DEVELOPMENT AND IMPLEMENTATION OF THE WOLF WORKBOOK AS A SCIENCE EDUCATION TOOL FOR STUDENTS AND TEACHERS

A Professional Paper

by

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ABSTRACT

How can educators prepare students to understand the dynamic nature of scientific inquiry? What type of professional development would be needed to prepare teachers to use materials designed to stimulate scientific inquiry? To investigate such questions, a team of educators and scientists designed a technology-rich module packaged as the "Wolf Workbook". The Wolf Workbook is an inquiry based learning tool that supports "discovering science" through the study of animal behavior. The materials are designed to be adapted by teachers and students through integration of technology such as video, internet, and software programs (e.g. a spreadsheet).

The main goal of this paper was to analyze what steps would be needed to facilitate the creative use of these materials, to meet the learning objectives of state and federal standards for secondary science curricula. My central question was whether these pilot materials would be rejected by teachers as too complex to use in the classroom. The research team wanted feedback on the following options for implementation: (a) use in the education of college students preparing to be biology teachers, (b) use in professional development activities for teachers, (c) use in learning enhancement activities such as gifted and talented programs, or (d) use by teachers in science classrooms.

My inductive study was intended to define questions suitable for future quantitative investigations, more than to provide definitive answers suitable for generalization to a broader population. Qualitative and quantitative information were collected using integrated techniques, including: content analysis of written documents, participant observation, self-reflection, workshop evaluations, and informal interviews.

The initial reaction of teachers in-training and in-service was enthusiasm, not rejection of the Wolf Workbook. Potential barriers to adoption included: (a) inadequate background knowledge of the specific subject matter, animal behavior, (b) limited visuals and artifacts for introducing the materials in a manner that ties in with concepts listed in the standards for secondary science curricula, (c) lack of access to the required software, (d) poor audio/video quality and issues associated with copyright restrictions, (e) uncertainty about approval of the materials by science coordinators and curriculum advisors and (f) lack of a supportive collaborative learning community for teachers who

adopt the materials on an individual basis. Recommendations were made for further investigation of potential solutions to address these issues.

Time is precious in a classroom and so it is important that the lessons taught and the technology tools are applicable to the school's curriculum. This can be better achieved through material such as the Wolf Workbook if there is integration of other biological concepts. In the current form, the Wolf Workbook fits in well while teaching about the scientific process and animals. By adding text such as DNA, ecology, environmental science, evolution, and other aspects of science, the workbook could then be used as a semester or even year-long project. This would not only foster more interest in other topics but also would bring a continuity and connection to these different areas of teaching about science and its role in society. Each of these ideas, along with others contributed by a learning community, would enhance the future utility of adaptable materials such as the Wolf Workbook. Professional development can continue to implement them into the classroom as well.

ACKNOWLEDGEMENTS

This professional paper is the result of years of education and help from so many people. Dr. Packard has been the most patient, kind, and helpful professor and advisor that any student can ask for. I would like to thank Dr. Packard for the years of education, several trips to Fossil Rim Wildlife Refuge, and the patience to stand by me as a student while at Texas A&M University. Also thanks to my committee members for taking the time to give me their guidance throughout the production of this paper.

I would also like to thank several other key people at Texas A&M University for their assistance. This work was also made possible with the help of John Milam for allowing me to participate in his professional development of the wolf workbook and to those teachers who gave wonderful feedback. The professional development was made possible through the National Science Foundation (NSF) funded ITS in Teaching & Learning Center. This program was designed to help bridge the gap between educators and scientists which is perfectly in line with the vision of the wolf workbook and my background as a scientist who has moved into the field of education. Thank you also to Nedaro Bellamy for sharing with me her past experiences and research with the development of the wolf workbook through the Rice Model Lab at Houston Independent School District (HISD).

Last but most certainly not least I would like to thank my husband Bob and daughter Gabrielle who gave up much time and tuition money to allow me to follow my goals achieved here through this degree. Their love, sacrifice, and belief in me has been overwhelming.

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INTRODUCTION

As a secondary school science teacher, I have found that I spend an enormous amount of time searching for new and exciting teaching tools to use in my classroom. My students are so much more engaged in learning when it is presented in an appealing manner; so my nights are spent searching for video clips, explorations, simulations, great pictures, and anything else I can find to add zest to my lesson. In my experience, much more is needed to be an effective science teacher than is provided through formal education channels. How can district-level science support programs better serve teachers like me, who are eager to use materials prepared for informal education programs?

Since the knowledge gained from science is always changing and new discoveries are made every day there is a need to continuously revisit how we teach science and what we include in the content (Gunter et al., 2003; Roblyer, 2006; Zook, 2001). This dynamic view of science is necessary to prepare our students for the challenges they will face when they leave school and pursue careers in the world of science or elsewhere. In general, the use of multiple technologies in the classroom improves student performance through improved attitude and increased competence. A prevailing hypothesis is that technology-rich learning environments may be more stimulating to students and more effective for high-risk students. Consistent with this hypothesis, the International Society for Technology in Education (ISTE) has created technology standards for teachers and students that define the guidelines for applying technology in education. Part of those standards include (a) using technology that addresses diverse needs, (b) developing higher order thinking skills and creativity, and (c) managing learning activities in a technology enhanced environment.

Education and technology

Leaders in guiding the transformation of education, ISTE developed the National Educational Technology Standards (NETS). Their project is based on the idea that in an

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Prepared in the style of: American Biology Teacher

effective educational setting, technology can enable students to become capable users, information seekers, analyzers and evaluators, problem solvers, decision makers, with the goal of ultimately becoming creative and effective users of productivity tools. The problem is the need to be informed about the most effective uses and impact of technology in education. There are physical, human, financial, and policy dimensions which greatly affect the success of technology use in schools and their project has developed standards for using technology based on national consensus.

According to the NETS project, the most effective learning environment through technology should prepare students to: communicate using a variety of media and formats; access and exchange information in a variety of ways; compile, organize, analyze, and synthesize information; draw conclusions and make generalizations based on information gathered; know content and be able to locate additional information as needed; become self-directed learners; collaborate and cooperate in team efforts; and interact with others in ethical and appropriate ways.

Technology enables students to learn in ways not previously possible. Science has not only been changed by technology but it has also changed how scientists work. Discoveries have accelerated as a result of new and emerging technologies and the scientific process itself relies extensively on technology. NETS has gathered a great number of learning activities, which are based on technology, and they have outlined curriculum and content area standards specific to science at each grade level.

However, if teachers have not experienced learning in a technology-rich environment, will they be comfortable creating such an environment in their classrooms? What does it take to encourage those teachers who are willing to be innovative and explore new technology-rich approaches to science education?

Professional support for teachers

What is available at the district level to support teachers who are eager to use the materials available and how can access be gained to those programs? Administrative positions at the school, district, state, and independent levels are assigned the responsibility of providing opportunities for teachers to learn and adopt new technology resources. Most schools have science coordinators who evaluate incoming texts and

resources to make recommendations to the curriculum advisors at the district and state office. All levels of administration can then plan professional development opportunities to introduce those technologies to teachers. Ultimately it is up to the teachers to properly implement the resources that are best suited to their subject matter. It is for educators in these positions as well as others interested in the connection of science and education that this paper is directed, as a means of evaluating and upgrading an additional resource for science teachers.

As a test case to analyze a tool available for teachers through professional development programs, I chose an inquiry-based learning tool called the "Wolf Workbook" (Appendix A). The structure of the Wolf Workbook follows an idealized model of the scientific process: observation, creating mental models, asking questions, designing experiments, measurements, testing hypothesis, answering questions, and revising mental models. The scaffolding guides learners through three cycles of the scientific process allowing them to revise mental models from simple anthropomorphic interpretations, to more sophisticated understanding of the basic scientific concepts of structure and function. At each step, more information is introduced, simulating the historical progression of scientific discovery as technology has improved the study of behavioral biology.

The workbook was co-created by professionals in science education and research as part of an interdisciplinary program "Instructional Technology and Science in Teaching and Learning" funded through the National Science Foundation (N. Bellamy and J. Packard, personal communication[1]). The original draft has been updated annually with the input of students, teachers, and educators. Appendix B shows the correlation of those standards to the wolf workbook as a basis for its usefulness as a technology tool in the classroom.

Available in both Microsoft Excel and pdf formats, the workbook integrates classroom technology and supports learning of science concepts through the study of animal behavior. It is scaled to be used in a variety of settings including college courses and public education programs such as zoos. However, to be adopted by secondary school teachers, it must encourage students to meet the state and national standards for science and technology learning. Later in this paper, these specific standards are

addressed and I will describe how the Wolf Workbook could be utilized to meet these standards. Actual barriers to this implementation will be identified, with recommendations for engaging teachers in participatory research to overcome the barriers.

Goal and objectives

My main goal is to provide information needed to expand the creative use of the Wolf Workbook by secondary school teachers and students. This paper will (a) evaluate its use in a professional development workshop for teachers, (b) introduce additional introductory materials developed for new users, and (c) recommend future upgrades for applications, such as inclusion in continuing-education professional development programs recommended by science coordinators.

METHODS

In this section, I will explain how and where I found the information used in this professional paper and what my role has been in the development of the Wolf Workbook. I used four main sources of information: (a) participant observation in the roles of both student and teacher using the Wolf Workbook as an educational tool, (b) informal interviews with educators involved in its creation and implementation, (c) feedback from participants in a professional development workshop for high school science teachers, and (d) content analysis of relevant literature.

Participant Observation

My first introduction to the Wolf Workbook was within an undergraduate college course in the Distance Education program for the degree of Master of Wildlife Science at Texas A&M University. As a graduate student with limited direct access to instructors, I was especially excited about the creative way the Wolf Workbook stimulated me to combine the scientific process with observations of wolf behavior. This excitement was due to a combination of my passion for the subject matter as well as the interaction it provided. In the context of that college course, the purpose of the workbook was to teach concepts of animal behavior using the wolf as the “instructional hook”.

The “hook” worked for students like me, because of shared personal interest in the subject. My interest in wildlife began early in my education while studying biology at the University of North Carolina at Greensboro. After finishing my bachelor’s degree, seasonal employment reinforced my desire to work outdoors. Soon after that I began attending Texas A&M University to finish my Masters degree in wildlife. A major part of my education was focused on behavior and was the key in choosing a wildlife biologist, Dr. Packard as my advisor.

At a key transitional point associated with my role as mother and wife, my career focus changed from biological field work to biology education. This led me to attend Letourneau University full time to obtain my teachers certification. Through this instruction I gained valuable insight into using technology in education.

Subsequently, this professional paper became a means of learning more about how to integrate the theory and practice of teaching, through applications of the wolf workbook. While working on my teaching certification, we had several projects that involved creating lessons using technology in the classroom. Since I wanted to focus on my interest in biology, I chose the wolf workbook; it was through that lesson that I was able to see it as a curriculum resource. This experience was a good transition for me as a biologist who needed to learn more about pedagogy.

The workbook was originally designed for professional development of middle school teachers, encouraged to explore innovative approaches for stimulating at-risk students to learn the scientific process (Bellamy 2003). It was integrated into the college course to illustrate educational tools of potential use in informal educational settings such as zoos (J. Packard, personal communication). The pedagogical value that I had overlooked as a student of wildlife biology became more apparent to me as I made the professional transition from biologist to teacher of biology.

The experience within the classroom has evolved dramatically over the last twenty years that I have been in school. Currently, more teachers strive to make the classroom be a direct reflection of life’s experience outside the school. My students have become very knowledgeable about computer technology due to their use of it at home. At an early age they are exposed to technology both in an educational setting and for

recreation. IPods and video games have taken the place of cassette players and dominoes. Text messaging has filled the spot where handwritten notes used to “dwell”.

My personal experience has been that students’ current knowledge of technology exceeds that of most teachers. Just as it would be difficult and frustrating for a new teacher to use a slide rule to teach math, it is difficult for new students to learn through outdated methods. There are basic skills and teaching methods that will never change but if we are to reach a new technological generation we must speak their language.

Theoretically, by using such an interactive program teachers would be speaking the right language to grab the student’s attention. By using the Wolf Workbook I was able to combine different types of technology including video, internet and various software programs. The National Study of School Evaluation (NSSE) has set up criteria for evaluating what is good and bad use of such technology. Most states in the US now require a technology plan or curriculum to be in place in schools and they now can turn to the NSSE for evaluation of those plans (Frick, 1996). I could envision how this tool could be used in a variety of ways. For those schools where each student has a computer and audio headphones, individuals could work independently on the workbook and its contents. The workbook could also be completed as a class in a “low technology” setting. With a single computer attached to a projector, the video clips and links could be accessed by the teacher and students together. Each student could work on a printed copy of the workbook.

Personally, I enjoy finding creative ways to teach. I began working for Friendswood Independent School District in August of 2005, teaching biology for freshmen and chemistry for juniors at Friendswood High School. During that time I was able to use a variety of tools to teach biological concepts as illustrated by animal behavior. This was my first opportunity to integrate the workbook into education and the students showed a high level of interest, enthusiasm, and increased learning through its use. I did discover quite a few limitations as well which have become the basis of the future development of the workbook discussed later in this paper.

Through the summer of 2006 I developed a week-long camp for kids, age 7 to 12, called “Backyard Wildlife” based on a program by the National Wildlife Federation. Although wolves are certainly not considered backyard wildlife, the activities related to

dogs were used to discuss how to study behavior of animals we can find in our backyards and to introduce the scientific method to the kids in an informal setting.

During the winter of 2006 I moved to Augusta, GA and began teaching environmental science at Augusta Prep middle school. Since we were previously able to conduct the professional development for middle school teachers, I was prepared to implement the wolf workbook from the start of the semester. It was during that time that I developed the additional materials suitable for use of the workbook as a long-term class project designed to unfold throughout an entire year.

My interest in wildlife began early in my education while studying biology at the University of North Carolina at Greensboro. After finishing my bachelor's degree I began studying animal behavior as a graduate student. Soon after that I began attending Texas A&M University to finish my Masters degree in wildlife. A major part of my education was focused on behavior (Drickamer et al. 2002) and was the key in choosing Dr. Packard as my advisor. As I was studying at Texas A&M my career changed focus from biology in field work to biology education.

Data Collection

The National Science Foundation has provided funding opportunities through which the wolf workbook has been presented to teachers. Professional development (PD) workshops were organized separately by Nedaro Bellamy and John Milam. As experienced educators, both participated in a graduate program at the center for Instructional Technology and Science in Teaching and Learning at Texas A&M University. Nedaro provides in-service teacher training at the Rice Model Lab in the Houston Independent School District (HISD). She participated in a summer ITS program: National Science Foundation, SSII, "Biology Team: Macro &Micro Living Worlds", with L. Griffing and R. James. This program was administered through the Center for Information, Technology and Science in Teaching and Learning. She was encouraged through this program to design technology intervention that could be used for an inquiry project about student learning in their classrooms during the school year. Providing in-service training for teachers, she wanted to create an IT that could be used during behavioral and food web study which also allowed mapping to the TEKS (Texas

Essential Knowledge & Skills). The TEKS are the learning standards that have been set for Texas Students. Formal interviews were done with Dr. Packard and Ms. Bellamy while informal discussions with Mr. Milam were applied. Surveys from teachers and students were collected during professional development and classroom instruction. Lastly as I began teaching in the public school system I interviewed teachers and curriculum directors for school districts about the implementation of the workbook.

