Education Fourth Grade Students in Michigan about Gray Wolves (Canis Lupus) Using a Teaching Trunk

Jessica Marie Wesel
EDUCATING FOURTH GRADE STUDENTS IN MICHIGAN ABOUT GRAY WOLVES (CANIS LUPUS) USING A TEACHING TRUNK

by

Jessica Marie Wesel

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The Michigan Gray Wolf Recovery and Management Plan was signed on December 1997, and made residents aware that the population of gray wolves in Michigan would be on the rise. Because the number of wolf-human interactions eventually will increase, it is essential that people are educated about wolves to avoid the stereotyping and misconceptions that often are associated with wolves. A good place to start with this type of education is with children in elementary school.

A teaching trunk was used in two schools, one in Michigan’s Lower Peninsula, and one in Michigan’s Upper Peninsula. Three classrooms from each school were used. The teaching trunk was presented in different ways. Students were given a pre-survey and two post-surveys. Study results determined which portions of the trunk were effective, if the components (the game and the curriculum) were effective as stand alone pieces, and if students retained any of the information presented. This trunk will be given to the Michigan Department of Natural Resources so it can be loaned to teachers across the state.
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CHAPTER I
INTRODUCTION

Gray wolves once roamed throughout the State of Michigan, but over time their numbers dropped and they began to disappear from different parts of the state. Several factors were responsible for the elimination of wolves from Michigan throughout the twentieth century. A Michigan Department of Natural Resources (MDNR) report notes that some of the factors leading to the elimination of wolves were based on the European beliefs that wolves were of the devil, that people could not cohabitate with wolves, and because of the various predator control programs that were established throughout the twentieth century (MDNR, 2006). Wolves were not protected in Michigan until they were given full protection within the state in 1965 notably before wolves were federally listed for protection in 1973 under the Endangered Species Act (MDNR, 2006).

Background

The first whelping of pups in Michigan occurred in 1991, sure evidence that wolves had returned to the state. In 1992, the Michigan Department of Natural Resources (MDNR) confirmed that Michigan had a viable wolf population once again. Since then, the wolf population has grown from approximately 20 animals in 1992, to approximately 360 wolves in 2004 (MDNR, 2006). Because Michigan wolf numbers continued to increase, the MDNR was charged with developing a plan for
management of these amazing animals. The Michigan Gray Wolf Recovery and Management Plan was accepted December 15, 1997 (MDNR, 1997). The main purpose of this plan was to allow the wolves that entered, and remained in Michigan to increase their population, and recover to some portion of what it was before the prior wolf population had been eradicated some time in the 1960s (IWC, 2006). This plan was created to help involve both state agencies and Michigan residents in a cooperative effort to restore and manage wolves in Michigan (MDNR, 1997). One important part of this plan is the education of Michigan residents about wolves and to inform residents about how people can live peacefully with them.

As wolf numbers continue to increase and areas with viable wolf populations expand, it is important to be sure that wolf education information is being effectively presented throughout the state to ensure that the former negative opinions and beliefs about wolves do not once again become the dominant beliefs among Michigan residents. Without continuing effort and on-going wolf education programs, the wolf recovery success that Michigan has experienced will have been for naught. Without wolf education, it is likely that conflicts related to human and wolf cohabitation, and negative perceptions of wolves will increase, and could possibly lead to similar outcomes that occurred to eliminate the wolves in the last century. Section 6.12 of the wolf management plan outlines materials that can be used for specific education needs and states that several different educational materials will be purchased for statewide usage. The materials that are to be purchased are for use by several
different groups, including statewide agencies, schools, environmental groups, community groups, and individuals (MDNR, 1997).

Unfortunately this part of the management plan has not been realized. Wolf education programs have yet to be developed and implemented within Michigan. Although there are programs and materials that have been used during the course of the implementation of the Management Plan, there is not actually a curriculum available that focuses specifically on wolves in Michigan [Hammill, Jim (2005) personal communication (Sept 22, 2005), Hammill, 2005].

This lack of action on the part of the MDNR opens the door for academic input from a variety of sources as to what this new curriculum should look like and how it should be developed. Therefore, the focus of this thesis is to develop and test a new wolf education curriculum and its effectiveness in fourth grade classrooms. Fourth grade classrooms were selected for this research study because in the state of Michigan, this is the grade in which the study of Michigan is incorporated into the curriculum allowing for easier implementation into curricula teachers may be using. Specifically, this research determines how responses to these educational materials given to the students in an Upper Peninsula school differ from the students in a Lower Peninsula school. Responses might be different for the Upper Peninsula classes and the Lower Peninsula classes because the students from the two areas have very different exposure to wolves. Students in the Upper Peninsula live with wolves in their environment each day, while the students in Kalamazoo probably come close to wolves at the zoo. Three classrooms from each school were given a pre survey,
different sections of the curriculum, and a post survey and a delayed post survey were administered to determine the effectiveness of the materials at both schools. The hypothesis driving this research was that students who received the full curriculum would have a greater percentage of correct answers to the knowledge based questions, and will have more pro wolf perceptions on the post and delayed post surveys than students who received only a section of the curriculum, such as the game. After the analysis of the data, this research also suggests ways to improve the curriculum and some possible next steps that can be taken by the Michigan Department of Natural Resources.

*Organization of Study*

This study is organized as follows. Chapter II summarizes the literature and examines the different wolf education methods that are used in other states as well as the wolf education programs that are available within Michigan. There is also a discussion about the need and importance for a new wolf education curriculum in Michigan. Chapter III discusses the study sites and methodology used in this study. Chapter IV explains and explores the research findings, offers discussion about what topics are effective within the curriculum, and suggests recommended changes to the curriculum. The conclusion, Chapter V, recommends changes to the curriculum used in this research as well as providing further recommendations for the Michigan Department of Natural Resources and future research.
CHAPTER II
LITERATURE REVIEW

Wolves have a long history in Michigan. The Michigan Department of Natural Resources (MDNR) believes that at some point wolves could be found in each county in Michigan. However, by 1840 they were no longer found in the southern part of the Lower Peninsula, and by 1910 there were no wolves located anywhere in Michigan’s Lower Peninsula (MDNR, 2006). Wolves were eliminated from the state for a variety of reasons, some of which was the belief that wolves and humans were incompatible in regards to civilization, a negative view of wolves brought by European settlers and rooted in fairy tales, and stories. In addition there were predator control programs that remained in effect in Michigan until 1960 (MDNR, 2006). One of the predator control programs often promoted by farmers was the wolf bounty, a program that began in Michigan in 1838. There was a period when the wolf bounty was stopped temporarily as a State Trapping System was established in Michigan in 1922. However, the bounty was reinstated in 1935 (Archives of Michigan, 2006; International Wolf Center, 2006).

Wolf numbers continued to dwindle in the Upper Peninsula and the state bounty on wolves was repealed in 1960 in an attempt to preserve the population. It was thought that there was only one wolf left in the entire state in 1959 (International Wolf Center, 2006). Wolves were finally placed under State protection in 1965 as the population was estimated at zero. Wolves were not protected under Federal
legislation until the Gray wolf was placed on the endangered list as part of the Endangered Species Act promulgated in 1973. In 1974, four wolves were unsuccessfully translocated from Minnesota to Marquette County in Michigan, within months all four wolves were killed by humans. Still this is a resilient species and in 1989, wolves were spotted traveling together within Michigan’s Upper Peninsula, these wolves apparently produced pups in 1991. The MDNR believes that the current wolf population is descended from wolves that entered the state as lone animals from Ontario, Wisconsin, and Minnesota and eventually mated (MDNR, 2006). A few decades made a lot of difference, a 2006 winter survey estimated that the current wolf population was 434 animals (MDNR, 2006).

Because wolf populations are growing, the MDNR developed the Michigan Gray Wolf Recovery and Management Plan in 1997. The Plan dictates how Michigan state agencies and others will help wolf populations recover, and outlines policies that need to be made regarding wolf-human conflicts, such as livestock depredations, and attacks on domestic pets. The Michigan Gray Wolf Recovery and Management Plan also emphasizes that wolf education is important to wolf recovery in the state. Although wolf educational materials exist, there is neither a “wolf education curriculum” available specifically for Michigan, nor does the MDNR have a comprehensive wolf education plan for the state.
Wolf Education Programs Developed in Other States

Wolf education programs are applied sporadically throughout the United States. The most prominent wolf education programs, curricula, and educational resources were developed by the International Wolf Center located in Ely, Minnesota. The International Wolf Center contributes much to the world of wolf education through various education programs that are available both at the center and off-site. The Center’s educational programs are presented in a way that presents facts about wolves to the public without giving opinions about these facts. This unbiased presentation allows participants to draw their own conclusions and formulate their own opinions about wolves. It is important to maintain an objective approach when developing wolf education programs because the educator wants to be sure that they are giving the students facts and allowing them to develop their own informed opinions. Programs free of rhetoric are thought to be more effective.

The International Wolf Center has developed several different educational programs and makes them available to the public. Some of the available programs are:

- Various films about wolves from different areas, and covering different species of wolves.
- Guided hikes through wolf habitat explaining what wolves need to survive.
- A program that explains basic wolf biology.
- A look at dogs and their biological relationship to wolves.
• Programs instructing and allowing students to track wolves using telemetry equipment.

• Programs that allow visitors to see how people and wolves can live harmoniously.

• Off site trips to track, howl to, and learn more about wolves.

• Longer off-site learning vacations to learn more about wolves that range from trips to Yellowstone National Park in Montana to trips to Isle Royal National Park in Michigan.

• Day camps and programs to teach children about wolves.

• Behind the scenes programs where visitors can see how Wolf Center staff interact and care for the resident Ambassador Wolf Pack living at the Center.

The International Wolf Center also has educational literature available on-site, which ranges from information on wolf biology to wolf-human interactions. Much of this literature is also available for free on their website (http://www.wolf.org). Several different sections of the website provide different levels of educational information.

Incorporated into the website there are sections that are provided specifically for children. Other sections have information available in the form of scientific articles. The International Wolf Center website also offers interactive learning opportunities such as daily wolf logs about their resident wolf pack, which help to teach people about wolf behaviors, and the opportunity to watch the wolves interacting on the Town of Ely web camera. There is also information available for teachers to use within their classrooms, including an entire wolf based curriculum.
The International Wolf Center has an extensive curriculum available to
classroom teachers that is geared for students in grades 4-12 entitled *Gray Wolves,*
*Gray Matter.* The curriculum has been made available in two formats, which were
designed, ideally, to be used together. One part is a workbook. The other is an on­
line program utilizing a Web-based Inquiry Science Environment (W.I.S.E.) that
allows for a more interactive experience. The W.I.S.E. version of the *Gray Wolves,*
*Gray Matter* program allows for the lessons to be adjusted from a basic introduction
to more complex levels depending on the amount of work and information the
classroom teacher using the program wants to incorporate. An activity guide related
to these materials was available on the International Wolf Center website for $24.95
in 2006, or downloadable in PDF format, and included 27 activities that teachers
could use. These activities are created to be ready for use in the classrooms. In 2006
or 2007 the W.I.S.E. program will soon be renamed Projects Analyzing Wolves and
Society (PAWS) and will be geared more for middle school students [Strauss, Andrea
(2006) personal communication (September 7th, 2006); International Wolf Center,
2006)].

