar Movey because he moved all the time. The puppet presentation itself was a form of imaginative drama. The children shared their new knowledge in first person, with the narrator being the caterpillar, cocoon and butterfly. The process of preparing and practising the puppet play helped the children reflect on what they had done during the project.

Children's literature also helps children personalize new knowledge (Katz & Chard, 2000). Every day fiction and non-fiction texts about insects and specifically butterflies were shared aloud and available for independent reading. The literature included an author study about Eric Carle in Language Arts, which complimented and supported the learning in the project.

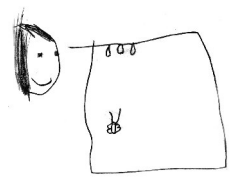

Figure 4*. Meg's drawing of herself closely watching the cocoons.*

The Ontario Curriculum and The Project Approach

Throughout the project, the children had daily extended opportunities to explore, manipulate and observe the Painted Ladies at various stages of life. Svetlana, Jake, Khalid and Meg patiently watched the caterpillars double in size. Excitedly, they noticed the appearance of a thread-like web and saw the transformation from caterpillar to cocoon. The group observed subtle changes in the cocoon over time including the appearance of gold spots and tiny spikes. The cocoon darkened and began to swing until the adult eventually emerged. Because of their experiences during the project, this group had a solid understanding of metamorphosis. With confidence and detail, they were each able to draw, describe, make models and answer questions about three of the four stages of the butterfly's life cycle.

An important goal of the Ontario Science and Technology Curriculum (1998) is for students to understand deeply the basic concepts within each strand. After observing Svetlana, Jake, Khalid and Meg during the project, it was evident that the Project Approach helped meet this goal. This instructional strategy provided the children with vital opportunities to interact with their surrounding environments, to help build essential behavioural knowledge, and to support the understanding of more abstract concepts.

However as Katz (1994) points out, the Project Approach is designed to complement the formal, systematic teaching of a standardized curriculum. Systematic instruction helps children acquire skills and allows teachers, using their professional expertise, to direct the children's work. During projects, children are given opportunities to apply these newly learned skills and to determine the questions and issues they consider worth investigating. In these situations, the children, not the Ministry of Education, are the experts regarding their learning needs.

Katz and Chard (2000) are the first to admit that both systematic instruction and project work have a place in the curriculum. So while Svetlana, Jake, Khalid and Meg had the opportunity to investigate some things in great depth not all the basic concepts in the Life Systems strand were covered during the course of the project. Directed instruction was required to provide a more thorough coverage of the curriculum.

The provincial curriculum and the Project Approach complement each other in a number of ways with regard to the methods of building knowledge in young children. One similarity is the emphasis on first-hand experiences. The Science and Technology Curriculum (1998) states that children should "discover and learn fundamental concepts through investigations, exploration, observation, and experimentation" (p.6). Teachers are encouraged to provide as many hands-on activities as possible. Similarly, the Project Approach is based on the belief that knowledge is learned more effectively in this way.As well, both the provincial curriculum and the Project Approach believe in a unified approach. The Science and Technology Curriculum (1998) states that concepts should be learned through integrated units of study. This policy document suggests that teachers coordinate the teaching of related content and provide opportunities for students to work towards expectations in two or more subjects within one lesson. Katz and Chard (2000) argue that one of the advantages of the Project Approach is the way it uses and connects concepts from many subject areas, as children investigate meaningful questions. For instance, in the Painted Ladies project expectations in Language Arts, Math, Visual Arts and Dramatic Arts were met in addition to some of the specific expectations in the Life Systems Science strand (see Table 1).

Table 1 Cross-curricular expectations addressed during the project

By the end of Grade One, Students will:

- investigate the characteristics and needs of animals.
- classify characteristics of animals by using the senses.
- describe different ways in which animals move to meet their needs.
- describe some basic changes in living things.
- describe patterns that they have observed in living things.
- select and use appropriate tools to increase their capacity to observe.
- ask questions about and identify some needs of living things, and explore possible answers to these questions and ways of meeting these needs.
- plan investigations to answer some of these questions or find ways of meeting these needs.
- use appropriate vocabulary in describing their investigations, explorations and observations.
- record relevant observations, findings, and measurements, using written language
- communicate the procedures and results of investigations for specific purposes, using demonstrations, drawings, and oral and written descriptions.
- use some basic conventions of formal texts to locate information.
- write simple but complete sentences.
- present ideas in speech in a coherent sequence.
- allow others to speak, and wait their turn in conversations.
- listen to and comment positively on the contributions of others in group discussions.
- produce two- and three-dimensional works of art that communicate thoughts and feelings.
- communicate their responses to a variety of stimuli by using elements of drama.
- represent the results of measurement activities using concrete materials and drawings
- use mathematical language to describe dimensions (e.g., height, length).
- estimate, measure, and record the linear dimensions of objects using non-standard units.
- order sequences of events orally and with pictures.
- demonstrate understanding that an event may or may not occur.

Note. *From The Ontario Curriculum, Grades 1-8: Science and Technology (p.15, p.16), by Ministry of Education and Training, 1998, Toronto: Publications Ontario. The Ontario Curriculum, Grades 1-8: Language Arts (p.12, p.30, p.40), by Ministry of Education and Training, 1998, Toronto: Publications Ontario. The Ontario Curriculum, Grades 1-8: The Arts (p.30, p.48, p.12), by Ministry of Education and Training, 1998, Toronto: Publications Ontario. The Ontario Curriculum, Grades 1-8: Mathematics (p.29, p.62), by Ministry of Education and Training, 1998, Toronto: Publications Ontario.*

In Summary

Clearly, the goals of the Ontario Science and Technology curriculum and the Katz-Chard's Project Approach are compatible in many ways. With respect to gaining knowledge, a project may or may not address specific concepts listed in the Science and Technology Curriculum. It depends upon the question or topic the students choose to investigate. However, the teacher has the freedom to initially select the general topic from the five strands outlined in the Science and Technology Curriculum with the hope that the questions children choose to explore will address some of the specific expectations in a unit. The teacher can supplement the learning with direct instruction mini-lessons (as was done in this project on the mouths of insects).

The greater potential of the Project Approach is that it can provide a meaningful context for children to apply the skills and dispositions they have developed during the more formal teaching of the science program. Skills and dispositions are like muscles; they are strengthened and developed the more they are used. Katz and Chard (2000) *"...advocate incorporating the Project Approach into the curriculum as a way of increasing children's opportunities to actively construct and deepen their understandings of significant phenomena around them"* (p.28). Indeed, there are many effective instructional strategies that teachers can use to implement the Ontario Science and Technology Curriculum (1998). Methods that support and complement the goals of our standardized curriculum such as Katz and Chard's Project Approach need to be selected more frequently.

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