Nedaro Bellamy's program at the Rice Model Lab in HISD (Houston Independent School District) piloted the workbook in real classrooms with feedback for both impact on students and teachers (Bellamy, personal communication[1]). I interviewed Ms. Bellamy by email correspondence to gather background information.

John Milam's program of professional development through Texas A&M University was also funded by the National Science Foundation. His two grants provided sustained professional development to middle school science teachers in that region of Texas. One grant served approximately twenty-two teachers for grades six through eight. It was in one of his sessions that we presented the wolf workbook to the teachers.

One of the most exciting aspects of the process was assisting in the professional development of a group of middle school teachers on using the wolf workbook in the classroom as part of John Milam's program. We also conducted pre- and post-surveys on their attitudes toward the workbook. I will discuss this in more detail later in the section about professional development.

The teachers were given pre-workshop questions, which they were able to answer as they arrived. These pre-workshop questions included 1) What are your expectations for this workshop, 2) How has your background influenced you to participate, and 3) How would you explain the concept of scientific inquiry before the workshop. Overall most of the teachers had been pleased with previous workshops done through John's grant and so were excited about participating again. Also they were excited about the use of wolves and the applications of behavior in their classroom. The background responses were similar in that most said they were middle school science teachers looking for new and exciting ways to teach science. The workshop lasted approximately four hours with a few breaks and consisted of a brief review of wolves and in depth use of one circle of worksheets. The teachers were very excited throughout the entire workshop and were

able to envision how the workbook could fit into their curriculum. The most prevailing thought was that not only was the use of wolves exciting but the workbook did a great job of integrating scientific inquiry into a good technology based program that could be used by them and their students. After the workshop the teachers answered a series of six post-workshop questions including; 1) What did you find appealing about the wolf workbook, 2) Was the workshop engaging and understandable for you, 3) Regarding the workshop and the wolf workbook what worked for you, 4) What didn't work, 5) How would you explain the concept of scientific inquiry now, and 6) Any suggestions.

Document analysis

Fortunately there is a wealth of information on wolf behavior since its listing as an endangered species in 1973 (Gill, 1991)s. Having never had the opportunity to personally study wolves in a natural setting I must depend on document analysis as a portal into that area. This approach to research is not only cost effective but also a good comparative study from different researchers in the field. The U. S. Fish and Wildlife Service (USFWS) along with Non-governmental Organizations such as the International Wolf Center have a variety of materials available from public information articles to peer reviewed scientific reports. Documents used in this paper consist of scientific journals including those written by Dr. Packard, education textbooks, and informational articles found on trusted websites such as the USFWS recovery pages.

Informal discussion/Interviews

When writing about an education tool such as the wolf workbook the best source of information comes from the very people who were involved in its creation, continued development, and implementation. Those include Dr. Jane Packard, Nedaro Bellamy, a specialist in professional development for teachers, and John Milam along with the teachers and students who have used and taught with it.

Evaluation Results

The response from teachers participating in the Professional Development Workshop was overwhelmingly positive. It was up to them to implement the program if

they chose to do so when it works for them. The teachers agreed that the choice depends on the availability of time and technology in the classroom.

Overall the results of the questions showed that the teachers left with a very positive attitude about the workbook and had plans to use it in their middle school science classes. One discussion regarded how to set aside time to do the workbook. Some suggestions made included working on the workbook for ten minutes each day during the appropriate unit of study. Another idea was to split the workbook up throughout the year, doing one circle of worksheets at a time, by applying it to different areas of study and adding additional fields of scientific study when appropriate. This again shows the great flexibility of the workbook to be customized to each teachers schedule and curriculum. Some of the responses of the questionnaires have been organized into Table 1 below. I have focused on the questions most specifically related to the wolf workbook.

Professional Development (PD) is one of the best avenues to present the wolf workbook to teachers as a technology tool to use in their classroom. All teachers have continuing education credits they must meet every year to maintain their certification. PD experiences serve as a way for teachers to obtain those credits as well as to enhance their classroom in a fun and exciting way. Also, once a tool such as the wolf workbook is introduced in a PD, it must have already met approval by the school district.

Continued development

The wolf workbook is annually evaluated and updated by Dr. Packard. Perhaps one of the most useful aspects of the workbook is the flexibility for users to customize it. Some of the ideas that have been discussed for future development include a teacher's guide, a hierarchy of ethograms, workbooks for other species, and integration of additional science text.

The application of new technology in any classroom can be challenging and rewarding. As a new teacher or an experienced teacher with a new tool, it is extremely helpful to have a guide, or a teacher's version of a product. This is a problem with the workbook as it exists now since it lacks that resource for teachers. Since the workbook is based on wolf behavior, most teachers would need assistance with what is actually happening in the video clips. At the very least they would want to be comfortable that

Table 1. Professional development workshop survey responses

What are your expectations for this workshop?
To learn new and exciting ways to engage students in the science classroom.
To get a better understanding of the behaviors of a wolf. I hope to end my year with this project.
Learn something new about wolves and incorporate it into my teaching.
Learn how to incorporate wolves into middle school science curriculum making it interesting/engaging.
Looking for an inquiry based lesson to incorporate behavior, evolution of behavior to integrate
What did you find appealing about the wolf workbook?
Inspiring and exciting for me and I am sure it will be totally engaging to even the most slug-a-bed students.
Using video clips to introduce the subject and prompt inquiry!
Everything, it seems extremely user friendly.
Very interesting, makes me want to learn more.
Will work for a variety of levels of students – high interest.
Adaptability of the workbook (excel), and adaptability of the resources to all levels of students.
The interactive set-up of the excel workbook, video clips, and authentic science research.
Covering so many 6th TEKS that are connected to my districts scope and sequence.
Regarding the wolf workbook, what worked for you?
Inferencing (one of our lowest performing TEKS), research skills, inquiry.
All of it!
The ethogram is great along with all of the resources.
Video and sources
I appreciate all of the tips throughout the workbook pages, easy to understand.
The CD was understandable and easy to follow.
Workbook is user friendly, I like the included tips.
Regarding the wolf workbook, what didn't work?
Social distance was more difficult. Names of wolves would be helpful for clarification and identification.
Time, I wonder if I would be able to devote the proper time to this that is required with my current curriculum requirements
Identifying the alpha, beta, gamma, and omega wolves.
Too much sexual behavior.
Nothing, I don't know much about wolves but we would learn together.
Suggestions
On page M2, a table to label and describe the different wolves.
A section for teachers comments on student work.

interpretation of the clip was appropriate and in line with intentions of the video. Ideally, a teacher's version would include not only a "play by play" of the video clips but also multiple possible accurate responses to the questions. This would assist in guiding the teachers on what other activities and information could be added to make the workbook more applicable to their curriculum.

Higher level ethograms for each year, or each level of the workbook, would help to introduce the ethogram concept to those students who have never used one before. The first level of the workbook is for younger or beginning students and focuses on dogs since they are able to relate more to them. Each level thereafter increases in difficulty and so brings in higher level behavioral observations. If the ethogram was divided so as to introduce the behavior definitions in a more organized manner then the students could build on that information as the difficulty is increased.

SUPPORTING MATERIALS

Ethograms

While we are studying wolf behavior in the course of the wolf workbook, it is essential to be able to express what we observe about their behavior. A wolf-to-human dictionary known as an "ethogram" will enable us to talk about their behaviors on the same level. An ethogram is a dictionary written from the scientific perspective of an ethologist. By having a common basis of communication through an ethogram, students, wildlife interpreters, and experienced researchers can all use the same language to talk about wolves and their behavior.

There are two specific ethograms used in the wolf workbook and in this paper. The first was written through the International Wolf Center and includes color pictures of the wolves' behavior in action. To maintain consistency their ethogram was derived verbatim from the Wolf Park Ethogram. It includes a description of each wolf in the retired pack at the Center in Ely, MN, and a diagram of wolf topography. Each behavior is listed alphabetically beginning with Ambush and ending with Yawn (See figure 4 below). In 2007 they created a new version on CD as well which will prove to be a valuable asset in comparing behaviors in the video clips with those on the CD.

Figure 1. Example photo of the action "Yawn"(photo credit to International Wolf Center Exhibit Pack, Maya)[2]

The second ethogram used is the dictionary of wolf behavior found in Dr. Packard's chapter on wolf behavior (Packard 2003). This ethogram was originally created by student Tammy Stewart while assisting in the study of wolves at the Houston Zoo. It can be accessed through a link on the source page of the workbook. There is also a "Wolf Behavior Pictorial Guide" that correlates with this ethogram which can be found in the source section as well. Below are two examples from this guide.

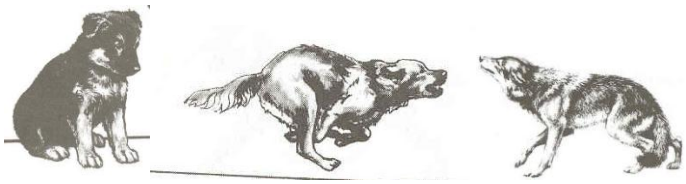

Figure 2. Example of behavioral states, as defined in the unpublished ethogram provided with the Wolf Workbook: sitting, running, least self-secure (adapted from Abrantes 1997)

Some scientists state that an ethogram is a complete collection of behaviors for a specific species. Rarely is there ever a complete list of all behaviors and so scientists call a partial list of behaviors a "catalogue of behavior". In this paper I have used the term ethogram to refer to any list of behaviors used in the workbook.

Teacher tool kit

A wolf loan box is currently available through the International Wolf Center at Wolf.org online. This box is filled with a variety of specimens, books, videos and activities and can be used in a way that suits the needs of the classroom and students. There are several boxes available which contain some or all of the following: wolf pelt, wolf skull, moose bones, deer bones, beaver skull, radio collar, plaster wolf track,

drawing of wolf track, wolf scat, herbivore scat, mapping activity, recovery role play, videos and DVD's, wolf howl CD, teachers guide and books. Lastly it also contains the International Wolf Center award winning curriculum *Gray Wolves, Gray Matter.* There is a fee charged for delivery to the school and it is available for a two week period.

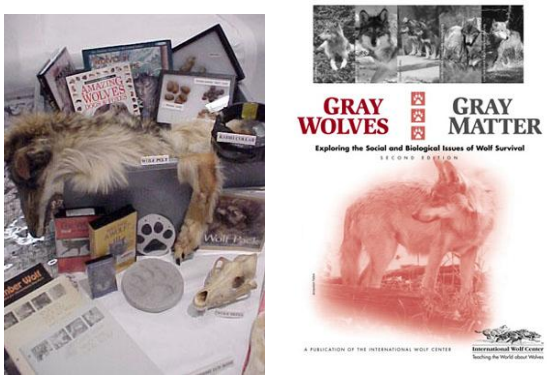

Figure 3. Items found in the wolf loan box from the International Wolf Center (photo credit to the International Wolf Center)

Dr. Packard has also developed a wolf tool kit that will be available soon through the ethology lab in the Wildlife and Fisheries Department at Texas A&M University. This is a kit very similar to the one offered on line (http://wolf.org) but also includes both printed and digital copies of the wolf workbook for study. These printed versions of the workbook can be copied for use in the classroom and have been arranged by color for easier use. For example, the observation pages were printed on green paper and the question pages on blue paper.

PowerPoint presentation

A supporting PowerPoint presentation created by Dr. Packard is included in the sources section of the wolf workbook. When I began preparations for the PD I modified the presentation to fit the instruction of the function of the wolf workbook for the teachers participating. Below I have included a couple of the slides from that presentation (Figure 4).

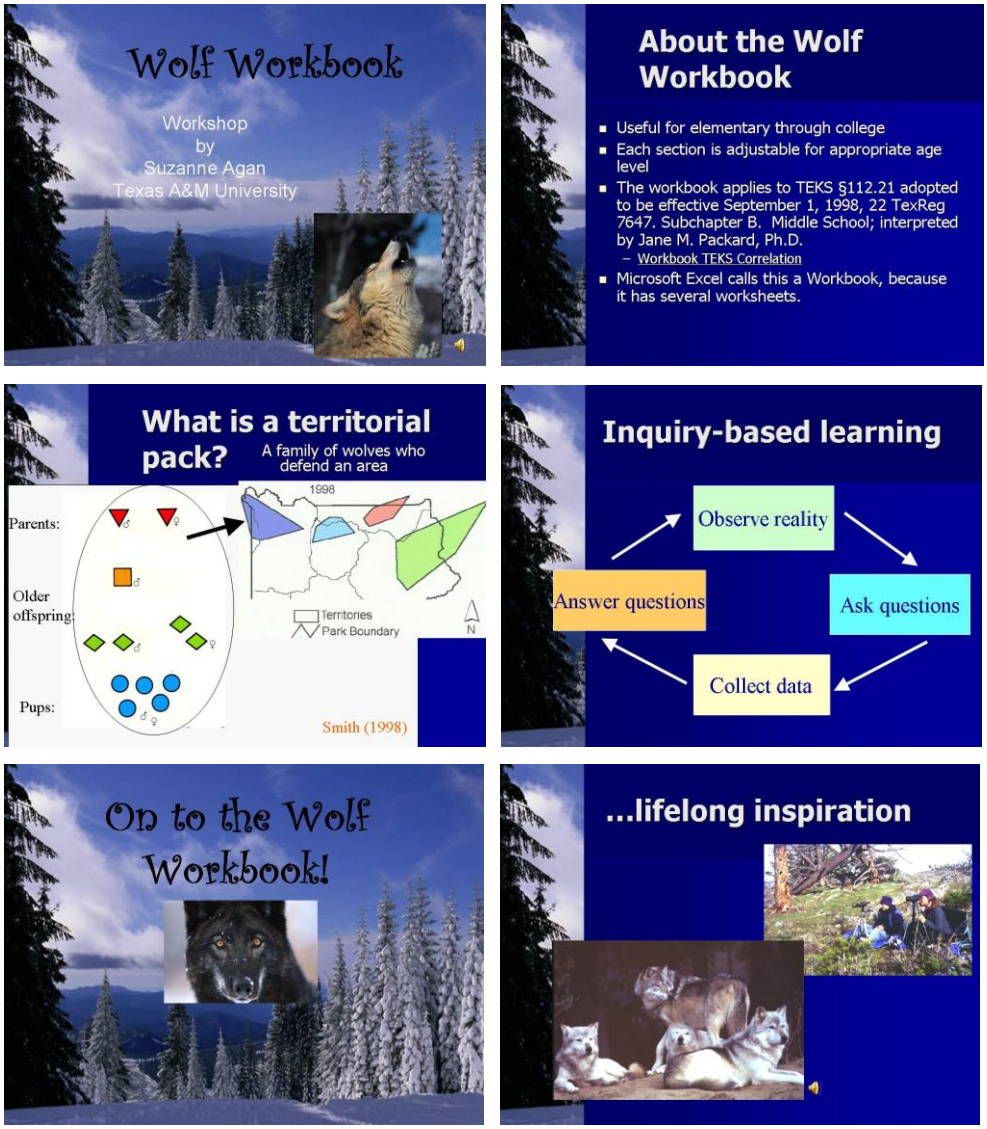

Figure 4. Presentation prepared for the professional development workshop at Texas A&M University (adapted from materials provided with the Wolf Workbook).