Another resource for wolf education is the Searching Wolf website
(http://www.searchingwolf.com) run by Bill Forbes. This resource can be used to
locate different wolf programs and activities. There are several different wolf
activities that are listed ranging from activities for children to activities that could be
of use in a classroom to a bibliography of informative books and pamphlets and
videos, as well as sources for “learning boxes” and slides to track wolf packs in the
“wild”. All of the information available on this website is valuable to educators. However, none of the wolf programs found at the above mentioned sites are specific to Michigan.

**Wolf Education Availability in Michigan**

The Michigan Department of Natural Resources (MDNR) is required to have a wolf education curriculum according to guidelines established under Michigan’s Wolf Management Plan. Indeed education is identified as a high priority; however, as of this writing the MDNR does not have a comprehensive wolf information and education plan. Certainly, some efforts have been made, however they only have the wolf recovery plan, which states that wolf education is an important part of wolf recovery. The MDNR has been providing wolf education through various activities including presentations and stakeholder groups and promotes the distribution of information through various pamphlets and brochures (MDNR, 2006). Perhaps most importantly there is a wolf coordinator who is a full time employee of the MDNR. His primary responsibilities include, but are not limited to, being sure that the MDNR is in compliance with all specifications of the Federal and State Endangered Species Acts concerning wolves in Michigan, spending and dispersing federal monies allocated for wolf programs, being involved with wolf research, and making sure that the state makes progress meeting the goals established in the Michigan Wolf Management Plan [Hammill, J. (2006) personal communication (July 17, 2006)].
Despite budget constraints, the MDNR is focusing on getting more information about wolves to Michigan residents. This mission stems from a survey in which Michigan residents indicated education as the most effective way of avoiding wolf-human conflicts and issues (MDNR, 2006). A wolf fact sheet and bookmark are available. Brochures informing individuals on how to minimize wolf predation on livestock are also available through the MDNR. The MDNR has also developed a website with general wolf information and facts, as well as providing information on wolf recovery and biology. Currently, the MDNR is developing a brochure that has information on how to avoid wolf-human conflicts (MDNR, 2006).

Another program in place is Wolf Awareness Week. This week is typically the third week in October and is promoted by the MDNR in conjunction with several other agencies. Some of the agencies involved in Wolf Awareness Week both federally and locally in the past have included the U.S. Fish and Wildlife Service, the Timber Wolf Alliance, the International Wolf Center, the National Wildlife Federation, Defenders of Wildlife, and Wolf Park, just to name a few. During Wolf Awareness Week, these different state and federal agencies with other various groups sponsor programs intended to inform people about wolf behavior.

As has been shown, there is still a need in Michigan for a comprehensive wolf education curriculum focused on Michigan. Some teachers in the Upper Peninsula have stated that there is a great need for a wolf education, especially in areas where students are in close proximity to wolf populations. Although the MDNR is not currently providing wolf education, efforts by teachers in the Upper Peninsula to
incorporate wolf education into their curricula underscores the need for a more comprehensive program in Michigan schools. It is essential for the Michigan Department of Natural Resources to develop a statewide wolf education curriculum that will assure that the students are getting correct and accurate information. This is very important because teachers who are currently incorporating wolf education into their curriculum may not have access to the most accurate and objective information. Given their expertise, the MDNR should be a primary source of information. In addition, the curriculum developed by the MDNR must satisfy state and national benchmarks for students; otherwise teachers will be unlikely to use this curriculum because of the stringent requirements established by the No Child Left Behind Act and related state education guidelines [Schwartz, S. (2006) personal communication (Feb 5, 2006)].

Distribution of this new curriculum into classrooms is critical. While teachers in Michigan’s Upper Peninsula are currently dealing with wolf-human interactions and need this curriculum, teachers throughout the State need to be aware of the availability of current curriculum materials, especially as wolf numbers continue to rise and animals migrate to new locations. Wolf recovery will eventually impact everyone throughout the state, and it is better to educate residents in statewide, at the present time, before wolf-human interactions become political, economic, or safety issues. An option is for the MDNR to work with the Michigan Department of Education Science coordinator and the various regional Math and Science centers
throughout the State to disseminate information about the wolf curriculum as well as information on how to obtain it
CHAPTER III

METHODS

Study Sites

Two Michigan elementary schools were chosen as the study sites for this research. The first school, Stephenson Elementary (Fig. 3.1a), is located in Michigan’s Upper Peninsula and was chosen because many of the attending students reside in homes that are located near prime wolf habitat. The town of Stephenson (Fig. 3.1b) had a population of 875 in the year 2000 (City-data, 2006). Stephenson Elementary School has students in grades three through five enrolled, with a total enrollment of 250 students each year. There were approximately 60 children currently enrolled in their fourth grade classes at the time of the research (Stephenson, 2006). The students living within the Stephenson school district are familiar with wolves because they are exposed to them often in their everyday lives.

The second school chosen was Winchell Elementary (Fig. 3.2a) located in Kalamazoo, Michigan (Fig. 3.2b). This school was chosen because the attending students reside in a suburban area that provides an interesting comparison to the students from Stephenson Elementary School. The Winchell students do not live in prime wolf habitat, at least at the present time. Kalamazoo had a population of 77,145 people in the year 2000 (City-data, 2006). Winchell Elementary incorporates grades kindergarten through sixth, with an annual enrollment of 422 students each year.
Figure 1. Stephenson Elementary School

Figure 2. The town of Stephenson, MI
Figure 3. Winchell Elementary School

Figure 4. The city of Kalamazoo, MI
Approximately 75 students were enrolled in fourth grade at the time of the research [Kalamazoo Public Schools, personal communication (August 8\textsuperscript{th}, 2006)]. Winchell Elementary serves students from the surrounding neighborhood, as well as those who are accepted through school of choice within the Kalamazoo Public School District. The students attending Winchell in Kalamazoo experience gray wolves only if they have seen them in a zoo.

Three fourth grade classrooms from each school participated in the study. Fourth grade students were selected because this is the grade that students study the state of Michigan. This grade level and its curricular requirements makes the fourth grade an optimal year for wolf education because teachers do not need to make extra room in their curricula to add additional lessons. The lessons being tested in this thesis fit easily into the required curriculum and satisfy state-level science benchmarks that are already in place.

\textit{Data Collection}

Before any research could be performed, approval from the Human Subjects Institutional Review Board (HSIRB) at Western Michigan University was necessary for this study to be in compliance with federal law. The data collection instrument was submitted to the HSIRB, and was approved for use in this research (See Appendix A). The survey consisted of fifteen questions including ten true/false questions, four short answer questions, and one map question. Half of the questions were “knowledge-based” questions; these questions evaluated student knowledge
about wolves. The remainder asked for opinions that would allow the researcher to determine each student's opinions about wolves before and after the curriculum was presented.

Data collection for each classroom consisted of one survey (Appendix B) about wolves that was administered to each student three times. The first survey was distributed before the students received any instruction about wolves. This survey was given to establish a knowledge baseline, which allows for the measurement of how much students learned about wolves during the course of the *Wolves in Michigan* curriculum. The third grade classroom that served as the control group for the study was given only one survey. The survey served to inform the researcher if the experimental groups were significantly different from another similarly aged elementary group of students. In each school, each classroom received a different portion of the curriculum. One classroom in each school received the full curriculum; another classroom received the lessons, and the third classroom received the jeopardy-type game.

The two schools received the same curriculum and surveys. In each school, each classroom received a different portion of the curriculum. One classroom received the full curriculum another classroom received only the lessons. The third classroom received only the jeopardy-type review game.
**HSIRB Approval**

As required by federal law and by Western Michigan University, the data collection instrument was submitted to HSIRB. Once it was approved, permission was sought from the administrators at Stephenson Elementary School and at Winchell Elementary School (Appendix C). Parental consent letters were mailed to the student’s homes (Appendix A). An additional copy of this letter, which included a photo release form, was also included. One copy was for the parents/guardians to retain for their records. The other was returned to a confidential box in the school offices to which only the researcher had access.

**Data Collection Procedures**

Upon entering the classroom, those students whom had parental or guardian permission to participate were given an opportunity to consent to being part of the study. The students were asked to fill out a student assent form (Appendix A) only if they were willing to participate. The student assent form also provided permission by students to have their photographs taken during the study. Those students giving consent were then administered the preliminary survey. The students were provided fifteen minutes to complete each survey. Students who were not able to participate in this study read library books or had opportunities to finish other work. Students were given the respective portions of the *Wolves in Michigan Curriculum* (Appendix D), assigned at random. One class from each school was given the full curriculum, one was given the lessons, and the last was given the review game. The students who
received only the game played each day the other classes had the lessons. At the end of the week, the student survey forms were administered again. Three weeks later the student survey forms were administered again, as a delayed post survey. The results of the surveys were analyzed.

Data Analysis

The responses to the survey were coded prior to data analysis (Appendix B). The coded answers appear in italics and in a grey font on the survey in Appendix B. The correct responses for the fact based true-false questions were coded as a “1” and the incorrect answers were coded as a “5”. Responses that were either double circled (where both options True and False were selected, or where nothing was circled was coded with a “0”. The scores on the survey were then subjected to analysis of variance (ANOVA) tests using SPSS 13. The opinion questions were analyzed by comparing the percentages of the true and false responses to determine if the students’ opinions changed during the wolf curriculum unit. Questions eleven, twelve, thirteen and fourteen were qualitative and were analyzed by comparing the percentages of students changing their positions relative to wolf knowledge as evidenced by the statements on the surveys for pre, post, and delayed administration.

Question fifteen presented an outline map of Michigan and requested for students to indicate where wolves lived in the State by circling the appropriate areas. The map was an outline of the State of Michigan with the county names and the county borders. The students’ answers were individually analyzed, and a “farthest
extent map" was created for each classroom based composite of the individual responses for each of the surveys. The classes will be compared according to their scores on each of the three surveys, and then compared within the three treatment groups in order to assess the effectiveness of the curriculum for each class.
CHAPTER IV
RESULTS AND DISCUSSION

This chapter will consist of a presentation and discussion of the results of the data analysis. Each classroom was presented with either the entire teaching trunk (lessons and game) or a portion of the trunk, which serve as the educational treatments in this research. Classrooms that received either the trunk or a specific treatment using materials from the trunk were determined randomly. In addition a pre survey was administered immediately before the instruction, a post survey was administered immediately after the instruction (on Friday of the respective week) and a delayed post-survey administered three weeks after instruction. The results on students' performance on these surveys are discussed in the subsequent sections of this chapter.

Results

Individual Classrooms

Each classroom was given an identification code to allow for ease in analysis, and to allow for anonymity during analysis (Table 1). Analysis of variance (ANOVA) was used to compare the mean scores from the surveys within and among classrooms. The identification numbers 100, 200, and 300 were used to represent the categories for the preliminary survey, the post survey, and the delayed post survey (Table 4.2).
Stephenson 88

One classroom was given the full curriculum at Stephenson Elementary School. The instructor of these students had taught about wolves prior to this research. Students’ responses on the pre, post, and delayed post surveys were compared using the mean scores from the survey (Table 2). There was not a significant difference in student knowledge based on the survey given pre-study (p < 0.05) and the two administrations of the survey after the curriculum was presented. This result suggests that students’ change in knowledge about wolves from the pre to the post survey was not statistically significant. There was not a statistically significant difference in the mean score for the survey administered three weeks later.

<table>
<thead>
<tr>
<th>Classroom</th>
<th>Portion Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stephenson 88</td>
<td>Full curriculum</td>
</tr>
<tr>
<td>Stephenson 77</td>
<td>Lessons only</td>
</tr>
<tr>
<td>Stephenson 99</td>
<td>Game only</td>
</tr>
<tr>
<td>Winchell 44</td>
<td>Full curriculum</td>
</tr>
<tr>
<td>Winchell 66</td>
<td>Lessons only</td>
</tr>
<tr>
<td>Winchell 55</td>
<td>Game only</td>
</tr>
</tbody>
</table>

Table 1. SPSS code assignments

The true/false portion of the survey had five opinion questions. A criterion level for practical change in student survey scores on those items at twenty percent on particular items or sub items, was set by the researcher in accordance with the literature. When twenty percent change was observed, it is indicated by an asterix in
the respective columns. When a change in the response patterns between pre, post and or delayed post survey was observed, the researcher judged it to be the result of the educational experience with the wolf curriculum or the respective portions of the curriculum that the students experience. The basis for this research protocol criterion is that the wolf curriculum was designed to have significant effects on knowledge about wolves and dispositions towards wolves among fourth grade students. While effect on knowledge was analyzed using ANOVA, dispositions are more complicated to measure, and may be the more difficult to affect in a unit of study. Therefore, the criterion of twenty percent is judged by the researcher as a practical level to expect.

The Stephenson 88 students demonstrated a change greater than twenty percent from the pre survey to the post survey on questions two and four. Question two asked students if there are too many wolves in Michigan and question four asks if the students feel wolves kill too many deer in Michigan. The change in the response patterns by students suggests that the curriculum affected change in the dispositions of the students for these particular questions (Table 3).

<table>
<thead>
<tr>
<th>Question #</th>
<th>Pre Survey</th>
<th>Post Survey</th>
<th>Delayed Post Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TRUE</td>
<td>FALSE</td>
<td>TRUE</td>
</tr>
<tr>
<td>2</td>
<td>27%</td>
<td>*73%</td>
<td>7%</td>
</tr>
<tr>
<td>3</td>
<td>31%</td>
<td>69%</td>
<td>20%</td>
</tr>
<tr>
<td>4</td>
<td>50%</td>
<td>*50%</td>
<td>13%</td>
</tr>
<tr>
<td>5</td>
<td>75%</td>
<td>25%</td>
<td>67%</td>
</tr>
<tr>
<td>9</td>
<td>88%</td>
<td>13%</td>
<td>80%</td>
</tr>
</tbody>
</table>

Table 3. Opinion question results for Stephenson 88
The Stephenson 88 student response patterns revealed changes greater than twenty percent from pre to post to delayed post for Questions 11 and 12 (Table 4). Data suggest that the practical significance of the unit to change dispositions as measured by question eleven, second part, (Give examples of what wolves do in packs) experienced a significant increase in the number of responses, greater than twenty percent from the pre survey to the post survey, this change was significant. There was not a significant change from the post survey to the delayed post survey on this question. Question twelve (Define conservation) displayed an increase greater than twenty percent from the pre survey to the post survey. The twenty percent increase demonstrates practical significance in that students’ short term learning was more effective compared to long term learning, as measured by the delayed post survey.

<table>
<thead>
<tr>
<th>Questions 11 &amp; 12</th>
<th>Pre</th>
<th>Post</th>
<th>Delayed post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correctly described a wolf pack</td>
<td>31%</td>
<td>50%</td>
<td>38%</td>
</tr>
<tr>
<td>Explained what wolves do in a pack</td>
<td>*38%</td>
<td>*63%</td>
<td>50%</td>
</tr>
<tr>
<td>Correctly defined conservation</td>
<td>*56%</td>
<td>*81%</td>
<td>63%</td>
</tr>
</tbody>
</table>

Table 4. Questions 11 and 12 analysis for Stephenson 88

For question thirteen, students were asked to state if they liked wolves (Table 5). The surveys revealed no practical changes in the student responses for any of the component parts of questions thirteen. These data suggest that the practical significance of the unit to change knowledge or dispositions measured by this question was not effective.

Question fourteen asked students to explain what wolf recovery meant to them. The responses to this question were divided into five categories (Table 6).
Question 13 "Do you like Wolves?"

<table>
<thead>
<tr>
<th>Question</th>
<th>Pre</th>
<th>Post</th>
<th>Delayed post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do like wolves</td>
<td>56%</td>
<td>67%</td>
<td>56%</td>
</tr>
<tr>
<td>Do not like wolves</td>
<td>38%</td>
<td>33%</td>
<td>44%</td>
</tr>
<tr>
<td>1-Uneecided on wolf preference</td>
<td>6%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>2-Wolves are mean and/or scary</td>
<td>5%</td>
<td>11%</td>
<td>6%</td>
</tr>
<tr>
<td>3-Wolves are just like dogs</td>
<td>5%</td>
<td>11%</td>
<td>6%</td>
</tr>
<tr>
<td>4-Wolves attack/kill people and/or animals</td>
<td>37%</td>
<td>28%</td>
<td>41%</td>
</tr>
<tr>
<td>5-Wolves are cute/cool</td>
<td>21%</td>
<td>22%</td>
<td>18%</td>
</tr>
<tr>
<td>6-Other</td>
<td>32%</td>
<td>28%</td>
<td>29%</td>
</tr>
</tbody>
</table>

Table 5. Question 13 analysis for Stephenson 88

Practical significance was observed for three of the categories. There was an increase greater than twenty percent from the pre survey to the post survey for responses to item 14. This significant result was partially maintained to the delayed post test pattern of responses. Students’ short-term memory was stimulated, but not maintained as a long-term disposition as measured by the instrument. An interesting reversal was observed in with question 14.2, which recorded a negative change of practical significance, followed by a movement of practical significance from the post to the delayed post survey. Little information is available in the study to explain this pattern from a curriculum that was designed to have a significant influence on 4th grade students. This observation was unexpected and remains unexplained. Student responses to item 14.5 demonstrated an increase in responses greater than twenty percent from the pre survey to the post survey. However, the 14.5 “other” category was a catch all question that proved difficult to interpret. The research suspects that these responses were expressions of prior knowledge and constructed ideas about wolf recovery that were not the intended outcomes of the curriculum, but were valid in the minds of the students.
The researcher requested the students to circle the places in Michigan where wolves lived in the wild (Appendix B). For analysis, the researcher made composite maps of students' responses and has presented them in this chapter (Figures 5-7).

<table>
<thead>
<tr>
<th>Question 14 &quot;Describe Wolf Recovery&quot;</th>
<th>Pre</th>
<th>Post</th>
<th>Delayed post</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Save and/or conserve wolves</td>
<td>.44%</td>
<td>.67%</td>
<td>56%</td>
</tr>
<tr>
<td>2-Help wolves recover from injury</td>
<td>.50%</td>
<td>.0%</td>
<td>.25%</td>
</tr>
<tr>
<td>3-Bring in from other states/places</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>4-Don't know</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>5-Other</td>
<td>.6%</td>
<td>.33%</td>
<td>19%</td>
</tr>
</tbody>
</table>

Table 6. Question 14 analysis for Stephenson 88

These maps revealed the spatial distribution of knowledge and disposition about wolves and their territorial range. These maps were analyzed using auto correlation in order to determine the changes in the patterns for students who received specific treatments. Analysis of the pre survey map for Stephenson 88 students suggested that students perceived the Upper Peninsula as prime wolf areas along with smaller, isolated ranges in the Lower Peninsula (Figure 5). The post survey composite map suggests that only the Upper Peninsula was perceived as wolf range by most students. Several students continued to select some locations within the Lower Peninsula (Figure 6). The delayed post survey map (Figure 7) corroborated the perception by students that the Upper Peninsula represented the wolf range in Michigan. It also demonstrated a greater agreement that wolves could range across an area of the northern Lower Peninsula. A sizeable area identified as wolf range on the pre and post survey maps including Mecosta, Isabella, and Midland Counties were not part of the perceived wolf territory on the delayed post map. The changes in the composite
Figure 5. Stephenson 88 Map: Pre-Curriculum Survey
Figure 6. Stephenson 88 Map: Post Curriculum Survey
Figure 7. Stephenson 88 Map: Delayed Post Survey
maps suggests that students did learn and retain information about where wolves live in Michigan as presented in the treatments. On the two map surveys given after the curriculum, nearly all of the students identified the Upper Peninsula as a location where wolves are living in the wild. These results represent a significant growth in spatial knowledge about wolves.

Further analysis of the maps from Stephenson 88 revealed several additional patterns that the researcher judges as educationally significant. On the pre survey students demonstrated their perception if there were wolves in one location in Michigan, such as the Upper Peninsula, then there must be wolves all over Michigan. The effect of distance from Stephenson Elementary School did not seem to influence students’ choice of wolf locations in Michigan on the pre survey. For the post survey, and the delayed post survey, there was one student who continued with that perception and subsequently continued to identify the Lower Peninsula as wolf range on the post and delayed post surveys. The removal of that student’s responses on the map survey would clearly have resulted in composite maps from the post and delayed post survey that reflect current information that wolves do not currently have a viable range within the Lower Peninsula. There is speculation that wolves may have migrated to the Lower Peninsula in the past, but there is currently no evidence that they have established a natural range. Amid this speculation, students perceived the possibility of such a wolf migration and reestablishment of a range. The researcher recognized this and judges that the post and delayed post maps reflect accurately the
current perceptions of wolf range in the Upper Peninsula, and perhaps in the northern
tier of counties in the Lower Peninsula at some future time.

*Stephenson 77*

Stephenson 77 was given only the lesson portion of the curriculum and a basic
description of their scores can be found in Table 7. ANOVA results indicate that there
is a significant difference between the Stephenson 77 classroom’s scores on the
preliminary survey, and between the latter two surveys both given post-curriculum.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>14</td>
<td>10.14</td>
<td>10.795</td>
<td>0.000</td>
</tr>
<tr>
<td>200</td>
<td>13</td>
<td>6.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>300</td>
<td>14</td>
<td>5.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>41</td>
<td>7.56</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7. ANOVA results and descriptive statistics for Stephenson 77

The result of the post hoc Fischer’s Least Squares Difference analysis shows that
there was a significant difference in the pre survey, the post survey, and the delayed
post survey scores at the 95% or greater confidence level between the preliminary
survey, and the post survey given immediately after the curriculum, and between the
preliminary survey and the second post curriculum survey given three weeks later
(Table 8). The second survey is not significantly different from the third survey,
indicating that after three weeks students retained the same amount of information as
they retained immediately after instruction.
For the true/false portion of the survey, Table 9 illustrates that Stephenson 77 experienced an increase in responses greater than twenty percent only for question two from the post survey to the delayed post survey. The change in response patterns for question two suggests the treatment affected student dispositions after both the post survey and the delayed post survey when compared to the pre survey.

The Stephenson 77 patterns of student response for question eleven (Table 10) experienced an increase in the number of correct responses that was greater than twenty percent from the pre survey to the post survey (Table 10), a decrease of greater than twenty percent was experienced from the post survey to the delayed post survey. (Again, as established by this researcher, a decrease of greater than twenty
percent is considered to be significant.) One explanation for these results could be that the students demonstrated short-term memory for the post survey. However, the structure of wolf packs was not developed adequately by the curriculum to allow the students to recall the information three weeks later during the delayed post survey.