This presentation not only describes the workbook but also shows the teachers how to use it in the classroom and describes its interdisciplinary possibilities. In order to educate the teachers on the biology there are slides on the basics of wolves and wolf behavior and focuses on why we have used them as the subject matter for the workbook. Next it describes the function of the workbook and then links to the wolf workbook itself. Lastly there are additional references for the teachers to link to in order to further educate them on wolves and gives them additional science education resources.

For my first introduction of the wolf workbook to my middle school science class in Georgia, I used the presentation to introduce the discussion of ecosystems. Most of the same slides that were used in the PD were also used in the class but were modified to fit the subject matter and age level. Below are several slides showing how this presentation can be modified to fit a classroom lesson. Looking at the behavior of wolves I integrated

Figure 5. Presentation prepared for a middle school lesson on ecosystems (adapted from materials provided with the Wolf Workbook).

the concepts of competition and predator/prey relationships. In discussions of how wolves live together in families along with the picture created for the background, forest habitat as part of the ecosystem was explored. Also in the slide which is titled “Lifelong Inspiration”, the pictures were directly related to the concepts of direct and indirect observation, sampling, and mark and recapture studies. All of these concepts were from the student environmental science textbook and was used as a bridge from the lesson into the wolf workbook.

IMPLEMENTATION

Secondary schools

A school districts curriculum has very strict standards which emphasize basic academic skills, higher academic thinking skills, and cooperative learning strategies. When choosing any tool that is being used as part of that curriculum it is those standards which are looked at and which must be met to be incorporated on a more universal level. Part of the mission statement for Friendswood Independent School District for example is to include technology integration into all schools. However at an individual level, teachers are allowed a certain amount of freedom to choose tools they feel would benefit their classroom as long as they meet the district standards. Though the wolf workbook has not been adopted as part of the curriculum at any of the schools I have taught in I have been allowed to use it personally in my classroom. My goal then would be to make the wolf workbook known and accessible to those teachers through programs such as professional developments and perhaps other avenues such as a website where teachers can find the information through their own research.

One of the most important aspects of teaching science is to make it exciting enough that the students will take an interest in it and remember not only the content but also the process of science. Science can be fun and challenging but it can also be difficult and confusing to students. The wolf workbook was designed as an education tool for secondary schools. The most current version of the workbook, which is the one written about here and included in the appendix, can be tailored to fit any grade or age within a science classroom. As discussed already the workbook has three numbered cycles. Each

cycle increases in difficulty from the first to the third cycle. These cycles can be used for different ages or level of education. My first year of implementation in middle school I the students began with cycle one and then with experience moved on to cycles two and three sequentially. This was the same technique we used in Dr. Packard's ethology class. For elementary students the teacher can focus only on cycle one which focuses on dogs and is most relevant and basic for their level of education. Cycle two then can be used in middle school with cycle three coming in during the high school years. These different cycles increase in difficulty accordingly and are most applicable at these grade levels.

In education it is important that the lessons taught are interdisciplinary. This means that you can connect the science lesson with other subjects such as History and English. Since the wolf workbook is scientific and discusses wolf behavior, it can easily bring in principles of other disciplines to add to the content value, e.g. American History. The settlement and development of early America had an overwhelming impact on wolf population dynamics. Wolf populations grew smaller as ranchers moved into each pack's territory and government programs almost eliminated much of the species. By bringing in this parallel to early American history students can connect their roots in America to the state of the wolf and gain a better understanding of both.

Students can also connect to the USFWS website and learn about government regulations. Wolf reintroduction of the past and present will take students through a wealth of information about geography in America and specifically the western states where reintroduction has been more expansive and successful (. Through this time period there also arose several government regulations related to the wolf such as the Endangered Species Act (ESA) of 1973. Congress passed the ESA to protect and recover imperiled species and the ecosystems upon which they depend.

Behavior can be measured like any other data collected in the scientific process so long as there is an established system of scoring. For example counting the number of times a certain behavior takes place in a given amount of time. This data collection and analysis allows the workbook to institute mathematical concepts.

Lastly the mental models presented within the workbook cover family interactions and relationships not only among wolves, but also dogs and humans. This portion can bring in concepts and theories of psychology. For example, page Q1 discusses folk

psychology and how people as well as dogs get along in groups. The examples listed here are certainly not all inclusive of the interdisciplinary nature of the wolf workbook but it does give an idea of how the workbook can be implemented and molded to fit not only the scientific lesson currently in the classroom but also to be interdisciplinary across the curriculum.

When deciding on appropriate material to use in a classroom teachers are encouraged to use those tools which can be utilized by different learning styles and which uses multiple intelligences. Learning styles are simply different approaches or ways of learning. These include visual, auditory, and kinesthetic. Each of us has a unique way of learning and at least one particular way in which we learn and retain information the best.

Visual learners are those who learn through seeing. These students will be most influenced by the video clips in the workbook as well as the written part of the scientific process. Video clips of dogs and wolves are found on each cycle and the ethogram is an essential visual portion of the process in identifying behavior.

Auditory learners learn through listening. They will benefit from the audible aspects of the clips and from discussion of the steps in the workbook. These discussions include group dynamics, thoughts and feelings of dogs and many others.

Kinesthetic learners are those who learn through moving, doing, and touching. They excel when they are able to actively explore the physical world around them. As an expansion of the lessons derived from the workbook, the teacher could expand the study of behavior to another species which can be observed in real life by the class. A field trip to a local nature center or zoo would provide that connection for them. They will also benefit from the items in the wolf trunk such as the wolf and coyote pelts, the skulls, and other items. Just as we remember that bunnies are soft from experience of holding them, the students are more able to relate to the wolves once they have held such items themselves.

The theory of multiple intelligences was developed at Harvard University in 1983 by Dr. Howard Gardner and suggests that the traditional notion of intelligence based on I.Q. testing is far too limited. Instead he proposed eight different intelligences for everyone which include linguistic, logical-mathematical, spatial, bodily-kinesthetic, musical, interpersonal, intrapersonal, and naturalist. These eight intelligences have

advanced education to get away from just lectures, textbooks and worksheets. The wolf workbook's design can be utilized to incorporate almost every one of these intelligences and as such provide eight different potential pathways to learning. Following I have provided definitions and applications of each.

The linguistic intelligence is word smart. It is the ability to use words and language. Within the workbook itself there are several sections in each page to write about observations and also recommended books to include in the lesson.

The second intelligence is logical/mathematical and is the ability to use reason, logic, and numbers. These types of learners ask lots of questions and like to do experiments which of course are perfect for a science class. The workbook uses time and distance observations along with calculations in the measurement portion of the process.

Spatial intelligence is the ability to perceive the visual. One of the unique aspects of the workbook is the use of video clips of dogs, captive wolves, and wild wolves. In one such clip the student is asked to estimate the distance of wolf A from wolf B in order to make inferences about their relationship. A visual intelligence would also be able to utilize the many pictures in the wolf ethograms available.

The bodily/kinesthetic intelligence is the ability to control movements and handle objects skillfully. Their greatest learning comes through hands on experimentation and so these learners will get the most use out of the wolf trunk that can be borrowed by the teacher while using the workbook. The items it contains give a real life connection through its pelts, skulls and other items.

Musical intelligence is the ability to produce and appreciate music. There are several creative assignments which can be used along with the workbook including having students write a song about a particular pack of wolves. Wolves bring forth a wealth of emotions and dramatic visions and inspiration that could be applied to the arts. I remember once visiting the Cherokee reservation in North Carolina to watch an outdoor drama. Even though I could not understand the language they used, it was the music, the dramatic motions and the use of animals such as wolves that made it so powerful and memorable. Wolves have been used as symbols for many years and still instill those emotions today.

Interpersonal intelligence is the ability to relate to and understand others while intrapersonal is the ability to self-reflect and be aware of one's inner state of being. There are portions of the workbook that would be great for students to work on together just as there are portions that would be better done on an individual level. The observation of the video clips could be done on an individual level with reflection activities accomplished as a group.

The last intelligence is the naturalist intelligence. This one is probably the most applicable to the workbook since it involves an experience in the natural world. The workbook uses the natural world and specifically the behavior of wolves to teach science. Other sections of this paper go into more detail about how the workbook can be manipulated and personalized to add many other aspects of nature and science education.

Texas Essential Knowledge and Skills (TEKS)

In the Texas Education Code (§112.21), school districts are required to provide instruction in essential knowledge and skills at the appropriate grade levels. There are specific standards for science and it is essential that content used within the classroom match up with the TEKS (Table 2).

Table 2. List of middle school science essential knowledge and skills

Source: Texas Education Code - Science

- provide clear, concise statements of what students should know and be able to do;
- encourage schools to select instructional approaches best suited to their local needs;
- focus in great depth on selected topics at each grade level;
- provide students with the skills to solve complex problems related to the world outside of school;
- provide content depth to ensure students' understanding of science in Grades K-12; and
- move cautiously, but meaningfully, toward a world-class system that develops Texas students as competent, technologically-literate problem solvers.

On the last worksheet within the workbook is a list of TEKS that are applicable to the workbook (Appendix A). The provisions of this refer to §112.21 (adopted to be effective September 1, 1998, 22 TexReg 7647. Subchapter B. Middle School) and are interpreted by Jane M. Packard. The sheet is divided up into the sections of worksheet number, TEKS number, what knowledge and skills will be tested, and how does the workbook apply. For example, all of the worksheets apply to TEKS #3 which states that students identify life processes and the relationships between structure and function of organisms. This workbook focuses on the structure and function of social behavior. There are twenty-five total TEKS which have shown to be applicable to the workbook in its current form. These are only for middle school students but those for high school science could be added to adjust it to the appropriate level if needed.

Below is a table showing a few of the TEKS which are found in the workbook. A complete table can be found in Appendix B.

Table 3. Selected examples of how the Wolf Workbook relates to the Texas Education Code.

Worksheet #	***TEKS #***	***Knowledge Tested***	***Skills tested?***	***Workbook application***
Q1, Q2, Q3	(6.10)(A)	Differentiate between structure and function		Blue worksheets: Cause questions address social structure and Function questions address function
M1, M2, M3	(6.20)(C)		"analyze and interpret information...from direct..evidence	Yellow worksheets: direct evidence is from measurements.

As another avenue for future development the wolf workbook could be aligned with other state standards such as the Georgia Professional Standards (GPS) in the state where I now teach. In talking with the director of curriculum at our school, it is that standard alignment that they look to first when making curriculum choices.

Public education

There are many opportunities for the wolf workbook to be utilized outside of the classroom. Though we have many ideas on how this can be accomplished it is still in the developmental stage. It is important that I express these are only our ideas of how the

wolf workbook can be implemented and do not convey any agreement by the agencies mentioned. One such idea is through the education department at the Houston Zoo, where there has been discussion of the possibility of implementing the wolf workbook into their education program. Since Dr. Packard has been a part of wolf behavior observations at the Houston Zoo, there is a strong possibility there to use this tool perhaps with the teachers and students who come for the workshops or as part of their professional development program.

Yellowstone National Park has a program called the Wolf Tracker. The Yellowstone Wolf Tracker (YWT) promotes successful and responsible approaches to wolf-watching. They offer guides for single and multiple day excursions as well as an education program. This program includes a curriculum for the study of Yellowstone, a cyber-tour of gray wolves, electronic field trips and online classes. The instructors there can customize the curriculum to match the course goals of the students. How exceptional would it be to us the wolf workbook in the setting of live observations rather than through the video clips? For example, the following quote illustrates a valuable observation that would fit in perfectly with the learning goals of the workbook and is part of what I imagine for its use in public education. One participant in a field course at Yellowstone, Jeff Tollefson, said in an article in the Billings Gazette (February 6, 2001):

> "On this day, the last of their tour, the Deals heard howling and barks as the alpha male let other wolves know he didn't want to be disturbed. The actual mating lasted about 14 minutes, observers said. The alpha male, beta female and about 10 other pack members that were bedded down in the snow nearby then trotted off into the trees. 'That's something that you wouldn't see in textbooks, but it's something we're seeing in Yellowstone,' Varley said."

Success of the wolf workbook

In the fall of 2002, Nedaro Bellamy introduced the wolf workbook to a group of students and teachers at the Rice Model Lab. The interactive workbooks were used to encourage inquiry within instruction by using activities that promote analytical thinking, formation and justification of hypotheses, distinction between observations and inferences, and the use of experimental design to understand the roles of wolves within their environment (Bellamy, personal communication, 2003[1]). The culminating activity

within the lab provided an opportunity for the students to debate the issue of wolf reintroduction in areas where they are considered endangered or threatened. For this discussion they were able to draw on previous units of study such as animal behavior and organism responses within the environment. The students were enthusiastic about the workbook and the issues discussed which also included threats to farmers, cost to government, habitat destruction, public opinion, and wolf populations in the United States. For Bellamy it was exciting to see that some students even began to accept responsibility as citizens and adopted wolf cubs through the World Wildlife Federation. Another result of the use of the workbook in this lab was a discussion of family dynamic and hierarchy including the emotional health of students. One resident teacher even encouraged using the wolf workbook as part of a counseling program for teens.

Dr. Packard has been using the wolf workbook as part of her Ethology class at Texas A&M University since its initial development in the fall of 2002. These students are preparing for jobs in informal education in zoos, nature centers, and parks. Their comments are listed in Table 4. It is important to see what

Table 4. Undergraduate student comments

Question	Student Comment
What worked?	Working green-blue-yellow-orange and cycling worked better than working each section all at once.
	What we were able to cover was great, very understandable.
	I liked the order of the workbook.
	This workbook was much easier to go through and figure things out on my own. My confidence level was much higher than on a previous workbook.
Suggestions	Use this workbook to build confidence
	Try to streamline each session more. In the video folder, name each clip with which section it belongs to so if the link is broken we can work around it.
	If possible for the next workbook maybe 2 or 3 examples instead of 3 or 4 so that the cycle will move more quickly.

works at all levels and to see what suggestions the user has since each person swill have their own experience with it. The wolf workbook has been piloted and adapted as a result of these experiences and feedback from participants in both the teacher continuing education and the college pre-teacher programs.

RECOMMENDATIONS

The initial reaction of teachers in-training and in-service was not rejection of the Wolf Workbook; however, potential barriers to adoption were identified. In this section, I will elaborate briefly on recommendations for further investigation of potential solutions to address these issues

(a) Inadequate background knowledge of the specific subject matter,

(b) Limited visuals and artifacts for introducing the materials,

(c) Lack of access to the required software,

(d) Poor audio/video quality and issues associated with copyright restrictions,

(e) Uncertainty about approval of the materials by science coordinators and curriculum advisors and

(f) Lack of a supportive collaborative learning community for teachers who adopt the materials.