<table>
<thead>
<tr>
<th>Questions 11 &amp; 12</th>
<th>Pre</th>
<th>Post</th>
<th>Delayed post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correctly described a wolf pack</td>
<td>*14%</td>
<td>*36%</td>
<td>*14%</td>
</tr>
<tr>
<td>Explained what wolves do in a pack</td>
<td>64%</td>
<td>57%</td>
<td>64%</td>
</tr>
<tr>
<td>Correctly defined conservation</td>
<td>64%</td>
<td>50%</td>
<td>36%</td>
</tr>
</tbody>
</table>

Table 10. Questions 11 and 12 analysis for Stephenson

The first portion of question thirteen on the preliminary survey demonstrated that students’ responses experienced no change greater than twenty percent, therefore the researcher determined the effects of this treatment had no practical significance (Table 11). Category three for question thirteen was the only category to experience a change that could be considered to have practical significance. The significant change in the number of responses for category three demonstrates that from the pre survey to the post survey, students’ knowledge and disposition gained accuracy when comparing wolves to dogs. The significant change in the students’ dispositions can be attributed to the information they received from the treatment.
Table 11. Question 13 analysis for Stephenson 77

Question fourteen asks students to explain what wolf recovery meant to them, and the responses to this question were also divided into five categories (Table 12). There was not a significant change in any of the responses for question fourteen from the pre survey to the post survey, or to the delayed post survey. The lack of significant change suggests that the effects of the unit to change the knowledge or dispositions measured by this question were not effective.

Table 12. Question 14 analysis for Stephenson 77

On the final portion of the survey, the composite maps, analysis of the pre survey map for Stephenson 77 (Figure 8) suggests that the Upper Peninsula was perceived as prime wolf habitat, along with large portions of isolated areas in the Lower Peninsula. The post survey map revealed that students isolated fewer areas in
Figure 8. Stephenson 77 Map: Pre-Curriculum Survey
Figure 9. Stephenson 77 Map: Post Curriculum Survey
Figure 10. Stephenson 77 Map: Delayed Post Survey
the Lower Peninsula (Figure 9). After the delayed post survey (Figure 10) students properly identified the Upper Peninsula as prime wolf habitat, however isolated areas in the Lower Peninsula and including Kalamazoo were also selected.

Additional analysis of the Stephenson 77 maps revealed several patterns that were considered significant for educational purposes. On the pre survey the students demonstrated the perception that if there were wolves in one location in Michigan, then there must be wolves throughout the entire state. The effect of distance did not seem to influence the students in Stephenson 77 classroom. An additional reason for the selection of Kalamazoo County could be attributed to the researcher’s home location and the students’ perception that the researcher’s home location could be connected to wolf habitat in Michigan. Similar to Stephenson 88, students speculated that the natural range of wolves extended into the northern Lower Peninsula because of the prior evidence of wolves there.

*Stephenson 99*

Stephenson 99 received only the game portion of the curriculum. The instructor of these students had taught about wolves prior to this research. ANOVA shows that students did not gain a significant amount of knowledge from their portion of the curriculum (Table 13). This result was not unexpected because this classroom was given only the game from the curriculum.
For the true/false portion of the survey (Table 14) there was not a significant change in disposition of the students from pre survey, to the post survey, to the delayed post survey. The lack of significant change suggests that practical significance of unit to change knowledge or dispositions measured by these questions was not effective.

The Stephenson 99 students did not experience a significant change in dispositions for all portions of question eleven and twelve (Table 15). The lack of significance suggests that the practical significance of the curriculum to change knowledge or dispositions measured by these questions was not effective for this question.
For the first portion of question thirteen students' dispositions toward wolves was not considered to be significant (Table 16). Category three was the only category to experience a significant change in students' dispositions associating wolves with dogs. The decrease in significant responses for category three is considered significant, and one explanation for this change could be that although the game was not successful in changing many student knowledge and dispositions overall, the game was successful in changing the student knowledge and dispositions comparing wolves to dogs.

For question fourteen, there was not a significant change in students' dispositions about wolf recovery from the pre survey to the post survey and the
delayed post survey (Table 17). The lack of significance for this question demonstrates that the game portion of the treatment was not effective in educating students about wolf recovery.

<table>
<thead>
<tr>
<th>Question 14 &quot;Describe Wolf Recovery&quot;</th>
<th>Pre</th>
<th>Post</th>
<th>Delayed post</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Save and/or conserve wolves</td>
<td>7%</td>
<td>15%</td>
<td>29%</td>
</tr>
<tr>
<td>2-Help wolves recover from injury</td>
<td>36%</td>
<td>38%</td>
<td>36%</td>
</tr>
<tr>
<td>3-Bring in from other states/places</td>
<td>14%</td>
<td>15%</td>
<td>14%</td>
</tr>
<tr>
<td>4-Don't know</td>
<td>7%</td>
<td>8%</td>
<td>0%</td>
</tr>
<tr>
<td>5-Other</td>
<td>36%</td>
<td>23%</td>
<td>21%</td>
</tr>
</tbody>
</table>

Table 17. Question 14 analysis for Stephenson 99

For the composite mapping section of the surveys for the students in Stephenson 99, there was no significant change from the pre survey to the post survey to the delayed post survey. All of the Upper Peninsula and a large part of the Lower Peninsula were indicated as good wolf habitat as perceived by these students (Figures 11-13). Essentially these students did not gain any new or correct knowledge of where wolves live in Michigan. This class received only the game portion of the curriculum, and results of this portion of the survey show that these students did not receive or retain as much information about wolves in Michigan as those students who received the complete lessons. Students from Stephenson 99 also performed less well on the knowledge portion for each of the surveys when compared to the other two Stephenson classrooms. These results suggest that only using this game to impart knowledge fails as a pedagogical method. The pre curriculum survey map for Stephenson 99 demonstrated that students felt that wolves live throughout Michigan, and although the map was not centralized around Stephenson Elementary School,
Figure 11. Stephenson 99 Map: Pre-Curriculum Survey
Figure 12. Stephenson 99 Map: Post Curriculum Survey
Figure 13. Stephenson 99 Map: Delayed Post Survey
students possibly thought that if there were wolves in their area in Michigan, wolves could be found throughout Michigan. For the post survey, students from Stephenson 99 did not experience a change in their knowledge of where wolves lived in the wild. The results for the post survey and the delayed post survey did not change significantly from the pre curriculum survey.

**Winchell 44**

Winchell 44 was given the full curriculum with both the lessons and the review game. ANOVA suggests that the differences in students' survey results from the three surveys were not significant (Table 18), meaning that they did not gain or retain a significant amount of knowledge during the course of the study.

A section of the true/false questions were also disposition based. Question two percentages decreased from the preliminary survey to the post curriculum survey, and then remained the same from the post curriculum survey, to the delayed post survey (Table 4.19). The results from question two could have changed after students learned about wolves in Michigan.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>15</td>
<td>7.93</td>
<td>0.647</td>
<td>0.528</td>
</tr>
<tr>
<td>200</td>
<td>17</td>
<td>7.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>300</td>
<td>17</td>
<td>9.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>49</td>
<td>8.33</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 18. ANOVA results and descriptive statistics for Winchell 44

There was no significant change in the dispositions of the students in Winchell 44 for the true/false portion of the survey from the pre survey to the post survey, and to the delayed post survey (Table 19). The absence of change suggests that practical
significance of the unit to change knowledge or dispositions measured by these questions was not effective.

<table>
<thead>
<tr>
<th>Question #</th>
<th>Pre Survey</th>
<th>Post Survey</th>
<th>Delayed Post Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TRUE</td>
<td>FALSE</td>
<td>TRUE</td>
</tr>
<tr>
<td>2</td>
<td>0%</td>
<td>100%</td>
<td>12%</td>
</tr>
<tr>
<td>3</td>
<td>27%</td>
<td>73%</td>
<td>35%</td>
</tr>
<tr>
<td>4</td>
<td>20%</td>
<td>80%</td>
<td>35%</td>
</tr>
<tr>
<td>5</td>
<td>100%</td>
<td>0%</td>
<td>82%</td>
</tr>
<tr>
<td>9</td>
<td>100%</td>
<td>0%</td>
<td>94%</td>
</tr>
</tbody>
</table>

Table 19. Opinion question analysis for Winchell 44

The Winchell 44 students demonstrated a significant increase in dispositions for the first portion of question eleven from the pre survey to the post survey (Table 20). There was no significant increase from the post survey to the delayed post survey. The increase in the dispositions demonstrates that student's short term learning was more effective compared to their long term learning as measured by the delayed post survey, this is a significant change. Question twelve (Define conservation) demonstrated a significant increase in students' dispositions. One possible explanation for this result could be that students' short-term memory was stimulated for the post survey. However, the long-term influence of the treatment did not have long-term effects.

<table>
<thead>
<tr>
<th>Questions 11 &amp; 12</th>
<th>Pre</th>
<th>Post</th>
<th>Delayed post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correctly described a wolf pack</td>
<td>*39%</td>
<td>*78%</td>
<td>67%</td>
</tr>
<tr>
<td>Explained what wolves do in a pack</td>
<td>44%</td>
<td>61%</td>
<td>56%</td>
</tr>
<tr>
<td>Correctly defined conservation</td>
<td>*22%</td>
<td>*44%</td>
<td>28%</td>
</tr>
</tbody>
</table>

Table 20. Questions 11 and 12 analysis for Winchell 44
For both portions of question thirteen as well as question fourteen there was not a significant change in the dispositions of the students (Tables 21 and 22). The lack of significant changes for all components of questions thirteen and fourteen suggest that the treatment was not effective in delivering the messages intended in the treatment.

<table>
<thead>
<tr>
<th>Question 13 &quot;Do you like Wolves?&quot;</th>
<th>Pre</th>
<th>Post</th>
<th>Delayed post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do like wolves</td>
<td>87%</td>
<td>76%</td>
<td>76%</td>
</tr>
<tr>
<td>Do not like wolves</td>
<td>13%</td>
<td>24%</td>
<td>24%</td>
</tr>
<tr>
<td>1-Undecided on wolf preference</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>2-Wolves are mean and/or scary</td>
<td>0%</td>
<td>6%</td>
<td>11%</td>
</tr>
<tr>
<td>3-Wolves are just like dogs</td>
<td>7%</td>
<td>0%</td>
<td>6%</td>
</tr>
<tr>
<td>4-Wolves attack/kill people and/or animals</td>
<td>13%</td>
<td>12%</td>
<td>17%</td>
</tr>
<tr>
<td>5-Wolves are cute/cool</td>
<td>33%</td>
<td>29%</td>
<td>11%</td>
</tr>
<tr>
<td>6-Other</td>
<td>47%</td>
<td>53%</td>
<td>56%</td>
</tr>
</tbody>
</table>

Table 21. Question 13 analysis for Winchell 44

<table>
<thead>
<tr>
<th>Question 14 &quot;Describe Wolf Recovery&quot;</th>
<th>Pre</th>
<th>Post</th>
<th>Delayed post</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Save and/or conserve wolves</td>
<td>46%</td>
<td>41%</td>
<td>41%</td>
</tr>
<tr>
<td>2-Help wolves recover from injury</td>
<td>23%</td>
<td>18%</td>
<td>29%</td>
</tr>
<tr>
<td>3-Bring in from other states/places</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>4-Don't know</td>
<td>8%</td>
<td>6%</td>
<td>0%</td>
</tr>
<tr>
<td>5-Other</td>
<td>23%</td>
<td>35%</td>
<td>29%</td>
</tr>
</tbody>
</table>

Table 22. Question 14 analysis for Winchell 44

As the composite map shows, Winchell 44 students all of Michigan as prime wolf habitat, along with several continuous areas within the Lower Peninsula (Figure 14) for the preliminary survey. For the post survey, all of the Upper Peninsula was selected, along with isolated areas in the northern Lower Peninsula, including Kalamazoo, Barry, Muskegon, and Washtenaw Counties (Figure 15). These maps show that the lessons were successful for teaching the habitat location information to
students for the short term. The delayed post survey (Figure 16), however, showed a lack of retention by students who received the treatment since all of the Upper Peninsula was considered by the students to be prime wolf habitat. However many isolated areas in the Lower Peninsula were also chosen. For this class the treatment was effective in changing dispositions in the short term. However it was not successful in maintaining the change in dispositions long term. The effect of distance did not seem to be applicable for this group, as they were not consistent in their selections. The delayed survey map for Winchell 44 demonstrates a lack of retention for the students after a three-week break in treatment. One explanation for this result could be that although the students did remember areas of wolf habitation following the treatment, the information was not presented throughout the curriculum. Therefore the students' limited exposure did not result in retention.
Figure 14. Winchell 44 Map: Pre-Curriculum Survey
Figure 15. Winchell 44 Map: Post Curriculum Survey
Figure 16. Winchell 44 Map: Delayed Post Survey
Winchell 66

Winchell 66 received only the lesson portion of the curriculum. ANOVA interpretation suggested the differences in the scores from the three surveys were significantly different (Table 23). Results suggest that this class did change significantly in their knowledge of wolves among the three survey times. A Fischer's Least Squares Difference post hoc test determined that there was a significant difference in test scores between the pre survey, and the delayed post survey given three weeks later (Table 24). Students may have had time to reflect on the information given throughout the curriculum and could have decided to look for more information on their own. The teacher had time with students between the surveys without the researcher present to review content, Therefore, circumstances within the classroom could have resulted in this increase in knowledge. Further research would need to be conducted to determine why this change occurred, and any additional research might want to determine the influence of outside factors on students' knowledge.

Results for the true/false portion of the survey are shown in Table 25. There was no significant change in Winchell 66 students' dispositions. The absence of change from the pre survey to the post survey, and from the post survey to

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>20</td>
<td>9.75</td>
<td>3.659</td>
<td>0.032</td>
</tr>
<tr>
<td>200</td>
<td>21</td>
<td>7.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>300</td>
<td>21</td>
<td>6.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>8.13</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 23. ANOVA results and descriptive statistics for Winchell 66
Table 24. Fischer's Least Squares Difference post hoc analysis for Winchell 66.

the delayed post survey demonstrates that the treatment was unsuccessful in altering students' dispositions through instruction during this portion of the treatment. For the first part of question eleven Winchell 66 students demonstrated a significant increase from the pre survey to the post survey in the responses. The increase indicates that

Table 25. Opinion question analysis for Winchell 66

in the short term the treatment was successful in changing student dispositions (Table 26). The influence and change in dispositions did not continue and from the post survey to the delayed post survey there was a significant decrease in responses. For the second portion of question eleven, there was a significant increase in responses from the post survey to the delayed post survey. One explanation for this could be
that although students’ short-term memory was stimulated for the post survey, information about wolf packs was not used consistently throughout the curriculum, and students would have needed consistent application throughout the curriculum for it to have been effective. Question twelve (Table 26) demonstrated a significant increase in the significant changes in disposition from the pre survey to the post survey. However there was a decrease of more than twenty percent from the post survey to the delayed post survey. One explanation for this could be that although students’ short-term memory was stimulated for the post survey, conservation was not taught consistently throughout the curriculum. Therefore, students would have needed more application of this concept if retention were to be achieved. Ultimately this portion of the treatment was unsuccessful in changing dispositions.

<table>
<thead>
<tr>
<th>Questions 11 &amp; 12</th>
<th>Pre</th>
<th>Post</th>
<th>Delayed post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correctly described a wolf pack</td>
<td>*38%</td>
<td>*86%</td>
<td>*43%</td>
</tr>
<tr>
<td>Explained what wolves do in a pack</td>
<td>38%</td>
<td>*48%</td>
<td>*71%</td>
</tr>
<tr>
<td>Correctly defined conservation</td>
<td>*43%</td>
<td>*67%</td>
<td>*33%</td>
</tr>
</tbody>
</table>

Table 26. Questions 11 and 12 analysis for Winchell 66

For question thirteen (Table 27) there was not a significant difference in the dispositions of the students. The only significant change, and occurred for question thirteen in category six. One explanation for the significant changes in category six was that this category was a “catchall” category. Because category six was identified as an “other” category, it was composed of multiple responses and is difficult to interpret.
Table 27. Question 13 analysis for Winchell 66

<table>
<thead>
<tr>
<th>Question 13 &quot;Do you like Wolves?&quot;</th>
<th>Pre</th>
<th>Post</th>
<th>Delayed post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do like wolves</td>
<td>85%</td>
<td>90%</td>
<td>81%</td>
</tr>
<tr>
<td>Do not like wolves</td>
<td>10%</td>
<td>5%</td>
<td>10%</td>
</tr>
<tr>
<td>1-Undecided on wolf preference</td>
<td>5%</td>
<td>5%</td>
<td>10%</td>
</tr>
<tr>
<td>2-Wolves are mean and/or scary</td>
<td>5%</td>
<td>0%</td>
<td>5%</td>
</tr>
<tr>
<td>3-Wolves are just like dogs</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>4-Wolves attack/kill people and/or animals</td>
<td>20%</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>5-Wolves are cute/cool</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>6-Other</td>
<td>*60%</td>
<td>*81%</td>
<td>75%</td>
</tr>
</tbody>
</table>

Question fourteen (Table 28) revealed no significant change from the pre survey, to the post survey, and from the post survey to the delayed post survey. This response suggests that the practical significance of the unit to change knowledge or dispositions related to wolf recovery was not successful.

Table 28. Question 14 analysis for Winchell 66

<table>
<thead>
<tr>
<th>Question 14 &quot;Describe Wolf Recovery&quot;</th>
<th>Pre</th>
<th>Post</th>
<th>Delayed post</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Save and/or conserve wolves</td>
<td>35%</td>
<td>36%</td>
<td>35%</td>
</tr>
<tr>
<td>2-Help wolves recover from injury</td>
<td>20%</td>
<td>18%</td>
<td>10%</td>
</tr>
<tr>
<td>3-Bring in from other states/places</td>
<td>0%</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>4-Don't know</td>
<td>10%</td>
<td>9%</td>
<td>25%</td>
</tr>
<tr>
<td>5-Other</td>
<td>35%</td>
<td>32%</td>
<td>25%</td>
</tr>
</tbody>
</table>

Analysis of the pre survey map for Winchell 66 suggests that the students perceived the entire state of Michigan as prime wolf habitat (Figure 17). The post curriculum survey map (Figure 18) suggests the students’ perceptions changes after exposure to the curriculum as students’ selected smaller, more isolated areas within the Lower Peninsula. The delayed post survey map (Figure 19) exhibits little
variation from the post survey map. Although students' perceptions seemed to change after the lessons, over time there was no significant further change in their responses.

Further analysis of the Winchell 66 maps reveal patterns that the researcher considers to be significant. Students consistently selected Kalamazoo County. This is considered to be in direct correlation to students' home geographical location. Students also consistently choose similar areas of the Lower Peninsula outside of Kalamazoo County, which indicates that although there was an initial change in their responses after the post curriculum survey. Overall, students' responses on these maps were consistent. It is also important to note that because of the way the maps were compiled, the responses of a few students can misrepresent the responses of the majority of the students. This could be the reason for the isolated selections outside of Kalamazoo County in the Lower Peninsula.

Winchell 55

Winchell 55 only received the game portion of the curriculum. ANOVA interpretation suggested that there was not a significant difference in the responses of this class across the three surveys (Table 29). The lack of significance between the three surveys leads to the conclusion that this class' knowledge did not change throughout the study and that the game is not sufficient to teach this material.
Figure 17. Winchell 66 Map: Pre-Curriculum Survey
Table 29. ANOVA results and descriptive statistics for Winchell 55

For the true/false portion of the survey (Table 30) Winchell 55 demonstrated an increase of practical significance for question three (wolves are mean and will attack people if given the chance) from the pre survey to the post survey. These changes in students’ responses suggest that the game caused a change in students’ dispositions for this specific question that is contrary to fact, but inconsistent with traditional beliefs.

Winchell 55 student response patterns demonstrated changes greater than twenty percent for question eleven. Data from the first portion of question eleven suggests that the unit changed student dispositions as is shown by the increase in significant responses. There was not a significant difference in the responses for Winchell 55 students, for this question between the post survey and the delayed post survey. For the second portion of question eleven and for question twelve, there was not a significant change in the responses from each of the surveys (Table 31).

For question thirteen (Table 32) students demonstrated an increase in the percentage of respondents that answered that they liked wolves. This was greater than twenty percent from the pre survey to the post survey, and is considered by the researcher to be of practical significance. Data from the first portion of
Winchell 55 Opinion Results

<table>
<thead>
<tr>
<th>Question #</th>
<th>Pre Survey</th>
<th>Post Survey</th>
<th>Delayed Post Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TRUE</td>
<td>FALSE</td>
<td>TRUE</td>
</tr>
<tr>
<td>2</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>3</td>
<td>32%</td>
<td>*68%</td>
<td>11%</td>
</tr>
<tr>
<td>4</td>
<td>28%</td>
<td>72%</td>
<td>22%</td>
</tr>
<tr>
<td>5</td>
<td>100%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>9</td>
<td>95%</td>
<td>5%</td>
<td>89%</td>
</tr>
</tbody>
</table>

Table 30. Opinion question analysis for Winchell 55

<table>
<thead>
<tr>
<th>Questions 11 &amp; 12</th>
<th>Pre</th>
<th>Post</th>
<th>Delayed post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correctly described a wolf pack</td>
<td>*53%</td>
<td>*74%</td>
<td>74%</td>
</tr>
<tr>
<td>Explained what wolves do in a pack</td>
<td>53%</td>
<td>53%</td>
<td>53%</td>
</tr>
<tr>
<td>Correctly defined conservation</td>
<td>42%</td>
<td>53%</td>
<td>53%</td>
</tr>
</tbody>
</table>

Table 31. Questions 11 and 12 analysis for Winchell 55

Question thirteen suggests that the unit was successful in changing the student dispositions as is shown by the increase in significant responses. Six categories, as were previously mentioned, were used to classify responses to question thirteen (second percentage portion), and of these categories only three and six demonstrated significant changes that were greater than twenty percent. Category three experienced a decrease in the respondents who felt wolves were just like dogs. This suggests that the unit was successful in changing students’ perceptions about wolves being similar to dogs. Category six experienced a significant increase from the pre survey to the post survey, as this was the “other” category and was a catchall category, this category proves difficult to interpret.