Inadequate background knowledge can be addressed with two resources. First a detailed description of the structure and function of the wolf workbook has been included in Appendix E. Teachers may also do their own investigation ahead of time into the subject matter of wolves using the links provided with the wolf workbook and the chapter on wolf behavior included in Appendix D.

Since student learning is increased through hands on applications, a wolf trunk discussed earlier would be the best resource for addressing the limited visuals and artifacts. Reference to these supplemental materials could be added to the Teacher's Guide.

Proper marketing of the Wolf Workbook would be needed to increase access to the required software. Currently the software is available through Dr. Packard and her team at Texas A&M University as well as through the professional development

programs discussed earlier. In the future we would like to see access of this software available to a much larger audience through marketing and publication.

It has been my experience that science coordinators and curriculum advisors are very open to technology that is available and appropriate for classroom instruction. School districts also have specific instruction tools that they adopt for the science classes in their district; adoption of this technology that would allow this program to be used and developed to its fullest potential. This would also address our last issue of lack of supportive collaborative learning. Typically when districts adopt materials for use in the classroom, they also provide training and collaboration on the use of those materials. Through this course, professional development programs would be set up to provide that instruction to teachers who would be using the Wolf Workbook. Therefore I seek to not only present the Wolf Workbook as a tool available to teachers but to also communicate with school district curriculum advisors on adoption and professional development.

CONCLUSION

The wolf workbook has been and continues to be a wonderful technology tool used in science education. The purpose of this professional paper was to introduce it as a tool for educators to bring excitement and a desire for learning to the students in the classroom. Throughout this process of writing we have successfully introduced it to both teachers and students and have found success. The wolf workbook will continue to be implemented within the classroom not only by myself but also by Dr. Packard and others who have participated in its pilot throughout many school districts in Texas and now Georgia. Also it will continue to be updated and improved as new information becomes available through scientific research. I believe the best course of action to present it to teachers is to begin at the district level with the curriculum director and through PD to the teachers themselves. This is where we have had success and is the most reliable resource for teachers. It is my hope that as this writing comes to an end that new areas of study will present themselves for further use of this wolf workbook. It is a truly valuable tool for teaching the scientific process and as shown by those who have had the opportunity to use it, brings a desire for learning to the student which is the true backbone of its intended creation.

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ENDNOTES

1. Bellamy, Nedaro. "Does student attitudes regarding Interactive Wolf Workbook instruction influence competency domains students remember? " Unpublished document. 2003.

2. International Wolf Center. http://www.wolf.org (accessed March 5, 2009)

3. "Red Wolf Recovery Project." US Fish and Wildlife Service. http://www.fws.gov/redwolf/index.html. (accessed March 5, 2009)

4. "Welcome to the Mexican Gray Wolf Recovery Program." US Fish and Wildlife Service. http://www.fws.gov/southwest/es/mexicanwolf/ (accessed March 5, 2009)

APPENDIX A. WOLF WORKBOOK

Print Form

SCIENCE IN ACTION!

Wolf Workbook

Frequently Asked Questions (FAQ)

OBSERVATIONS
- O1 Dog Pack
- O2 Wolf Pack
- O3 Wolf Family

creating mental models

ASK QUESTIONS
- Q1 Folk Psychology
- Q2 Social Structure
- Q3 Social Function

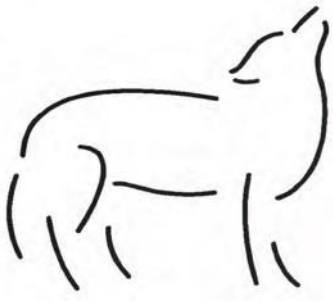
designing experiments

MEASUREMENTS
- M1 Units of behavior
- M2 Social distance
- M3 Resource distance

testing hypotheses

ANSWER QUESTIONS
- A1 First sources
- A2 Captive studies
- A3 Field studies

revising mental models



TIP: to return to the START page, click on the Wolf Icon; to read more tips, point your cursor at the red triangles.

TEKS
FAQ
SOURCES

WFSC 422 Ethology
Dr. J.M. Packard

EVALUATION (optional to earn supplemental points)

What worked?	
What didn't work?	
Suggestions?	

FAQ: Frequently Asked Questions

#	Keyword	Question	Answer	Source
1	workbook	How do we use this workbook?	To move between worksheets, click on the tabs at the bottom of the workbook. Read the steps at the top of each worksheet and type in the white boxes. If you have a question about how to do a step, point at the boxes with a red triangle. You will see a yellow TIP box appear, which will help you follow the instructions. To open a link (underlined blue words), point and click on it with the mouse. To hand in this exercise, you will need to save this workbook on your hard-drive or a diskette. Go to "File" on the top menu bar and pull down to "Save". Type in your name, so your teacher will know who wrote the answers. NOTE TO INSTRUCTOR: If you copy the entire CD to your hard-drive, then the links will work from the Excel workbook saved on your hard-drive. If the workbook is on your hard-drive and the video folder is on the CD, the links will not work. You will need Real One Player to view the video clips. Go to the Source worksheet to download it. Ask questions! (TIP: clicking on the wolf icon will get you back to "START")	For the Source worksheet, click here
2	questions	What if my question is not on this list?	Write to the friendly wolf educators at Wolf Park: http://www.wolfparkkids.com/ NOTE TO INSTRUCTOR: Add a question in an empty row at the bottom of this list. If you are a member of a university community, search scientific sources for the answer, using the tips listed below (Questions #4-7). When you get the answer, write it in this column on the same row where you wrote your question. Write the name of your source in the column at the far right of the same row. If you want an expert opinion, email a scientist, Dr. Jane Packard at: ethology@tamu.edu.	email Wolf Park experts
3	ethogram	What is an ethogram and where would I find an example?	An ethogram is like a dictionary of all the behaviors for one species (e.g. wolves, Canis lupus). Click on the link at the right to view a list that was made by a scientist who helped volunteers study wolves at the Houston Zoo. Her name is Dr. Jane Packard. One of her college students, Tammy Stewart, used this list to write a "Wolf Behavior Pictorial Guide". Ask your teacher for a copy. See how many of the behaviors you can find in the videos. If you are able to visit the wolves at the Houston Zoo, make a list of how many of the behaviors you can identify when you watch them. NOTE FOR COLLEGE STUDENTS: Some scientists say that an ethogram is a complete list of all the behaviors of a species (like a dictionary is all the words in a language, such as English or Spanish). The researchers in zoos usually do not worry about this technicality. They call any list of behaviors an "ethogram". Scientists use the term "catalogue of behavior" to refer to a partial ethogram (i.d. rarely do we have a complete list of ALL the behaviors of a species).	CD Rom
4	sources	Where do I find peer-reviewed articles from the journal Animal Behavior?	Ask your teacher. The scientific sources have been included as handouts in the information packet. They are also linked on the orange pages and the info page in this workbook. College students have access to the scientific sources at the university. They may use keywords to search for articles and download them as .pdf files: http://www.academicpress.com/anbehav	website
5	sources	Where do I search for scientific sources in general?	From a computer within the TAMU firewall, college students may search by keywords and authors to find abstracts and email them to yourself from the ISI Web of Science at: www.isiknowledge.com	website
6	sources	Where do I find books?	Go to your library. For college students, from a computer within the TAMU firewall, you may search for titles, authors and keywords for books in the TAMU library system: libcat.tamu.edu	website
7	sources	How can I order .pdf files of library sources?	For journal articles in the TAMU libraries, you may order a copy in .pdf format via Interlibrary Services: illiad.tamu.edu	website
8	litters	How many pups do they have in a litter?	Although most litters are 5-6 pups, as many as 11 pups have been reported in a litter. Litter size depends on nutrition of the mother. So during years when there is not a lot of food available, the average litter is likely to be only 3-4 pups. (Mech 1970:119). The age of the mother may also influence litter size. For example, the mom in the Rose Pack in Yellowstone had a litter of four pups. However, the same spring, her daughter had 11 pups. This was the first time the daughter gave birth and she was 2-years old. The mother was over 6 years old.	Dr. Jane Packard (personal communication) email: ethology@tamu.edu

9	teeth	How many teeth do wolves have?	Dave Mech wrote: "A total of forty teeth help the wolf in securing its food, the dental formula being: Incisors 3-3/3-3; Canines 1-1/1-1; Premolars 4-4/4-4; Molars 2-2/2-2. The largest teeth are the canines, or fangs, which may reach two and a quarter inches in total length, including the portion imbedded in the jaw." (SOURCE: page 14 in: Mech, L.D. 1970. The Wolf: the ecology and behavior of an endangered species. University of Minnesota Press, Minneapolis)	Dr. Jane Packard (personal communication) email: ethology@tamu.edu
10	Aggression	Are wolves aggressive towards people?	If a wolf is cornered, it will defend itself just like any animal that cannot escape. However, the wolves on Ellesmere Island were never aggressive toward us when we lived with them for 6 weeks on the arctic tundra. They were alarmed when we did strange things. For example, they were used to me riding on an ATV. When I left the vehicle one time, the yearling male bark-howled 80 times until I returned to the ATV. It was as if he was afraid I would sneak up on him. The mother wolf calmly walked with the litter of pups back to the den where they could escape into the cave in the rocks.	Dr. Jane Packard (personal communication) email: ethology@tamu.edu

Name:
Date(s):
Time (hour):

O1 Dog pack

STEP 1 Watch a video clip about dogs, carefully observing the behavior. Then, write notes on what you observed and learned. **SAVE**. *OPTION: Listen to the voice in the video to help understand what you saw.*

STEP 2 Learn to tell the difference between observations, "inference" and questions (?), by using the categories at the bottom of the page. Discuss with your classmate and teacher. *OPTION: Show your teacher that you understand these words: underline your observations; place quotes around phrases that are inference; add question marks. You may replay the clip to find evidence to support your opinion.*

STEP 3 Repeat for the second clip. Remember to save your notes by clicking on the "**Save**" icon that looks like a diskette. Be sure that all the white boxes are filled in before you hand in your worksheet. *OPTIONS: Take your own video of dogs and watch it.*

VIDEO	GENERAL NOTES ON WHAT HAPPENED
clip 1	*Type your notes here!*
clip2	

CODE	CATEGORY	DEFINITION	EXAMPLE
?	**Question**	what I'm curious to learn more about, to better understand what I observed; my hypothesis about cause/effect	I wonder if the dog at the front of the pack is a female in heat?
under-line	**Observation** (direct evidence)	what I actually saw, heard, smelled, or otherwise sensed about the animal and its environment	I saw individual dogs from separate yards jumped over fences and joined the group of dogs roaming the neighborhood
"quotes"	**Inference** (indirect evidence)	what I (or others) think about what I observed; my underlying mental model	"I think many dog packs are made up of males that are attracted to a female in heat"

Name:
Date(s):
Time (hour):

O2 Wolf pack

STEP 1 Watch a video clip about captive wolves, carefully observing the behavior. Then, write notes on what you observed and learned.**SAVE**. *OPTION: Listen to the voice in the video to help understand what you saw.*

STEP 2 Remember what you learned about observations, "inference" and questions (?) from worksheet O1. To show your that you understand these words: underline your observations; place quotes around phrases that are inference; add question marks at the end of questions.**SAVE**. *OPTION: You may replay the clip to find evidence to support your opinion.*

STEP 3 Repeat for as many more video clips as you have time. *OPTION: Take your own video of captive wolves at your nearest zoo.*

VIDEO	GENERAL NOTES ON WHAT HAPPENED
clip 9	
clip 10	
clip 11	
clip 12	

CODE	CATEGORY	DEFINITION	EXAMPLE
under-line	**Observation** (direct evidence)	what I actually saw, heard, smelled, or otherwise sensed about the animal and its environment	one wolf snarled and lunged at the other when it started mounting a third wolf
"quotes"	**Inference** (indirect evidence)	what I (or others) think about what I observed; my underlying mental model	I think the Alpha male was defending his mate from a subordinate
?	**Question**	what I'm curious to learn more about, to better understand what I observed; my hypothesis about cause/effect	I wonder how long these males have known each other, and if the Beta male is trying to take over the position of the Alpha male.

Name:
Date(s):
Time (hour):

O3 Wolf family

STEP 1 Watch a video clip about a wild wolf family, carefully observing the behavior. Then, write notes on what you observed and learned. **SAVE**. *OPTION: Listen to the voice in the video to help understand what you saw.*

STEP 2 Remember what you learned about observations, "inference" and questions (?) from worksheets O1 & O2. To show your that you understand these words: underline your observations; place quotes around phrases that are inference; add question marks at the er of questions. **SAVE**. *OPTION: You may replay the clip to find evidence to support your opinion.*

STEP 3 Repeat for as many more video clips as you have time. *OPTION: Watch a video of wild wolves that you check out from the library or from home. See SOURCES for suggestions.*

VIDEO	GENERAL NOTES ON WHAT HAPPENED
clip 14	
clip 15	
clip 16	

CODE	CATEGORY	DEFINITION	EXAMPLE
under-line	**Observation** (direct evidence)	what I actually saw, heard, smelled, or otherwise sensed about the animal and its environment	junior wolves tucked their tails between their legs and pawed then licked the face of the senior wolf; he muzzled them when they got too close
"quotes"	**Inference** (indirect evidence)	what I (or others) think about what I observed; my underlying mental model	I think the juniors were offspring of the senior, probably from a litter the previous year
?	**Question**	what I'm curious to learn more about, to better understand what I observed; my hypothesis about cause/effect	I wonder if the juniors got to eat after the senior left the carcass

Name:
Date(s):
Time (hours):

Q1 Folk Psychology

STEP 1 Discuss what the words "Folk Psychology" mean to you, and how we sometimes talk as if dogs think and feel like ourselves. Type your ideas in answer to questions #1 & #2. SAVE. *OPTION: To find what scientists think about these words, click on the wolf icon and follow the links to "Information" and "Folk Pschology"*

STEP 2 Think of some groups of which you are a member, for example: family, church, team, club, class. Discuss how people get along in these groups. Answer questions #3 and #4. SAVE. *OPTION: Draw boxes on a chart to illustrate how people are close or far apart in one group. Draw thick arrows between people who talk frequently and thin arrows between people who don't talk much.*

STEP 3 Think of a group of dogs that you have watched. Discuss how the dogs get along in their group. Answer questions #5 & #6. SAVE. *OPTION: Draw a chart to illustrate how the dogs interact, learning from what you did for people in STEP 2.*

Question 1: **What is Folk Psychology? How do we use it to think of hypotheses about behavior?**

My answer:

Question 2: **Do dogs really think and feel like humans?**

My answer:

Question 3: **What are some social groups to which you belong?**

My answer:

Question 4: **Compare and contrast the structure of your social groups?**

My answer:

Question 5: **What are some groups of dogs that you have watched?**

My answer:

Question 6: **Compare and contrast the structure of dog groups you have watched?**

My answer:

INQUIRY:	What is the social structure of a dog pack?	
Alternative Hypotheses	My Hypothesis	Evidence I would need to measure in order to test my hypothesis
Example	I hypothesize the structure of a dog pack is not like the "ladder model", instead, all individuals are equal.	If I counted the number of friendly and unfriendly actions, and all the dogs were equal, then I would accept my hypothesis.
My First Hypothesis		
My Second Hypothesis		
My Third Hypothesis		