Question fourteen asks for students to explain what wolf recovery means to them, and the responses to this question were also divided into five categories (Table 33). Practical significance was observed for one of the five categories; one
Table 32. Question 13 analysis for Winchell 55

<table>
<thead>
<tr>
<th>Question 13 &quot;Do you like Wolves?&quot;</th>
<th>Pre</th>
<th>Post</th>
<th>Delayed post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does like wolves</td>
<td>*63%</td>
<td>*83%</td>
<td>83%</td>
</tr>
<tr>
<td>Does not like wolves</td>
<td>16%</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>1-Undecided on wolf preference</td>
<td>21%</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>2-Wolves are mean and/or scary</td>
<td>6%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>3-Wolves are just like dogs</td>
<td>*29%</td>
<td>*6%</td>
<td>6%</td>
</tr>
<tr>
<td>4-Wolves attack/kill people and/or animals</td>
<td>18%</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>5-Wolves are cute/cool</td>
<td>6%</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>6-Other</td>
<td>*41%</td>
<td>*78%</td>
<td>78%</td>
</tr>
</tbody>
</table>

The explanation for this could be that the treatment Winchell 55 received contained adequate information about conservation throughout the course of treatment to educate the students about wolf recovery.

Table 33. Question 14 analysis for Winchell 55

<table>
<thead>
<tr>
<th>Question 14 &quot;Describe Wolf Recovery&quot;</th>
<th>Pre</th>
<th>Post</th>
<th>Delayed post</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Save and/or conserve wolves</td>
<td>*29%</td>
<td>*53%</td>
<td>53%</td>
</tr>
<tr>
<td>2-Help wolves recover from injury</td>
<td>29%</td>
<td>12%</td>
<td>12%</td>
</tr>
<tr>
<td>3-Bring in from other states/places</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>4-Don't know</td>
<td>6%</td>
<td>12%</td>
<td>12%</td>
</tr>
<tr>
<td>5-Other</td>
<td>35%</td>
<td>24%</td>
<td>24%</td>
</tr>
</tbody>
</table>

The map portion of the surveys yielded interesting results for this classroom. For the pre-curriculum survey (Figure 20), these students selected the entire state of Michigan as prime wolf habitat. One possible explanation for the preliminary survey result could be because the students are not aware of where wolves live in the wild, and therefore assume that wolves live throughout the entire state. The post curriculum survey and the delayed post survey (Figures 20-22) had almost identical results with the southwestern
Figure 20. Winchell 55 Map: Pre-Curriculum Survey
Figure 21. Winchell 55 Map: Post Curriculum Survey
Figure 22. Winchell 55 Map: Delayed Post Survey
portion of the state not selected. This class received only the game, so it is not apparent why the map patterns changed so significantly. A possible explanation for this result could be that the information available through the game was effective in changing the students' perceptions about where wolves are located within the state. One possible explanation for the results for Winchell 55 is that the classroom was influenced by the location of the school, because the students seemed to choose areas where they did not live, possibly thinking that there are not wolves near them, so wolves must live everywhere else.

Comparisons Between Classes

This section will evaluate the effectiveness of the curriculum across the different classrooms for the individual surveys. ANOVA tests were completed to compare the results of mean test scores for each class with the other classrooms for each of the three surveys.

Preliminary Survey Results

ANOVA results for the preliminary survey determined that there was no significant difference (p < 0.05) in survey results between classes for the first survey (Table 34). The lack of statistically significant differences demonstrated that each classrooms had similar knowledge about wolves before the curriculum was given. Results of this survey show that although some classes (Stephenson 88 and Stephenson 99) were given prior information about wolves that, based at least on the test that the researcher used, it had no bearing on the preliminary opinions, and that
all classes started with the same level knowledge base. This baseline suggests and allowed for the assessment of the effectiveness of the curriculum.

<table>
<thead>
<tr>
<th>N</th>
<th>Mean</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
<td>15</td>
<td>7.93</td>
<td>1.864</td>
</tr>
<tr>
<td>55</td>
<td>19</td>
<td>8.84</td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>20</td>
<td>9.75</td>
<td></td>
</tr>
<tr>
<td>77</td>
<td>14</td>
<td>10.14</td>
<td></td>
</tr>
<tr>
<td>88</td>
<td>16</td>
<td>7.5</td>
<td></td>
</tr>
<tr>
<td>99</td>
<td>16</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>9.2</td>
<td></td>
</tr>
</tbody>
</table>

Table 34. ANOVA results and descriptive statistics for the pre-curriculum survey for all classes

Post Survey Results

The first post survey was given to students immediately following the curriculum. Results of the ANOVA test revealed that there was a significant difference between the results of some of the classes on the first post survey at greater than the 95% confidence interval (Table 35). A Fischer’s Least Squares Difference post hoc analysis was then calculated to determine which of the classes were significantly different from the others. This test indicates that Stephenson 99 had significantly lower wolf knowledge than all of the other classrooms included in this study (Table 36). This result was not unexpected because this class was exposed only to the game. What is interesting is that the Winchell class that only had the game (Winchell 55) did not exhibit a significantly lower amount of knowledge at
than the other classes. Possible reasons for the differences between the two classes receiving only the game portion may be attributed to the different locations of the schools, and the possible differences in the information students received both during the game, and in the time before the delayed post survey. Further research would be recommended to determine influences on students’ knowledge from home and other sources. These results show that the lessons in the unit did affect some change in students’ responses.

Delayed Post Survey Results

The delayed post survey was administered approximately three weeks after the curriculum was finished. ANOVA determined that the differences between the classrooms were significant at the 95% confidence level (Table 37). A Fischer’s Least squares Difference post hoc analysis indicated that Winchell 44, Winchell 55, and Stephenson 99 were statistically no different in the amount they knew about wolves three weeks after instruction (Table 38). This result was expected for Stephenson 99 and Winchell 55 because these were the classes that received the game only. Winchell 44 yielded a surprising result because this class was given the full

Table 35. ANOVA results and descriptive statistics for the post curriculum survey for all classes

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
<td>17</td>
<td>7.82</td>
<td>2.321</td>
<td>0.049</td>
</tr>
<tr>
<td>55</td>
<td>18</td>
<td>8.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>21</td>
<td>7.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>77</td>
<td>13</td>
<td>6.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>88</td>
<td>15</td>
<td>6.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>99</td>
<td>15</td>
<td>10.53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>99</td>
<td>8.05</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

69
Table 36. Fischer's Least Squares Difference post hoc analysis for the comparison between classes for the post curriculum survey

<table>
<thead>
<tr>
<th>(I) Class</th>
<th>(J) Class</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
<td>55</td>
<td>-0.510</td>
<td>1.157</td>
<td>66</td>
<td>-2.81</td>
<td>1.79</td>
</tr>
<tr>
<td></td>
<td>66</td>
<td>0.014</td>
<td>1.116</td>
<td>990</td>
<td>-2.20</td>
<td>2.23</td>
</tr>
<tr>
<td></td>
<td>77</td>
<td>0.977</td>
<td>1.261</td>
<td>440</td>
<td>-1.53</td>
<td>3.48</td>
</tr>
<tr>
<td></td>
<td>88</td>
<td>0.957</td>
<td>1.212</td>
<td>432</td>
<td>-1.45</td>
<td>3.36</td>
</tr>
<tr>
<td></td>
<td>99</td>
<td>-2.710(*)</td>
<td>1.212</td>
<td>0.028</td>
<td>-5.12</td>
<td>-0.30</td>
</tr>
<tr>
<td>55</td>
<td>44</td>
<td>0.510</td>
<td>1.157</td>
<td>66</td>
<td>1.79</td>
<td>2.81</td>
</tr>
<tr>
<td></td>
<td>66</td>
<td>0.524</td>
<td>1.099</td>
<td>635</td>
<td>-1.66</td>
<td>2.71</td>
</tr>
<tr>
<td></td>
<td>77</td>
<td>1.487</td>
<td>1.245</td>
<td>235</td>
<td>-0.99</td>
<td>3.96</td>
</tr>
<tr>
<td></td>
<td>88</td>
<td>1.467</td>
<td>1.196</td>
<td>223</td>
<td>-.91</td>
<td>3.84</td>
</tr>
<tr>
<td></td>
<td>99</td>
<td>-2.200</td>
<td>1.196</td>
<td>0.69</td>
<td>-4.58</td>
<td>0.18</td>
</tr>
<tr>
<td>66</td>
<td>44</td>
<td>-0.014</td>
<td>1.116</td>
<td>990</td>
<td>-2.23</td>
<td>2.20</td>
</tr>
<tr>
<td></td>
<td>55</td>
<td>-0.524</td>
<td>1.099</td>
<td>635</td>
<td>-2.71</td>
<td>1.66</td>
</tr>
<tr>
<td></td>
<td>77</td>
<td>0.963</td>
<td>1.208</td>
<td>427</td>
<td>-1.43</td>
<td>3.36</td>
</tr>
<tr>
<td></td>
<td>88</td>
<td>0.943</td>
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</table>

curriculum with the lessons and the game. A possible reason that this class result occurred may be attributed to the limited number of fact-based questions on the survey. Because there is such a limited number of questions (5) having students
answer one question differently on the survey makes a large impact on the mean score for the classroom.

<table>
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<th>Sig.</th>
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Table 37. ANOVA results and descriptive statistics for the delayed post survey for all classes

The Fischer’s Least Squares Difference post hoc analysis test also revealed that Winchell 66 and Stephenson 77 were statistically similar in their retained knowledge. However, Stephenson 88 had significantly higher knowledge retention than Winchell 66, but not from Stephenson 77. Possible reasons for this difference could be attributed to the activities within the classroom when the researcher was not present between the survey given immediately post curriculum, and the delayed post survey given. Further research would be necessary to determine the influence of outside sources on the students’ knowledge about wolves.

Control Group

A control group, comprised of third grade students from Stephenson Elementary, was used. They were considered fourth grade students at the time of the survey because it was given at the conclusion of their school year. After an examination of raw data from the control group the decision was made to drop it from
the study. Analysis of the control group revealed that there could be no comparison made with students involved with the study because the control group lacked the knowledge base and maturity that the fourth grade students participating in the study had, because they could essentially be considered fifth graders.

Table 38. A Fischer’s Least Squares Difference post hoc analysis for the comparisons between classes for the delayed post survey

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<th>(J) Class</th>
<th>Mean Difference (I-J)</th>
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CHAPTER V

CONCLUSION

The purpose of this research was to design an effective curriculum that focuses on wolves in Michigan; the effectiveness of the curriculum was to be determined by the amount of information students retained based knowledge and disposition survey administered post curriculum. The hypothesis for this research was that students receiving the full curriculum would score significantly higher than those receiving only a portion of the curriculum. The research hypothesis was not supported. Students with the highest increase in knowledge and those that experienced the greatest changes in knowledge and dispositions about wolves, that were statistically significant, were not necessarily those classrooms that received all of the materials in the teaching trunk.

Results of this study indicate that overall, students did learn from the curriculum. Students who received the lessons tended to retain more of the information presented in the curriculum then did students receiving only the game. Although knowledge did increase after the presentation of the curriculum, there was reversion back to pre-curriculum knowledge for students receiving all the lessons. Students did experience some changes in their dispositions with the passage of time. Results from the mapping portion of the survey did demonstrate that those students receiving the lessons from the curriculum did learn more about the locations of wolf
habitat in Michigan. This research was effective in that it showed that the *Wolves in Michigan* curriculum was successful in educating the fourth grade students about wolves. However, it was not successful with the amount of information about wolves that students actually retained. Therefore, this curriculum would be beneficial in educating Michigan students to a particular level about wolves if implemented by the Michigan Department of Natural Resources (MDNR), but would probably not result in a high level of proficiency if presented in the same manner as the research based instruction reported here.

**Ideas for Future Study**

Throughout the study there were several issues that presented themselves as potential for future research or modifications to this study if it were to be replicated. The classroom enactment of the curriculum provided the most opportunity for change in future studies. The *Wolves in Michigan* curriculum consisted of four lessons, each comprised of several different components. Lesson three from the curriculum uses a Deer Math worksheet from the book *Discovering Wolves* (Field, 1991). Although the sheet is very effective in conveying the message that wolves kill fewer deer than hunters, starvation, and cars it was difficult for all of the students to understand it. Therefore, presentation of this worksheet in a different way, or a modified worksheet that would make it easier for fourth grade students to understand would be ideal. A worksheet using actual numbers from the Michigan Department of Natural Resources would also be helpful, as it would allow students to understand how many deer are
actually killed by wolves. This would present students with a more realistic data set of how many deer are killed by Michigan’s wolf population, as compared to the hypothetical 50 wolves that were used on the worksheet.

Additional changes to the curriculum would be a better explanation about wolf habituation. Students seemed to decrease in their pro wolf perceptions after the lessons, and on a few of the surveys they mentioned that they did not like wolves because “they will hurt you if you are their friend.” Teaching students about the importance of keeping wolves from being habituated is extremely important, especially in areas where students may encounter wolves, but the lesson could be less personal. Another change would be to revamp the Wolves in Michigan lesson to incorporate more student interaction in learning about the political processes involved with wolf recovery.

Future researchers may want to consider the role that teachers have in helping students’ learning process. There were different levels of teacher interaction throughout this study, and this is something that should be taken into account in future studies to eliminate the margin of error. This may have limited the results of this research. Researchers may also want to examine the amount that students learn and retain with their teachers involved with the curriculum in comparison to the amount students learn and retain when their teachers are not present during the presentation of the curriculum. For this research, teachers were all present within the classroom. However, some of the teachers were extremely involved with students, and some were not involved during the course of the curriculum.
An effective control group would also be a recommendation for future research. Steps would need to be taken to ensure that any control groups chosen would be comparable in maturity, development, and education with the experimental groups. It is also advisable to administer the survey to the control group three times as well to measure the variations in their answers between each of the surveys. Surveys would also need to be administered in the same time frame that was used for the experimental groups.

In addition to having a more useful control group, a better analysis of the effectiveness of the *Wolves in Michigan* curriculum could possibly be completed if the curriculum could be presented to a fourth grade classroom in each county, or to each fourth grade classroom within the state instead of three fourth grade classrooms in two different areas. Presenting the curriculum in each county or each classroom would allow for a more thorough understanding of the effectiveness of the curriculum, and how location affects student knowledge base and understanding of the curriculum. However, it would be expensive.

Additional research would also want to consider the survey that was used to measure learning and retention for this research. A survey with more questions, both factual and disposition oriented would be more revealing. Several questions from the survey used in this study were difficult to analyze so rewriting these may yield better, more insightful information. The map on the survey was also an issue throughout this study. The map contained the outline of Michigan counties as well as the county names. These map aspects seem to influence students' selection of where they
believed wolves lived in the wild as many students either circled county names or county boundaries. A possible solution to this problem may be to use only an outline map of the state of Michigan without county boundaries or names. This would allow students to more accurately circle areas they believe wolves inhabit, as wolves do not arrange their habitat around county lines.

Overall, this research has been successful in creating a curriculum, and then in testing its effectiveness. Michigan residents and wolves will have a better future together if wolf education is implemented throughout the state so a copy of the curriculum and all of its components will be donated to the MDNR for their use. In conclusion, this research is a good starting point for wolf education in the state of Michigan.
Appendix A
HSIRB Approval
Date: February 21, 2006

To: Lisa DeChano, Principal Investigator
    Jessica Wesel, Student Investigator for thesis

From: Mary Lagerwey, Ph.D., Chair

Re: HSIRB Project Number: 06-02-01

This letter will serve as confirmation that your research project entitled "Educating Fourth Grade Students About Wolves (Canis Lupis) Using a Teaching Trunk" has been approved under the exempt category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may only conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: February 21, 2007
Western Michigan University, Department of Geography, Principal Investigator: Lisa M. DeChano, Student Investigator: Jessica M. Wesel

Western Michigan University, H. S. I. R. B. Approved for use for one year from this date:

FEB 21 2006

Dear Parent or Guardian:

I am a master's student in the Department of Geography at Western Michigan University working with Dr. Lisa M. DeChano. My thesis involves determining the effectiveness of a teaching trunk focusing on wolf education of fourth grade students. Because Michigan is one of the major states in the Wolf Recovery Program this curriculum could be used to dispel any misinformation about wolves that students may have, and provide the children with a greater understanding about wolf conservation. I invite your student to participate in this study as part of the control group.

As part of the control group your student will be asked to complete a short (15-20 minutes) questionnaire that asked about their knowledge and attitudes toward wolves. They will not actually be exposed to the teaching trunk. The purpose of doing this is to see if students who did not have any extra education about wolves know more, less, or about the same as students who were exposed to the teaching trunk.

There is minimal risk to participants because the entire study will be completed in the classroom so they will be seated during the study. It is important to have this portion of the study completed because it will help judge that effectiveness of the teaching trunk so that it may be used in the future by other 4th graders...

I invite you to allow your student to participate in this study. Only students with parent/guardian permission will be allowed to complete the evaluation. Please be assured that the questionnaire is completely anonymous (participants are not asked to provide their name anywhere on the questionnaire. At no time will any individual’s answers to the survey questions be provided to anyone but the collaborators of the research project, nor will individual scores be reported when presenting results in the published literature that results from this study. You will be able to view my thesis either at the school, or the superintendent’s office at the completion of the study.

Attached to the bottom of this letter is a consent form. Without this consent form your student will not be able to participate in the study. Please check the appropriate box, provide the student’s name on the line, and sign the form. Please return the researcher copy of the consent form only, including the photo release form, to a designated box in the school office no later than (will fill in), 2006. Please be assured that students can refuse to participate, stop participating, or choose not to answer questions at any time without prejudice, penalty, or risk of any loss of service your student would otherwise have.

If you have any questions regarding this study, please do not hesitate to contact Dr. Lisa DeChano at (269) 387-3536 or Jessica M. Wesel at (269) 352-1813. You may also contact the Chair, Humans Subjects Institutional Review Board (269) 387-8293 or the Vice President for Research (269) 387-8298 if questions or problems arise during the course of the study. Thank you for considering this opportunity for your child to participate in academic research.

Sincerely,

Lisa M. DeChano, Ph.D. Jessica M. Wesel
Masters Thesis Advisor Masters Student

This consent document has been approved for use for one year by the Human Subjects Institutional Review Board (HSIRB) as indicated by the stamped date and signature of the board chair in the upper right corner. Do not participate in this study if the stamped date is older than one year.
Informed Consent:

☐ My student has permission to participate in this study.

☐ My student does not have permission to participate in this study

Student’s name: (please print)

____________________________________________

Parent’s Signature:

____________________________________________

Student’s Signature:

____________________________________________
I understand that ________________ (name of talent) is the subject of a photograph, slide, videotape, and/or audiotape produced by Western Michigan University for ___ Lisa DeChano and Jessica Wesel_______ (client).

I understand that the intended use of the finished production is

________________________________________________________________________

I hereby waive any liability of Western Michigan University, its officers and employees, vendors, or subcontractors and the above-mentioned client and its directors, trustees, employees, or officers regarding the use of my likeness or voice. I further agree not to seek compensation including residual fees or royalties from such use other than that defined in a separate contract.

Signature of talent or legal guardian

Print name of talent __________________________ Relationship of guardian __________________________

Address __________________________

Phone number __________________________ Date __________________________

Project Title/Description

I agree that my likeness may be part of the stock files of W.M.U. for use in future production without notification.

Signature of talent or legal guardian __________________________
Student Assent Form

Name: ______________________________

Date: _____________________________

☐ I want to have my photograph taken during this phase of the study.

☐ I do not want to have my photograph taken during this phase of the study.
“Wolves in Michigan” Questionnaire

*Please do not put your name anywhere on this questionnaire.*

Date: __________________________

Age: ______

Gender: (please circle one) BOY GIRL

County you live in: ________________________________________________

*Instructions: Please circle your answer.*

1) It is illegal to kill or hunt wolves in Michigan. True or False

2) There are too many wolves in Michigan. True or False

3) Wolves are mean and will attack people if given the chance. True or False

4) I believe wolves kill too many deer in Michigan. True or False

5) I believe that wolves should be saved from hunting. True or False

6) Wolves attack and kill for the fun of it. True or False

7) All dogs are relatives of wolves. True or False

8) It is a good idea to feed wolves and befriend them. True or False

9) Conserving and protecting wolves is important. True or False

10) Wolves kill every animal that they attack. True or False
11) Describe a wolf pack, give some examples of what wolves do in packs.

Key words given one point each choice

Describe a Wolf Pack

What do wolves do in packs

Dominant (leader)

Hunt (find food)

Pups

Protect territory

Yearlings

Lowest Ranking

Family

12) What does conservation mean?

Key words given one point for each choice

Preservation

Protection

Save

Restore

13) Do you like wolves? Why or why not? Please explain in a few short sentences

No Answer or I don’t know-0

Yes-1

No-2

Yes and No-3

14) Please describe what Wolf Recovery means to you in a few short sentences.
15) Please circle on the map of Michigan the areas where wolves live in the wild. 
*Circle represents area where wolves live in the wild in Michigan*
Appendix C
School Permission Letters
April 5, 2006

Dear Ms. Wesel,

I received the information you forwarded regarding your graduate research project on wolves. I shared this information with our 4th grade teachers and they are very enthusiastic about it and would like to participate.

You can contact Steve Buyarski, 906-753-2223 ext. 120, to make arrangements for coming in to set up your program and teach the classes.

If there is anything else you need from me let me know. Thank you for considering us for your project, I think the students will find it very interesting.

Sincerely,

Al MacNaughton
K-6 Principal
Stephenson Elementary Schools
W535 River Road
Stephenson, MI 49887

906-753-2223 ext. 118
amacnaughton@stephenson.k12.mi.us
To Whom This May Concern:

I am writing this letter to confirm that Ms. Jessica Wessell has permission to conduct research for her Michigan Wolves project at Winchell Elementary. She will conduct her project in our fourth grade classrooms in cooperation with the classroom teachers.

Sincerely,

Vickie Winfield
Principal
Appendix D
Wolves in Michigan Curriculum
Wolves in Michigan

Compiled By: Jessica M. Wesel
Lesson 1: Wolf Adaptations

Lesson Overview:
This lesson is an introduction to wolves, and was adapted from a program given by the International Wolf Center. Students will engage in this activity and learn about the different adaptations that wolves have that allow them to survive in the wild. The students will name the different parts of a wolf’s body, and an explanation will be provided of the usefulness of this characteristic. Students will be able to identify different characteristics of wolves, and how these characteristics help the wolf to survive in the wild.

Standards:
Science Benchmark: Standard III.2 The Organization of Living Things

Objectives:
Students will be able to list and explain three characteristics of wolves.
Students will be able to explain why wolves need adaptations to survive in the wild.

Background:
All animals have adaptations to help them. Humans have opposable thumbs, wolves have sharp teeth and a variety of different adaptations to help them survive in the wild. Typically adaptations that animals develop help them to better survive in the wild, and to perform their functions that will aid the survival of their species.