EXAMPLES OF CHARTS DESCRIBING GROUPS OF DOGS

CHART A: "LADDER MODEL"

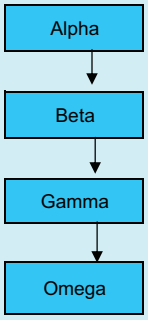


CHART B: "BRANCHED MODEL"

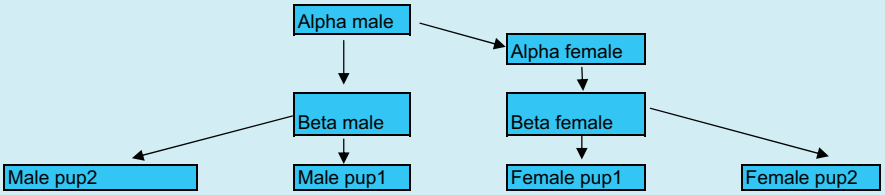
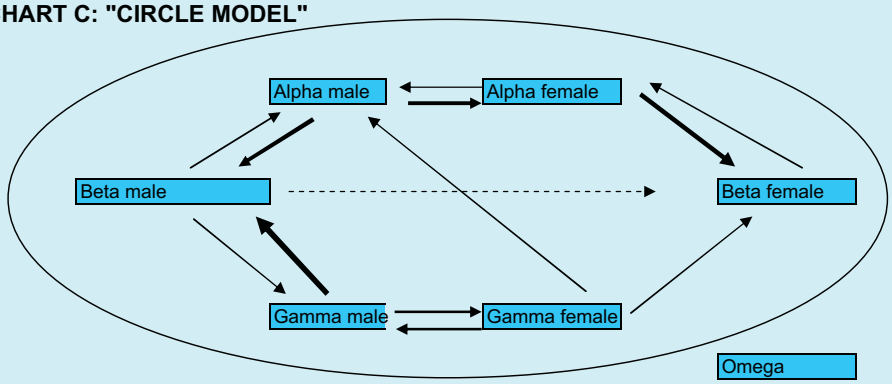


CHART C: "CIRCLE MODEL"



EXAMPLES OF CHARTS DESCRIBING GROUPS OF PEOPLE

CHART A: "LADDER MODEL"

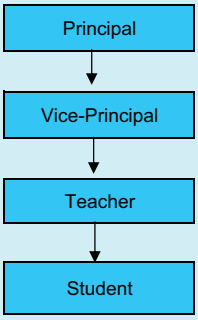


CHART B: "BRANCHED MODEL"

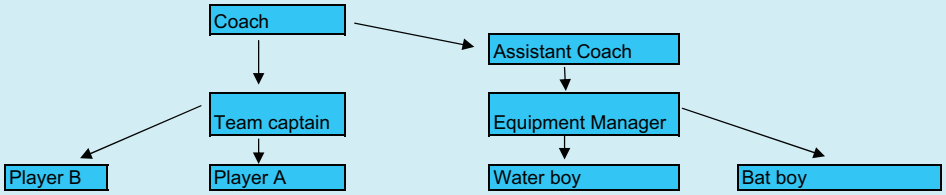
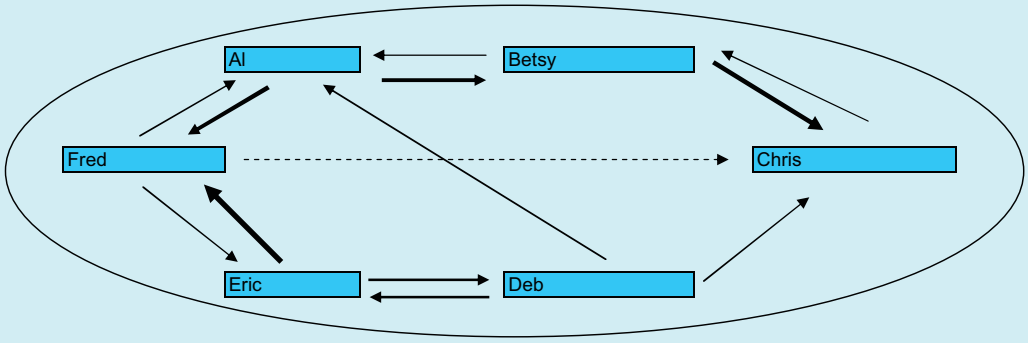


CHART C: "CIRCLE MODEL"



BONUS ACTIVITY:	What is the social structure of a dog pack?	
Alternative Hypotheses	My Hypothesis	Evidence I would need to measure in order to test my hypothesis
Example	I hypothesize the structure of a dog pack is not like the "ladder model", instead, all individuals are equal.	If I counted the number of friendly and unfriendly actions, and all the dogs were equal, then I would accept my hypothesis.
My First Hypothesis		
My Second Hypothesis		
My Third Hypothesis		

My name:
Date(s):
Duration (min):

Q2 Social structure

STEP 1 Discuss your notes about the captive wolf packs you observed in the video linked with worksheet O2. Think about your experiences with dogs, and answer questions #1 & #2 below**SAV**E

STEP 2 Discuss what you have learned about captive wolf packs from your experience or observations on Worksheet O2, and answer Question #3. **SAVE**. *OPTION: Interview a dog breeder or biologist to hear their ideas about instinct and learning.*

STEP 3 Use your mental model to write one testable hypotheses about the behavior of captive wolf packs. Discuss what evidence you would need to test your hypothesis. Answer Question #4. **SAVE** *OPTION: Compare your hypothesis with others in your group, discuss how the evidence needed might differ for each hypothesis.*

Question 1: What questions do you have about SIMILARITIES in behavior of captive dogs and wolves?

My answer:

Question 2: What questions do you have about DIFFERENCES in behavior of captive dogs and wolves?

My answer:

Question 3: What is your mental model of how captivity and genes influence the behavior of wolves?

My answer:

Question 4: **What is the social structure of a captive wolf pack?**

Alternative Hypotheses	Hypothesis about the best model	Evidence I would need to test my hypothesis
Example	I hypothesize the captive wolf packs do not fit the ladder model, because all individuals have the same instincts controlled by their genes and they all have enough food.	Each wolf is equally friendly to every other wolf and there is no difference in social distance among members of a captive pack.
My hypothesis:		

My name:
Date(s):
Duration (min):

Q3 Social function

STEP 1 Discuss the meaning of the words "Structure" and "Function" (read the box at the bottom of the page). Answer question #1 below. **SAVE**

STEP 2 Discuss your notes about the behavior of parents and offspring (subordinates) in the wild wolf pack you observed in the video. Answer questions #2 & #3 below. **SAVE**

STEP 3 Discuss what you have learned about the wild packs, and answer Question #4. **SAVE**. *OPTION: You may choose more than one chart if you believe the captive wolf packs you observed were different and each fit a different model.*

STEP 4 Use what you have learned to write two testable hypotheses about the function of wild wolf packs. Discuss what evidence you would need to test your hypotheses. Answer Question #5. **SAVE**

Question 1: In your own words, what is the meaning of "structure" and "function"?

My answer:

Question 2: What behaviors INCREASE distance between parents and offspring in a wolf family?

My answer:

Question 3: What behaviors DECREASE distance between parents and offspring in a wolf family?

My answer to question B:

Question 4: What is the function of the social structure of a wolf family?

Alternative Hypotheses	My Hypothesis:	Evidence I would need to test this hypothesis:
Example	I hypothesize the function of the dominant parents in a wolf pack is to keep juniors from breeding.	Only the parents produce pups, their juniors do not have pups that could compete with them for food.
H1		
H2		

CONCEPT	MEANING	EXAMPLE
Structure	How something is put together; the pieces of a system and how they are related	In a wolf's jaw, there are 6 incisors, 2 canine teeth, 8 premolars and 4 molars. Half are on each side of the jaw, arranged from front to back in the order listed.
Function	How the structure influences the survival and reproduction of the animal.	The canines help the wolf hang on to prey during the kill, the incisors help pluck fur and feathers off the skin, the premolars help chew meat, and the molars help break bones.

Name:
Date(s):
Time (hours):

M1 Units of behavior

STEP 1 Discuss what actions you would consider to be friendly and unfriendly behavior in groups of people a dogs; write your ideas in the top 4 boxes below. **SAVE**.

STEP 2 Discuss dominant and submissive behavior in people and dogs, then write examples of actions you believe would fit in each category (use the bottom 4 boxes) **SAVE**.

STEP 3 View as many of the video clips as you have time. Add to your lists in each of the 8 boxes. Discuss. **SAVE**. *OPTION: Watch (or videotape) a group of real dogs and add to your list.*

clip 3 clip 4 clip 5 clip 6 clip 7 clip 8

Type of behavior	My ideas about examples of body language for this type of behavior in: PEOPLE	DOGS
Friendly		
Unfriendly		
Dominant		
Submissive		

TYPE	MEANING	EXAMPLE
Friendly	Actions that bring individuals closer together	smile, laughter, gentle touch, backslap
Unfriendly	Actions that make individuals more distant	frown, yelling, hit, slap in face, shaking the fist
Dominant	Assertive actions that control the access of others to something they might want (resources).	cutting in line, taking another's food, sitting in another's chair
Submissive	Appeasing actions that reduce the probability of conflict.	hunched shoulders, turning away, sad face, closing the eyes, looking down.

Name:
Date(s):
Time (hours):

M2 Social distance

STEP 1 Watch video clip 13 and name 4 wolves "Alpha male", "Alpha female", "Beta", "Gamma"
OPTION: discuss as a group which names best match each wolf in the video

STEP 2 In the first frame of the video estimate the distance between the Alpha male and the other 3 wolves you named; write the numbers in the first row of the table

STEP 3 Play the video for 30 seconds and stop it; estimate the distances between the Alpha Male and each of the other 3 named wolves; write the distances between wolves in the next empty row of the table

STEP 4 Repeat Step 3 at 30 second intervals until all the white boxes on the table are full of numbers; Answer Questions A-C at the bottom of the page.

clip 13

Time counter	ALPHA MALE- ALPHA FEMALE	ALPHA MALE- BETA WOLF	ALPHA MALE- GAMMA WOLF
0 sec			
30 sec			
60 sec			
90 sec			
120 sec			
Average	#DIV/0!		#DIV/0!

Question A:	What was the average distance between Alpha Male and Alpha Female?	What was the average distance between Alpha Male and Beta?	What was the average distance between Alpha Male and Gamma?
Average:			

Question B: **Which wolves had the highest and lowest average distance from the Alpha male?**

My answer:

Question C: **Based on this evidence, can you reject your hypothesis from worksheet Q2 as "not a good model" (explain)?**

My answer:

EXAMPLES:

What is the distance between these two wolves, measured in wolf-body-lengths?

Alpha male | Alpha female

Answer: 1

TIP: If the distance is 1 body length or less, write "1"

Alpha male | Beta

Answer: 2

TIP: If the distance is greater than 1 and less than 3, write "2"

Alpha male

(Gamma is off the screen

TIP: If the other wolf is out of view write "3"

Answer: 3

Name:	
Date(s):	
Time (hours):	

M3 Resource distance

STEP 1 Watch video clip 16 and name 4 wolves "FATHER", "MOTHER", "JUNIOR", "BUBBA"

STEP 2 In the first still frame of the video, decide which of the wolves you named are close enough to the carcass to feed on it;

STEP 3 Play the video for 30 seconds and stop it; fill out the next empty row of the table; repeat until the video is finished

STEP 4 Count the number of boxes with "yes" in the column for each wolf and answer Questions A-C.

Clip 16

Time counter	FATHER	MOTHER	JUNIOR	BUBBA
0 sec				
30 sec				
60 sec				
90 sec				
120 sec				
Calculated "yes" Count:	0			0

Question A:	What was the "yes" count for FATHER?	What was the "yes" count for MOTHER?	What was the "yes" count for JUNIOR?	What was the "yes" count for BUBBA?
My "yes" Count:				

Question B: **Which wolves had the least access to the carcass?**

My answer:

Question C: **Based on this evidence, which of your hypotheses from Q3 can you reject as "not a good model" (explain)?**

My answer:

Name:
Date(s):
Time (hours):

A1 First sources

STEP 1 Divide into groups and choose a source to read about dog behavior, which you would like to describe to the rest of the class. Answer Question #1. **SAVE**. *OPTION: Use the sources written by Darwin, Tinbergen & Lorenz linked to the SOURCES page in the info folder on this CD. Answer the Bonus questions.*

STEP 2 Read your source and summarize what the author said, using your own words. Write your answer to Question #2 in the box. **SAVE**. *OPTIONS: Read your answer to the class and discuss. Play charades and act out the behavior to see if other groups can guess it.*

STEP 3 Discuss what was inference and what was observation in the source you read. Answer questions #3 & #4. **SAVE.** *OPTION: Report your findings to the class.*

STEP 4 Choose a second source. Discuss similarities and differences between the two sources. Answer Questions # 5, #6, and #7. **SAVE.** *OPTION: Write a report on dog behavior, using several sources and explaining why sources might differ in how they describe dog behavior.*

Question 1: **What is your source of information about dog behavior?**

My source:

Question 2: **In your own words, what information about dog behavior was in this source?**

My source said:

Question 3: **What statements in your source were direct observation (evidence)?**

Observations:

Question 4: **What statements in your source were indirect inference (Folk Psychology)?**

Inference:

Question 5: **How do these sources compare in terms of Folk Psychology?**

	Lots	Not much	None
After comparing Folk Psychology in these sources, I think they belong in these boxes:			

Question 6: **What was similar information in both sources?**

Similarities:

Question 7: **What was different about these sources?**

Differences:

BONUS POINTS

BONUS Q1: Who was Charles Darwin, and what other famous book(s) did he write?

My Answer:

BONUS Q2: Who was Konrad Lorenz, and what other famous book(s) did he write?

My Answer:

BONUS Q3: Who was Niko Tinbergen, and what other famous book(s) did he write?

My Answer:

BONUS Q4: What was happening in world history at the time your sources were published?

My Answer:

Question 5: **How do these sources compare in terms of Folk Psychology?**

	Lots	Not much	None
After comparing Folk Psychology in these sources, I think they belong in these boxes:			

Question 6: **What was similar information in both sources?**

Similarities:

Question 7: **What was different about these sources?**

Differences:

BONUS POINTS

BONUS Q1: Who was Charles Darwin, and what other famous book(s) did he write?

My Answer:

BONUS Q2: Who was Konrad Lorenz, and what other famous book(s) did he write?

My Answer:

BONUS Q3: Who was Niko Tinbergen, and what other famous book(s) did he write?

My Answer:

BONUS Q4: What was happening in world history at the time your sources were published?

My Answer:

Name:
Date(s):
Time (hours):

A2 Captive studies

STEP 1 Choose a source to read about captive wolf behavior. Answer Question #1**SAVE**. *OPTION: Divide into groups and report on your source to your group.*

STEP 2 Read your source and summarize what the author said, using your own words. Write your answer to Question #2 in the box. **SAVE**. *OPTIONS: Read your answer to the class and discuss. Play charades and act out the behavior to see if other groups can guess.*

STEP 3 Discuss what was inference and what was observation in the source you read. Answer questions #3 & #4. **SAVE.** *OPTIONS: Report your findings to the class. Play charades and act out the behavior to see if other groups can guess it.*

STEP 4 Choose a second source. Discuss similarities and differences between the two sources. Answer Questions # 5, #6, and #7. **SAVE.** *OPTION: Write a report on captive wolf behavior, using several sources and explaining why sources might differ in how they describe captive wolf behavior.*

Question 1: **What is your source of information about captive wolf behavior?**

My source:

Question 2: **In your own words, what information about captive wolf behavior was in this source?**

My source said:

Question 3: **What statements in your source were direct observation (evidence)?**

Observations:

Question 4: **What statements in your source were indirect inference (Folk Psychology)?**

Inference:

Question 5: **How do these sources compare in terms of Folk Psychology?**

	Lots	**Not much**	**None**
After comparing Folk Psychology in these sources, I think they belong in these boxes:			

Question 6: **What was similar information in both sources?**

Similarities:

Question 7: **What was different about these sources?**

Differences:

Name:
Date(s):
Time (hours):

A3 Field studies- wolf social systems

STEP 1 Choose a source to read about wild wolf behavior, one which would be useful to discuss the scientific concep "systems". Answer Question #1.**SAVE**. *OPTION: Divide in groups and decide if you want to share one source or several.*

STEP 2 Read your source and summarize in your own words what the author said about social systems of wolves. Write your answer to Question #2 in the box.**SAVE**. *OPTIONS: Read your answer to the class and discuss.*

STEP 3 Report your findings to the class. As you listen to reports of each group, take notes on Structure and Functio Write your notes in the boxes. Ask questions to fill in your empty boxes**SAVE.** *OPTION: Also take notes on Development and Evolution.*

STEP 4 Discuss and answer the questions C & F in the Systems Table.**SAVE**. *OPTION: Answer the questions about Development and Evolution.*

Question 1: **What is your source of information about field studies of wild wolf behavior?**

My source:

Question 2: **In your own words, how is the concept of "social systems" evident in your source? If not, why?**

My notes:

Question 3: **What is the STRUCTURE of wild wolf families? What might cause it to vary?**

My answer:

Question 4: **What is the FUNCTION of social structure in wild wolf families? How might this vary with the ecology?**

My answer:

Question 5: **How does social behavior DEVELOP in wolves? How might this influence social structure?**

My answer:

Question 6: **If wolves are genetic ancestors of dogs, why has social structure of dogs EVOLVED differently?**

My answer:

SYSTEMS TABLE	SYSTEM (snapshot)	CHANGE IN THE SYSTEM (video)
INDIVIDUAL LEVEL OF SYSTEM	C. STRUCTURE: How would you describe the social structure of a wild wolf family?	D. DEVELOPMENT: How does the action of food begging change as wolf pups grow into adults?
wolves in a family group		
POPULATION LEVEL OF SYSTEM	F. FUNCTION: Why does the social structure of the wolves on Ellesmere Island keep the population in balance with the food supply?	E. EVOLUTION: What is similar and different comparing behavior of dogs and their ancestors, the wolves?
family groups on Ellesmere Island		

REFLECTIONS: THE CONCEPT OF "SYSTEMS"

BONUS QUESTION A: **How have scientific models of wolf packs changed over the years as researchers discovered new information from captive packs, then wild packs?**

My answer:

BONUS QUESTION B: **What are your ideas of how "systems thinking" changed technology and society?**

My answer:

BONUS QUESTION C: **What are similarities and differences between the "wolf system" and the "solar system"?**

My answer:

SOURCES- BACKGROUND INFORMATION

KEYWORD		LINKS		RATINGS		SOURCES
Topic	**Short name**	**CD Rom**	**Website**	**Detail**	**Relevance**	**Name**
General Information	*descriptions; habitat; related species*					
Wolf Park Website for kids	**kid site**	link	website	**	*****	http://www.wolfparkkids.com
Wolf info for kids to teens	kid site		Website	**	*****	http://dmoz.org/Kids_and_Teens/School_Time/Science/Living_Things/Animals/Mammals/Wolves/
Email Wolf Park Kids	ask the expert		website	**	*****	wolfparkkids@aol.com
Canadian Center for Wolf Research	Canadian Wolf Center		Website	**	*****	http://www.wolfca.com/ Research is now concluded and this organization is no longer operating. Information still availa
Systems thinking	Mindwalk- video			*****	**	available at Hastings, College Station, or on loan from the Ethology Lab j-packard@tamu.edu
Viewing Information	*parks; web-cams; zoos/aquaria; CD Roms, tours*					
Download	Real Player One		website	******	*****	http://forms.real.com/netzip/getrde5_new_look.html?h=207.188.7.150&f=windows/RealOnePlayerGold.exe&p=RealOne
International Wolf Center	captive pack		website	******	*****	http://www.wolf.org/wolf/
Wolf Park	captive pack		website	****	**	http://www.wolfpark.org/
Wolf Haven International	sanctuary- captive		website	****	**	http://www.wolfhaven.org/
The Wolf Education & Research Center	captive pack		website	****	**	http://www.wolfcenter.org/
Yellowstone National Park	view wild wolves		website	****	**	http://www.yellowstone-natl-park.com/wolf.htm
Yellowstone Wolf Tracker	guided tours		website	****	**	http://www.wolftracker.com/
Following the Tundra Wolf	video	video clips		**	*******	Peace River Films, 15400 Sherman Way, Van Nuys, Calif. 91406
White Wolf	video	video clips		**	*******	National Geographic
Wolves at the Door	video	video clips		**	*******	Discovery
Wolf in your living room	video	video clips		**	*******	PBS
In Praise of Wolves	video	video clips		**	*******	KEG Productions ISBN 1-55971-237-6 1-800-336-5666
Behavior Information	*ethogram; feeding; mating; birthing; parenting; development*					
Introduction	Powerpoint presentation	link				
Dictionary of wolf behavior	ethogram	link		********	**	Table 2.2 from Packard, Jane (2003) Chapter 2 in: **WOLF BEHAVIOR: REPRODUCTIVE, SOCIAL, AND INTELLIGENT**, In: The Ecology, Behavior and Conservation of the Wolf. L. D. Mech and L. Boitani (eds.). The University of Chicago Press, Chicago, Ill.
Wolf Behavior Pictorial Guide	behavior list	handout		***	*****	Stewart, Tammy. 1998. "Wolf Behavior Pictorial Guide". Report available from the Ethology Lab, Wildlife & Fisheries S
World of Wolves	Tinbergen (1968)	handout		**	********	Niko Tinbergen, cited in: Rutter, Russell and Douglas Pimlott. 1968. The world of the wolf. J.B. Lippincott Co.: New York
Expression of Emotions (part 1)	Darwin1 (1872)	handout		***	*******	Darwin, Charles. 1872. The Expression of the Emotions in Man and Animals. The University of Chicago Press: Chicago.
Expression of Emotions (part 2)	Darwin2 (1872)	handout		***	*******	Darwin, Charles. 1872. The Expression of the Emotions in Man and Animals. The University of Chicago Press: Chicago.
Expression of Emotions (part 3)	Darwin3 (1872)	handout		***	***	Darwin, Charles. 1872. The Expression of the Emotions in Man and Animals. The University of Chicago Press: Chicago.
Man Meets Dog (part 1)	Lorenz1 (1953)	handout		**	*******	Lorenz, Konrad. 1953. Man meets dog. Penguin Books: New York. (pp 117-118)
Man Meets Dog (part 2)	Lorenz2 (1953)	handout		**	*******	Lorenz, Konrad. 1953. Man meets dog. Penguin Books: New York. (pp 117-118)
Man Meets Dog (part 3)	Lorenz3 (1953)	handout		**	*******	Lorenz, Konrad. 1953. Man meets dog. Penguin Books: New York. (pp 117-118)
Wolf Pack: Chapter 1	Johnson & Aamodt (1985)	book		*	********	Johnson, Sylvia and Alice Aamodt. 1985. Wolf Pack: Tracking wolves in the wild. Lerner Publications Co.; Minneapolis.
Wolf Pack: Chapter 2	A family group	book		***	******	Johnson, Sylvia and Alice Aamodt. 1985. Wolf Pack: Tracking wolves in the wild. Lerner Publications Co.; Minneapolis.
Wolf Pack: Chapter 3	Pups are born	book		***	*******	Johnson, Sylvia and Alice Aamodt. 1985. Wolf Pack: Tracking wolves in the wild. Lerner Publications Co.; Minneapolis.
Wolf Pack: Chapter 4	Keeping in touch	book		***	*******	Johnson, Sylvia and Alice Aamodt. 1985. Wolf Pack: Tracking wolves in the wild. Lerner Publications Co.; Minneapolis.
Wolf Pack: Chapter 6	Killing to survive	book		***	*******	Johnson, Sylvia and Alice Aamodt. 1985. Wolf Pack: Tracking wolves in the wild. Lerner Publications Co.; Minneapolis.
Wolf Pack: Chapter 8	Tracking wolves in the wild	book		***	*******	Johnson, Sylvia and Alice Aamodt. 1985. Wolf Pack: Tracking wolves in the wild. Lerner Publications Co.; Minneapolis.
Wolves of the High Arctic	IWC (1992)	book		****	*******	International Wolf Center (1992) Wolves of the high arctic. Voyageur Press: Stillwater, Minn. 126 pp.)
The Arctic Wolf	Mech (1988)	book		****	*******	Mech, L. David. 1988. The Arctic Wolf: Living with the pack. Voyageur Press: Stillwater, Minn 128 pp.
Wolves	Savage (1989)	book		****	*******	Savage, Candace. 1989. Wolves. Sierra Club Press: San Francisco. 159 pp.
A Society of Wolves	McIntyre (1993)	book		****	*******	McIntyre, Rick. 1993. A Society of Wolves: National Parks and the Battle over the Wolf. Voyageur Press: Stillwater, M
The Way of the Wolf	Mech (1991)	book		****	*******	Mech, L. David. 1988. The Way of the Wolf. Voyageur Press: Stillwater, Minn 120 pp.
Wolf behavior: social, reproductive and intelligent	Packard (2003)	handout		******	*****	Packard, Jane (2003) Chapter 2 in: **WOLF BEHAVIOR: REPRODUCTIVE, SOCIAL, AND INTELLIGENT**, In: The Ecology, Behavior and Conservation of the Wolf. L. D. Mech and L. Boitani (eds.). The University of Chicago Press, Chicago, Ill.
Environmental information	*prey species; weather; predators*					
Timber Wolf Information	TWIN		website			http://www.timberwolfinformation.org/
Gray Wolf Information			website			USFWS Gray wolf homepage
Geographic information	*species range; populations*					
Other canine species			website			http://dmoz.org/Science/Biology/Flora_and_Fauna/Animalia/Chordata/Mammalia/Carnivora/Canines/

Historical information	*change in numbers*					
Wolf recovery efforts			website			http://www.forwolves.org/
Conservation information	*threats; protection; laws; agencies and organizations*					
Wild Canid Research & Survival Center			website			http://www.wolfsanctuary.org/
Restoring predators to the Rockies			website			http://www.sinapu.org/
Gray wolf recovery			website			USFWS Midwestern region
Mexican Gray Wolf Recovery			website			USFWS Recovery Site
Return of the Wolves	video					KUED-TV University of Utah Press 800-444-8638 X6771
Research Information	*how and why we do behavior studies; ongoing studies; published studies*					
How to study behavior	Behavior basics	CD-Rom	website	**	*****	http://canis.tamu.edu/wfscCourses/Supplements/Behavior Basics.ppt
observation skills	Lehner (1996)	book		*****	**	Lehner, P.H. 1996. Handbook of Ethology
observation skills	Martin & Bateson (1993)	book		*****	**	Martin, P. & Bateson, P. 1993. Measuring Behavior. Cambridge University Press: Cambridge
shareware for counting	EthoLog		website	*****	*	http://www.geocities.com/CapeCanaveral/Lab/2727/ethohome.html
shareware for counting	Jwatcher		website	*****	*	http://galliform.psy.mq.edu.au/jwatcher/
Career Information	*summer learning programs; internships; veterinarians; animal-care; biomedical*					
Zoo/Aquaria jobs	AZA job board		website	**	***	http://www.aza.org/JobListings
Wildlife jobs	WFSC job board		website	**	***	http://wfscnet.tamu.edu/wfscnet/Jobs/Jobs.htm

APPENDIX B. CORRELATION WITH TEXAS ESSENTIAL KNOWLEDGE AND SKILLS

Worksheet #	TEKS #	What knowledge will be tested? & What skills will be tested?	How does this workbook apply?
All	(3)	"Students…identify life processes and the relation between structure and function of organisms."	This workbook focuses on the structure and function of social behavior. It is a life process related to how organisms gain nutrients and reproduce genotypes.
All	(4)	"Science is a way of learning about the natural world. Students should know how science has built a vast body of changing and increasing knowledge described by physical, mathematical and conceptual models, and also should know that science may not answer all questions."	This workbook focuses on animal groups as one example of the natural world. Each time the student completes a cycle of worksheets using 4 steps of the scientific method, additional information is provided from the published literature. This demonstrates how the body of knowledge has increased over time, because the articles are both chronological and reflective of technological advances. The three resulting mental models are presented, and students are invited to identify questions that are not answered by these scientific studies.
All	(5)	"A system is a collection of cycles, structures, and processes that interact. Students should understand a whole in terms of its components and how these components relate to each other and to the whole. All systems have basic properties that can be described in terms of space, time, energy and matter. Change and constancy occur in systems and can be observed and measured as patterns. These patterns help to predict what will happen next and can change over time."	A group of animals, in this case dogs or wolves, is viewed as a system. The components of this system are the individual animals. How they relate to each other is measured in terms of their interactions. Different qualities of each individual (component) are described in terms of gender (male, female, unknown), age (pups, junior, senior) and breeding condition (immature, non-breeder, breeder). The system is described in terms of space and time in worksheets A5-A8, and in terms of access to energy and matter in worksheets A9-A12. Constancy of pattern is investigated for individuals (CAUSE) and populations (FUNCTION). Changing processes are investigated for individuals (DEVELOPMENT) and populations (EVOLUTION).
	(6)	"Investigations are used to learn about the natural world. Students should understand that certain types of questions can be answered by investigations, and that methods, models and conclusions built from these investigations change as new observations are made. Models of objects and events are tools for understanding the natural world and can show how systems work. They have limitations and based on new discoveries are constantly being modified to more closely reflect the natural world."	Students are invited to investigate their own thoughts and experiences related to groups of dogs and wolves in the natural world, as well as learning about how scientists have investigated canid behavior in captive and field studies. Three models are compared: "LADDER", "BRANCHED", and "CIRCLE". Exercises are designed so students identify the limitations of each model and how the discovery of additional information led to modification of earlier models of wolf packs.
O1, O2, O3	(6.2)(B)	"collect data by observing.."	green worksheets (A1, A5, A9)
O1, O2, O3	(6.2)(C)	"analyze and interpret information ... from direct ... evidence	green worksheets: direct evidence is from observations

O1, O2, O3	(6.2)(E)		"construct graphs, tables, maps and charts using tools including computers to organize, examine and evaluate data"	green sheets- tables; blue sheets- charts; yellow sheets- graphs; computer tools
Q1, Q2, Q3	(6.2)(A)		"plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting and using equipment and technology"	Blue worksheets: A2, A6, A10
Q1, Q2, Q3	(6.3)(C)		"represent the natural world using models and identify their limitations"	blue worksheets: The models are presented in charts; orange worksheets: the limitations are identified .
Q1, Q2, Q3	(6.10)(A)	"differentiate between structure and function"		blue worksheets: Cause questions address social structure and Function questions address social function
M1, M2, M3	(6.2)(B)		"collect data by ...measuring"	yellow worksheets (A3, A7, A11)
M1, M2, M3	(6.2)(C)		"analyze and interpret information ... from direct ... evidence	yellow worksheets; direct evidence is from measurements
M1, M2, M3	(6.4)(A)		"collect, analyze, and record information using tools including timing devices….calculators, field equipment..computers"	yellow worksheets: Students are encouraged to collect their own data on canid groups, using a video or still camera. They may use a stopwatch or triathlon watch to record the duration of video clips or the number of snapshots within a period of time. They are asked to choose whether a video or snapshot photo is more appropriate to collect the data they would need to test hypotheses.
M1, M2, M3	(6.4)(B)		"identify patterns in collected "information, including percent, average, range and frequency"	yellow worksheets (A3, A7, A11)
A1, A2, A3	(6.2)(C)		"analyze and interpret information to construct reasonable explanations from... indirect evidence	orange worksheets (A4, A8, A12); indirect evidence is from readings
A1, A2, A3	(6.2)(D)		"communicate valid conclusions"	orange worksheets (A4, A8, A12)
A1, A2, A3	(6.3)(A)		"analyze, review and critique scientific explanations, including hypotheses and theories as to their strengths and weaknesses using scientific evidence and information"	orange worksheets (A4, A8, A12)
A1, A2, A3	(6.3)(D)		"evaluate the impact of research on scientific thought, society and the environment"	orange worksheets: As an optional extension, students are invited to explore what was happening in world and national history at the time their readings were published, and to interview elders about potential impacts of history and technology on scientific thought.

A1, A2, A3	(6.3)(E)		"connect Grade 6 science concepts with the history of science and contributions of science"	orange worksheets: As an optional extension, students are invited to search for when the word "social system" was first applied to humans and then to other animal groups. A supplemental video on social impacts of "systems thinking" is recommended, which could be obtained in local libraries or stores.
A1, A2, A3	(6.5)(A)	"identify and describe a system that results from the combination of two or more systems…"		orange worksheets: Cause questions are answered in terms of which physiological systems (respiratory, muscular, hormone, sensory) are underlying certain behaviors; the organism is made up of physiological systems; the social system is made up individuals in groups, groups in populations, and populations within species.
A1, A2, A3	(6.5)(B)	"describe how the properties of a system are different from the properties of its parts"		orange worksheets: How is the behavior of canid groups made up of each individual's behavior?
A1, A2, A3	(6.8)(C)	"describe energy flow in living systems including food chains and food webs"		orange worksheets: Function questions are phrased in terms of energy expended and energy gained as a result of individuals joining or leaving groups.
A1, A2, A3	(6.10)(C)	"identify how structure complements function at different levels of organization including organs, organ systems, organisms and populations"		orange worksheets: the first cycle (A1-A4) addresses the level of organ systems within individual organisms, the second cycle (A5-A8) addresses individuals within groups, and the third cycle (A9-A12) addresses groups within populations
A1, A2, A3	(6.11)(A)	"identify some changes in traits that can occur over several generations through natural occurrence and selective breeding"		orange worksheets: answers to Evolution questions
A1, A2, A3	(6.11)(B)	"interpret the role of genes in inheritance"		orange worksheets: answers to Development questions
A1, A2, A3	(6.12)(A)	"identify responses in organisms to…hunger"		orange worksheets: answers to Cause questions

APPENDIX C. DEVELOPMENT OF THE WOLF WORKBOOK

The wolf workbook was first developed in the fall of 2002. Originally the workbook was a result of the collaboration of Dr. Packard and Nedaro Bellamy,. Dr. Packard wanted to be able to use the technology in her ethology course for students in the wildlife and fisheries department. Her scientific work has been on the behavior of wolves. She is an ethologist and has spent decades studying wolves not only through video and literature but in the field as well. Through this workbook she wanted to provide an interface for public understanding about science. It is an outreach effort for the ethology lab as a result of her work with the Texas Agricultural Experiment Station. Since her background is in wolves the subject matter is only appropriate. There seemed to be sufficient appeal and resources available through the web for teachers to get background information. In addition there was the availability of a "wolf trunk" for checkout through the International Wolf Center. This trunk contains touchable artifacts such as pelts and skulls as well as books and videos on wolves. There is an emotive value to being able to get hands on with the wolves. With the motivation for students in place, the addition of dogs to the workbook allows kids to relate it to their own experience. The final product of dog families, captive wolf packs, and wild wolf families can appeal to the diverse experiences in a classroom of students.

Through these two programs of professional development and college pre-teacher programs, the workbook was piloted. Feedback has been taken from both programs and been used to update and adapt the workbook annually. The design of the workbook was such so that educators could take it and modify the materials to fit their needs. Each teacher can change the workbook to fit any lesson or style needed for their curriculum. Further development plans will be discussed later in this paper.

The structure of the wolf workbook follows the structure of the scientific process. That is to say that the wolf workbook is set up to teach and follow the scientific method as it relates to biological systems. The wolf workbook is literally science in action. It applies science through hands on activities which excite and stimulate the student's attention. It enables us to watch animal behavior in a natural setting right in the classroom which was not available only a few short years ago. For most students the experience of

watching wolves and studying their behavior firsthand is something they will probably never again be exposed to. That alone stimulates motivation to learn.

The wolf workbook is an intricately designed excel spreadsheet. The reason it is called a workbook is because excel defines a workbook as an excel document having more than one sheet. Each workbook has a sequence of pages taking the student through a series of activities and each page has links to videos, boxes to enter data, sources for background information, frequently asked questions, TEKS assessment, and options to expand the activities. It is designed to strengthen analytical and independent learning styles. See Appendix E for a detailed teachers manual with instruction on navigating through the wolf workbook.

Let's take a look at how the scientific process works in the wolf workbook. The steps as taught here are observation, creating mental models, asking questions, designing experiments, measurements, testing hypothesis, answering questions, and revising mental models. The first step, making observations, is important to distinquish between facts and inference. Our expectations can color what we observe and so watching carefully can can help us decide from the evidence what questions to ask. While making observations through watching the video clips the student has an opportunity to take notes on what happened in the clip. After writing down their observations they are allowed to review what is observation (direct evidence) and what is inference (indirect evidence). This is an important distinction for students to learn about science. An observation is what the student actually saw, heard, smelled, or otherwise sensed about the animal and it's environment. For example when watching a wild wolf family dynamics in a video an observation would be; "junior wolves tucked their tails between their legs". An inference is what the student thinks about what they observed. An example from the same observation as above would be "I think the juniors were offspring of the senior".

In the role of scientists, we ask questions based on our observations of the world around us. In doing this we are creating in our minds a model of how things work in this world . Questions about structure and function are basic in the scientific study of biological systems. The distinction is important because a different type of evidence needs to be collected to answer structure questions in contrast to function questions.

After asking questions we design experiments to measure how things differ related to different treatments (controlled experiments) or different conditions in the world around us (natural experiments). Part of the experiment is to take measurements. Behavior can be measured just like weight or volume. To find answers about social structure we measure social distance of individuals within the group. To find answers about function we need to look at the consequences of behavior and so would measure the wolves from resources such as food or mates.

After taking measurements we then make sense of them by stating a hypothesis in terms of cause and effect, and then look for evidence that shows the mental model does or does not match reality. The evidence comes from our earlier observations and from previous experiments done by other scientists. The evidence will be analyzed to determine if the hypothesis is to be accepted or rejected. Keeping alternative hypothesis in mind will help us in the future as we develop new questions.

After testing we then have the answers to our questions. In the role of scientists we want to practice critical thinking instead of letting our own mental models filter what we observe. To do this we reject a hypothesis that has been disproved and come up with a new way of thinking about the system we are studying. Reading other sources along with the previous answers will help to open our minds to new questions to consider and a new set of observations. Each time this is done cause and effect will be seen a little bit differently. This is how the cycle continues. You are now back at making observations and from there move again to creating mental models, asking questions, designing experiments, taking measurements, testing hypothesis, answering questions, and revising the mental model.

APPENDIX D. A PERSONAL PERSPECTIVE ON WOLF BEHAVIOR

Of all animals, wolves are very near in nature to humans and most animal researchers agree that wolves have complex feelings as we do. It is through our feelings that we relate to and experience the feelings of wolves, and most certainly, it is through their feelings that wolves experience us (Dutcher, 1996). Like humans, wolves evolved as cooperative family groups. This is one reason that wolves were chosen as the subject matter for the workbook. "Why wolves?" is a question that I get asked every time I talk about them or the workbook itself. Dr. Packard's experience and background is in working with wolves and their behavior. For me, I am fascinated by them and their family structure. This question is valuable because education professionals agree that it is important to touch on the emotions of students and to make the lessons applicable to their everyday lives. That being the case, any species such as spiders could convey the same educational message. Students encounter spider's everyday whereas they may never see an actual wolf. On the other hand it is the emotions, symbolism, and teaching stories which are so different for wolves. Dr. Packard's and my experience has been that student's eyes light up when you talk about wolves. Most of my students have been fascinated by their history, their struggle for survival, and the closely associated behavior patterns. It also brings into the picture the connection with the dog, a descendant of the wolf, which does exist in the everyday lives of the student. I must admit that my house is completely decorated with wolf art prints, statues, and photographs of wolves. Dr. Packard has seen the same response in some of her students who admit to being "wolf nuts", collecting posters and any other object related to wolves. What excites the teacher and how they can make a connection between the subject matter and the scientific inquiry is what the workbook is based on. It has been my experience so far that the teachers who have participated in the professional development of the workbook have been very excited about the use of the wolf as it's subject.

The wolf is an integral part of the North American landscape and once ranged from coast to coast and from Alaska to Mexico. Fear however led to government – sponsored wolf control programs which brought the wolf population to near extinction in the lower 48 states by the early 20th century.

We came to care about wolves once we started to realize just how much they impact the earth and our lives. Extinction is a natural process but there is nothing natural about the current rate of extinction in the world due to human impacts. The biosphere is a complex and delicately balanced environment in which all living things belong. The removal of some species will begin a chain reaction of extinction and destruction. Such species are called keystone species and the gray wolf was determined to be a keystone species in Yellowstone National Park. Elk leftovers from wolf kills provided food for ravens, eagles and bears also. Wolves also scare elk away from streams where they can tear down a large number of trees. Without the presence of a healthy population of wolves, the elk population exploded, tearing up trees along streams. This loss of trees along streams causes the water temperature to increase with the increased sunlight. Very sensitive to temperatures, the trout which thrive in the streams will decline in numbers. Once the wolf population was restored the elk population was again controlled, the trees along the streambanks were restored, streams were cooled, trout populations thrived, etc. According to National Geographic the reintroduction of wolves into Yellowstone National Park affects more than 25 other species in the park. This is just one example of what can happen when a keystone species such as the wolf is returned to it's natural habitat. Healthy populations now live in Cananda, Montana and Alaska.

There are two species of wolves in North America including the gray wolf (*Canis lupus*) and red wolf (*C. rufus*).

Figure 2 – Red wolf Figure 3 – Gray Wolves in pack
(photo credit to the U.S. Fish and Wildlife Service)

There are also five subspecies of gray wolves including the arctic wolf (*C. l. arctos*), Mexican wolf (*C. l. baileyi*), eastern timber wolf (*C. l. lycaon*), great plains wolf (*C. l.*

nubilus), and rocky mountain wolf (*C. l. occidentalis*). The classification of subspecies is difficult to determine and is based on many factors including geographic range, skull, size, fur color and length of appendages. This estimate of five subspecies was recently changed from 32 due to similarities found within each group. The red wolf is found only in North America and localized around North Carolina. Recovery efforts for the red wolf exist mainly at Alligator River National Wildlife Refuge in Manteo, North Carolina. Recovery efforts for the gray wolf are currently established by the USFWS (United States Fish and Wildlife Service) in several areas throughout the Northwest, Arizona, and New Mexico.

The wolf workbook uses wolf behavior specifically to explore the scientific process. Since an ethogram is used as reference in the study of the workbook I think it is important to review some of the typical behaviors here. For the purposes of this paper I have focused specifically on the gray wolf. Wolf groups, or packs, typically include a breeding pair (the alpha pair), their offspring, and other non-breeding adults. They are carnivores with males weighing 65 to 85 pounds and females weigh 55-70 pounds. The pack is territorial meaning the family of wolves will defend an area. These territories range in size from 50 square miles to more than 1,000 square miles depending on the availability of prey. Packs are usually started by a breeding pair including an unrelated male and female and they are usually monogamous. The chances of a new pair starting a family depends on the numbers of wolves in the area. Those groups without a breeding pair usually only last for a few months. Packs are also usually family groups, though this can have many meanings. A family can be nuclear, extended, disrupted, step, foster, or complex. (Packard) Earlier I stated that wolves evolved as cooperative family groups just like humans so it should not be surprising that the terms for families are also very similar to our own. Their function is also directly related to what we know from our own idea of a family. Disrupted families, meaning that one or both of the original parents are missing, are the most prevalent of captive packs. These packs are hostile to strangers from neighboring packs. Few territorial encounters have actually been witnessed but most can lead to injury or death. These conflicts are usually related to competition for food and mates. The study from which the information on wolves has come is developed from both

wild and captive packs. It is important that we understand the limitations of each perspective and to understand the whole as the sum of the parts (Packard).

Packs not only stay together in a territory but they also share in taking care of the pack as a whole. One way in which this is seen is through pup care by family members. They begin by helping to find and dig a den for the breeding female. These are usually located near water and can change depending on several factors including movement of prey and what is available for den choice. Non-reproductive pack members will provide indirect pup care including defense, by providing food to lactating females and food delivery to pups.

Intelligence is important in determining the source of the behavior. Intelligence is demonstrated when a canid anticipates the behavior of a social companion or solves a novel problem in obtaining food. The wolf's genotype enables it to solve problems encountered by its ancestors and new experiences allow the wolf to apply it to new problem solving skills. Throughout the study of wolf behavior it is easy to compare the traits with those of human families. We often learn by association and so when we view a family of wolves we sometimes will jump to conclusions about why a behavior is exhibited. Also we place our emotions or feelings onto wolves with words such as want and love. This is called folk psychology and will be a large part of our study in the workbook. It is important to distinguish between the actual scientific reasons and the emotional or folk psychology reasons for behavior. Both are legitimate.

One of the things that fascinate me is the connection between the social environment of wolves and their physical environment. This is the connection between how a wolf will interact among other wolves and the landscape within which the wolf lives. There is a strong relationship between the two. Stress from the physical environment could certainly lead to strained relationships within the pack. Also when there is plenty of prey and the physical world is in harmony with the pack the pack would experience more of the "good times". The video clips within the workbook can be used to stimulate discussion about these relational issues and how they compare to human behavior. Section Q1 in the workbook for example compares how people get along in groups such as family, church, teams, clubs, and class with how the wild dogs get along in their groups. Since it is important for the students to be able to relate to information in

order to retain it, it is beneficial to relate the behavior the students are viewing to their own experiences.

There are several locations and organizations such as Yellowstone Park which hold regular training on tracking and behavior to further education efforts. You can go to several places to simply watch wolves as well. National Parks with wolves include Yellowstone, Denali, and Isle Royale. Wolf centers devoted to wolf recovery include the International Wolf Center in Minnesota and Wolf Park in Indiana. Zoos also will sometimes have wolves available to watch. Whether in captivity or in the wild they are incredible to watch and we are reminded of our responsibility for the world around us.

Wolves have been studied extensively in recent years by many researchers. One thing is certain and it is that we have only begun to realize the mysteries of the wolf. As humans continue to move out into the wilderness previously occupied by these predator species it remains to be seen if we will be able to live in harmony with them.

APPENDIX E. TEACHERS MANUAL

In learning to navigate through the wolf workbook, follow figures 1 through 5 below which shows a sample of the pages for reference. The front sheet is the map of the workbook and is arranged around the central scientific process. You can move between sheets by clicking on a tab at the bottom of the document and each individual spreadsheet can be printed for hard copy use. The process follows four steps including observations, asking questions, measurements, and answering questions. Each step is assigned a color and depending on learning goals you can either work within one color at a time or one number at a time. For example if you want to work specifically on observations then you can do all of the green worksheets. The inquiry worksheets (asking questions) are all blue and focus on asking questions about structure and function from a scientific perspective as well as differentiating between folk psychology and science. Measurement pages are in yellow and these pages find the answers to questions about structure and function. These answers found are then applied on the orange pages of the answering questions section. On the other hand if you want to experience the entire inquiry cycle you can do O1 (Observation worksheet #1), Q1 (Question worksheet #1), M1 (Measurement worksheet #1), and A1 (Answer worksheet #1).

There are three numbered cycles within this workbook which are graded from simple to a more complex level. The first cycle (worksheets O1, Q1, M1, A1) focuses on dog packs and will be most relevant to elementary students or as an introduction. The second cycle (worksheets O2, Q2, M2, A2) focuses on captive wolf packs and is geared toward middle school students or as an intermediate level experience. Lastly, the third cycle (worksheets O3, Q3, M3, A3) is wolf families, or wild wolf packs. This cycle will be most appropriate for high school students or as a more advanced study of wolves and the scientific process.

Once on a study page there is a space for your name, the date and duration at the top. The duration time is a useful tool for teachers to not only check on the progress of their students but also to use as a planning guide to allow proper time for competition. Next you will see a series of steps to guide the students through each page. Having each step defined really builds the confidence of the students at every level. Since this is a method of teaching the scientific process, the students can be overwhelmed until they

learn to navigate their way around. The steps include various activities such as watching video clips, group discussion of experiences, connecting to outside links for additional reading and developing hypothesis among others. Page A1 guides the writing process with directions for how to express observations, inferences and questions along with definitions and examples of each. Each subsequent page is also just as user-friendly with examples in each text box. A history of wolf conservation and an introduction to wolf behavior is included as Appendix B as a resource for teachers. This section can be used to further educate those using the workbook in the behaviors that they will see in the video clips and assist them in leading relevant discussions in the classroom.

Figure 1 – Workbook Map

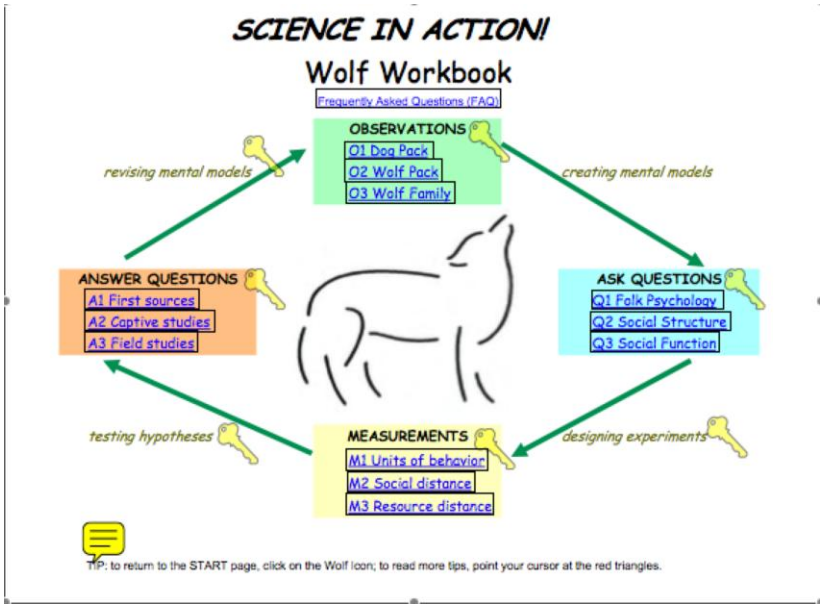
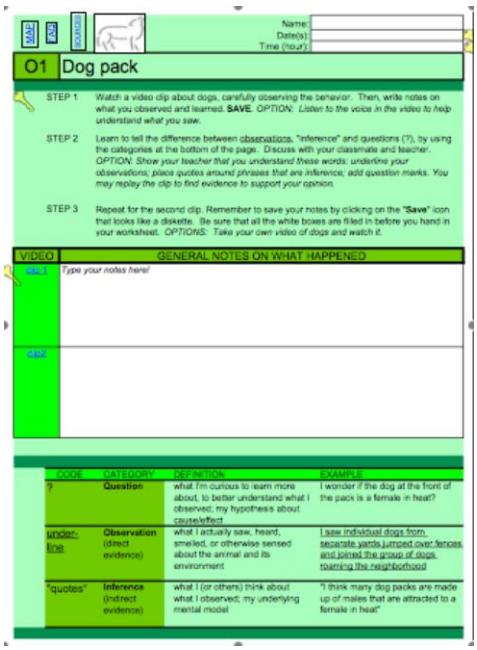


Figure 2 – Workbook page O1



MAP FAQ SOURCES

Name:
Date(s):
Time (hours):

O1 Dog pack

STEP 1 Watch a video clip about dogs, carefully observing the behavior. Then, write notes on what you observed and learned. **SAVE**. *OPTION: Listen to the voice in the video to help understand what you saw.*

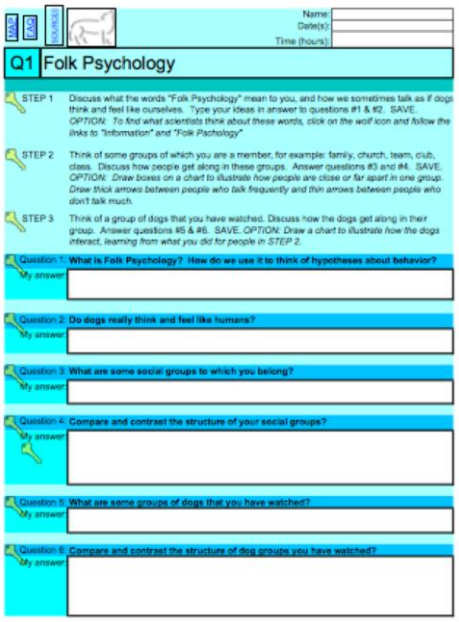
STEP 2 Learn to tell the difference between observations, "inference" and questions (?), by using the categories at the bottom of the page. Discuss with your classmate and teacher. *OPTION: Show your teacher that you understand these words: underline your observations; place quotes around phrases that are inferences; add question marks. You may replay the clip to find evidence to support your opinion.*

STEP 3 Repeat for the second clip. Remember to save your notes by clicking on the "**Save**" icon that looks like a diskette. Be sure that all the white boxes are filled in before you hand in your worksheet. *OPTIONS: Take your own video of dogs and watch it.*

VIDEO	GENERAL NOTES ON WHAT HAPPENED
clip 1	*Type your notes here!*
clip2	

CODE	CATEGORY	DEFINITION	EXAMPLE
?	**Question**	what I'm curious to learn more about, to better understand what I observed; my hypothesis about cause/effect	I wonder if the dog at the front of the pack is a female in heat?
under-line	**Observation** (direct evidence)	what I actually saw, heard, smelled, or otherwise sensed about the animal and its environment	I saw individual dogs from separate yards jumped over fences and joined the group of dogs roaming the neighborhood
"quotes"	**Inference** (indirect evidence)	what I (or others) think about what I observed; my underlying mental model	"I think many dog packs are made up of males that are attracted to a female in heat"

Figure 3 – Workbook page Q1



MAP FAQ SOURCES

Name:
Date(s):
Time (hours):

Q1 Folk Psychology

STEP 1 Discuss what the words "Folk Psychology" mean to you, and how we sometimes talk as if dogs think and feel like ourselves. Type your ideas in answer to questions #1 & #2. SAVE. *OPTION: To find what scientists think about these words, click on the wolf icon and follow the links to "Information" and "Folk Psychology".*

STEP 2 Think of some groups of which you are a member, for example: family, church, team, club, class. Discuss how people get along in these groups. Answer questions #3 and #4. SAVE. *OPTION: Draw boxes on a chart to illustrate how people are close or far apart in one group. Draw thick arrows between people who talk frequently and thin arrows between people who don't talk much.*

STEP 3 Think of a group of dogs that you have watched. Discuss how the dogs get along in their group. Answer questions #5 & #6. SAVE. *OPTION: Draw a chart to illustrate how the dogs interact, learning from what you did for people in STEP 2.*

Question 1: **What is Folk Psychology? How do we use it to think of hypotheses about behavior?**
My answer:

Question 2: **Do dogs really think and feel like humans?**
My answer:

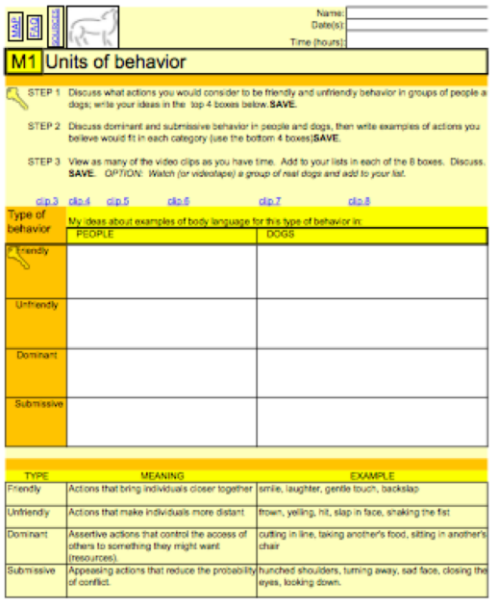
Question 3: **What are some social groups to which you belong?**
My answer:

Question 4: **Compare and contrast the structure of your social groups?**
My answer:

Question 5: **What are some groups of dogs that you have watched?**
My answer:

Question 6: **Compare and contrast the structure of dog groups you have watched?**
My answer:

Figure 4 – Workbook page M1



MAP FAQ SOURCES

Name:
Date(s):
Time (hours):

M1 Units of behavior

STEP 1 Discuss what actions you would consider to be friendly and unfriendly behavior in groups of people a dogs; write your ideas in the top 4 boxes below. **SAVE**.

STEP 2 Discuss dominant and submissive behavior in people and dogs, then write examples of actions you believe would fit in each category (use the bottom 4 boxes)**SAVE**.

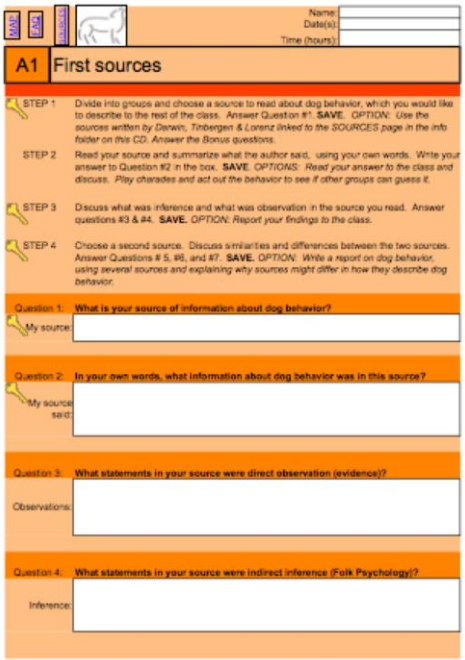
STEP 3 View as many of the video clips as you have time. Add to your lists in each of the 8 boxes. Discuss. **SAVE**. *OPTION: Watch (or videotape) a group of real dogs and add to your list.*

clip 3 clip 4 clip 5 clip 6 clip 7 clip 8

Type of behavior	My ideas about examples of body language for this type of behavior in: PEOPLE	DOGS
Friendly		
Unfriendly		
Dominant		
Submissive		

TYPE	MEANING	EXAMPLE
Friendly	Actions that bring individuals closer together	smile, laughter, gentle touch, backslap
Unfriendly	Actions that make individuals more distant	frown, yelling, hit, slap in face, shaking the fist
Dominant	Assertive actions that control the access of others to something they might want (resources).	cutting in line, taking another's food, sitting in another's chair
Submissive	Appeasing actions that reduce the probability of conflict.	hunched shoulders, turning away, sad face, closing the eyes, looking down.

Figure 5 – Workbook page A1



MAP FAQ SOURCES

Name:
Date(s):
Time (hours):

A1 First sources

STEP 1 Divide into groups and choose a source to read about dog behavior, which you would like to describe to the rest of the class. Answer Question #1. **SAVE**. *OPTION: Use the sources written by Darwin, Tinbergen & Lorenz linked to the SOURCES page in the info folder on this CD. Answer the Bonus questions.*

STEP 2 Read your source and summarize what the author said, using your own words. Write your answer to Question #2 in the box. **SAVE**. *OPTIONS: Read your answer to the class and discuss. Play charades and act out the behavior to see if other groups can guess it.*

STEP 3 Discuss what was inference and what was observation in the source you read. Answer questions #3 & #4. **SAVE**. *OPTION: Report your findings to the class.*

STEP 4 Choose a second source. Discuss similarities and differences between the two sources. Answer Questions # 5, #6, and #7. **SAVE**. *OPTION: Write a report on dog behavior, using several sources and explaining why sources might differ in how they describe dog behavior.*

Question 1: **What is your source of information about dog behavior?**
My source:

Question 2: **In your own words, what information about dog behavior was in this source?**
My source said:

Question 3: **What statements in your source were direct observation (evidence)?**
Observations:

Question 4: **What statements in your source were indirect inference (Folk Psychology)?**
Inference:

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