Procedure:
1) Vocabulary Development: Review this term before beginning the lesson.
   Adaptation: BIOLOGY a change by which an organism or species becomes better suited to its environment.

2) Classroom Activity: Understanding Adaptations
   Begin the exercise by asking the students to explain that wolves have adaptations that help them to do their job in the wild. Ask the students if they know what an adaptation is. Explain that an adaptation is something that helps an animal to do the job that it needs to do. Explain that we (humans) have an adaptation that makes us different from all other animals, and helps us to do almost everything that we need to, so that we can survive.
   Ask the students what our adaptation is, if the students are having a hard time guessing, hold up your hands and wiggle your thumbs. Explain to the students that our adaptation (opposable thumbs) is what allows us to do many of the things that we do every day to survive. Explain to the students that several animals have adaptations, then pass out the adaptation worksheet (located at the back of this lesson), and put up the blank worksheet overhead/poster. Ask the students to work with their groups to
fill out the adaptations for the different animals. The students should only work on the first two columns and should eliminate the portion of the worksheet that covers plant adaptations. After a few minutes, put up the answer key transparency/poster and explain very briefly how the adaptations listed are helpful for the animals that are pictures. Ask the students to try and tie their shoes and/or write without using their thumbs. Then ask the students for a volunteer, you will use this volunteer throughout the exercise.

The next part of the exercise will be largely dependent on the student’s responses, but you need to be sure that all of the adaptations are covered. You may need to lead students to the correct responses if they are not arriving at them on their own. You will want to ask the students what some characteristics wolves have are; ask them what things to wolves have that are adaptations, like our opposable thumbs. Students should respond with all of the adaptations that are listed below. As the student calls out the adaptation, you explain how that adaptation is useful for the wolf and use the prop that is listed for the volunteer.

Fur undercoat - **Wool sweater** - this helps keep the wolf warm
**Protective outer layer of fur - Raincoat** - this helps protect the wolf from the elements, such as wind, snow, and rain
**Teeth - knife and fork** - this allows the wolf to tear its food so they can eat it
**Jaw - Nutcracker** - this helps the wolf to break bones, and hold onto prey so it can catch and eat its dinner. A wolf’s jaws are strong enough to break a moose leg in half.
**Ears - Cups on String** - these allow the wolves to hear prey, and their pack, their families up to 5 miles away. Point out to the students that if we can hear a wolf howl, it means that the wolf is approximately only one mile away.
**Nose - Mask and Scent page** - a wolf had a very powerful sense of smell, the stamp is what we could smell if there were peanut butter on the page, but a wolf could smell the entire area
**Tail - Scarf** - the wolf uses its tail to cover its nose when sleeping, and to communicate with other wolves. The tail allows the wolf to cover its face in the snow and protect its face from harsh winter weather.
**Eyes - Flashlight** - the wolves eyes are very powerful, helping the wolves to see each other and to see prey even in the dark
**Pack (friends) - stuffed wolf** - the wolf has a pack, like a family that help it to grow, learn and survive just like our families help us
Looks like a wolf-wolf mask

**Claws- shovel** - it can use its paws to dig when it needs to, the paws and claws help the wolves to dig a den when they need a safe place to have their puppies, just like human parents prepare a room for a new baby, a special place for the baby.

**Paws- Snow shoes** - the wolf uses its big paws so that when it needs to it can walk across the snow, and it will not sink into the snow, so it is easier for the wolf to catch prey, and to go from one place to another. Feel free to pass around the paw print castings at this time for the students to examine.

**Protection-scat** - the wolf’s digestive track has the ability to protect itself from the sharp and dangerous things (like bones) that the wolf may eat. The wolf’s system will wrap the dangerous things being passed through its system in hair to protect itself as it is digesting food. The scat may be passed to the students to examine at this time, remind them not to open it as it is preserved.

When the all of the adaptations have been discussed, the volunteer should look just like our wolf friend, and the students should have learned about wolf adaptations, and why they are important to the wolf’s survival.

**Assessment Options:**

1) Have the student write three sentences about the wolf’s adaptations; the sentences should begin with: *An adaptation that the wolf had is____________, the reason the wolf needs this is to ______________.*

2) The students will be able to look at a picture of a wolf, and identify three or more adaptation, and explain the usefulness of the adaptation for the animal.

**Adaptations/Extensions/Enhancements:**

1) Engage the students in guided study, demonstrating the adaptation activity and explaining what you expect the students to do, then have the students separate into groups and perform the part of the activity where they discuss the different adaptations in groups, and then have the groups report their answers in the original setting, explaining each adaptation, as a class.
References:
   Email: outreach@wolf.org

2. International Wolf Center (2006) International Wolf Center Home (Date Retrieved:
   Sept 25, 2006)
   http://www.wolf.org/wolves/index.asp

### EXAMPLES OF ADAPTATIONS

<table>
<thead>
<tr>
<th>Coping with adverse factors (example cold)</th>
<th>Plants</th>
</tr>
</thead>
<tbody>
<tr>
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<th>Plants</th>
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<thead>
<tr>
<th>Finding and attracting mates, pollination</th>
<th>Plants</th>
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<tr>
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<th>Plants</th>
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<td><img src="image9" alt="Example of animals migrating and seed dispersal" /></td>
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### Examples of Adaptations

<table>
<thead>
<tr>
<th>Animals</th>
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<tr>
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<tr>
<td>Heavy fur</td>
<td>Deciduous habit</td>
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<tr>
<td>Flying south</td>
<td>Hardiness to cold</td>
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<tr>
<td>Hibernation</td>
<td>Bud</td>
</tr>
<tr>
<td><strong>Observing food</strong></td>
<td></td>
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<tr>
<td>Long neck to reach treetops</td>
<td>Long thin snout for digging out ant hills</td>
</tr>
<tr>
<td>Quick-moving tongue</td>
<td>Extensive roots and root hairs for absorbing water and nutrients</td>
</tr>
<tr>
<td><strong>Escaping predation</strong></td>
<td></td>
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<tr>
<td>Running ability</td>
<td>Qulls</td>
</tr>
<tr>
<td>Bad smell</td>
<td>Protective coloration</td>
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<tr>
<td><strong>Feeding and attracting mates (pollination)</strong></td>
<td></td>
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<tr>
<td>Odors given off as sex attractants</td>
<td>Elaborate &quot;headgear&quot;</td>
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<tr>
<td>Exotic plumage</td>
<td>Various flowers attract specific insects as pollinators</td>
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<tr>
<td><strong>Migration and dispersal</strong></td>
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<td></td>
<td>Parachute or wing for wind dispersal</td>
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Lesson 2: Wolf Communication and Behavior

Lesson Overview:
This lesson is an explanation of the dynamics within a wolf pack. The relationships within the wolf pack are compared to the relationships within a family. Communication between wolves and dominance behaviors will be explained, with a focus on tail posturing and body language.

Standards:
Standard III.2 The Organization of Living Things

Objectives:
The students will be able to view and identify different wolf dominance behaviors. Students will be able to list and discuss wolf pack behavior. Students will be able to compare and contrast wolf pack structure with a human family.

Background:
Wolves have very dynamic relationships within their pack structure, and as packs interact with each other. Wolves are able to communicate through several different means, they are able to howl, use body language, etc. As students come to understand the different ways that wolves communicate and interact with each other, and also the different dynamics that exist within the pack structure, they may come to understand wolves better, and may come to a better understanding of what wolves need to survive, and how they are able to survive in the wild.

Procedure:
1) Vocabulary Development:
Begin by having the students get into groups with between 3 and 5 students in each group. Ask the students to explain what they think that dominant means. Allow some students to share their definitions, and then review the definition with them. Repeat this for each of the vocabulary words.
Dominant: most important, powerful, influential
Submissive: ready to conform to the authority or will of others, meekly obedient or Passive: accepting or allowing what happens, or what others do, without active response or resistance
Male: relating or characteristic of men, or male animals; masculine
Female: relating to or characteristic of women, or female animals
Territory: (zoology) an area defended by an animal or group of animals against others of the same sex or species
Yearling: an animal a year old, or in its second year, could be compared to teenagers within the family structure
**Regurgitate:** bring (swallowed food) up again to the mouth

**Rendezvous Point:** a place that wolf pups will stay together and wait for the wolves that were hunting to return

2) Classroom Activity 1:
Begin the lesson by asking the who is in charge within their families (Mom, Dad, Grandma, Grandpa, etc) then explain that wolves have families called packs, and that wolf families also have members who are in charge. (Show picture of wolf pack) The members of the wolf family that are in charge are called the dominant pair. There is a male (boy) wolf, and a female (girl) wolf that make-up the dominant pair. These wolves are like the parents. The dominant pair mate, and have the puppies, lead the pack, determine territory, find places to live, etc. The dominant pair act as the parents of the pack. Ask the students to discuss within their groups the other members of their family. Take a few responses from the class. As you continue, have the students raise hands to indicate who has the following members within their families and then make the comparisons with members of a wolf pack.

- **Teenagers – yearlings**
- **Step-Brothers/Step-Sisters** – a wolf that was not born into the pack, but joined the pack at a later time.
- **Other children (siblings under 13)** - wolf pups

Continue by explaining that the wolf pups are like the new babies in a family, or the toddlers. You can explain at this point how the wolf pups are different from the other members of the pack in size, in appearance, in needs, etc. Give the students a few minutes to discuss within their groups the following things: (if it is not feasible to work with the students in a groups setting, then have students answer by raising their hands in the class)

1. List the things you could not do for yourself when you were a baby, but that you can do now.
2. How did your parents feed you?
3. Tell us when you were ready to eat solid foods.

Take a few answers from each group for #1, and then explain that the pups are the most needy members of the pack, and that when they are first born they will need to only drink their mother’s milk, and that they live for several weeks in a den. Explain that the den in a hole that the dominant female and other members of the pack dug before the pups were born. The pups never leave the den at first, and then they leave only to make short trips outside. Take a few answers for both #2 and #3 and then explain that as the pups grow they will begin to eat the food that other pack members eat and then regurgitate (spit back up) for them. Eventually the pups will be big enough to eat from the animals that the other members of the pack kill. Ask the students when they sit down to dinner, who in their family eats first. Take a few
answers and then explain that although the pups are the youngest they are usually are the last ones to eat. Ask the students why the pups may be the last to eat? Then if they do not guess explain to them that it is most important for the adults to get food, especially the dominant pair because if they starve the pack will not be able to continue. Although this seems mean to us, it is a very real part of surviving as a wolf in the wild. Ask the students who takes care of babies when their parents need to leave for a while. Take a few answers from students, and then explain that wolves need babysitters too. Now ask the students to raise their hands if they have a fire plan. Have them tell the other members of their group where they are supposed to meet their families if there is a fire. Have the children explain why having a safe place to meet is important. Then explain that while the other pack members are out hunting, there is always at least one pack member that is assigned to stay with the pups at a special place called a rendezvous point. Explain to the students that this is a safe location similar to their meeting places for their fire plans) that the pack has chosen to meet at after a hunt is finished, or after a kill has been made. The wolf that is chosen to stay acts as a babysitter, and needs to make sure that the pups are safe and protected while the others are away. This is similar to parents getting a babysitter for their kids while they go out to eat, or while they run to the store to get something for dinner.

3) Classroom Activity 2:
Pictures and explanations for this activity were taken with permission from the website http://timeberwolfinformation.org. Explain to the students that another very important part of wolf life and pack life is dominance behaviors. Ask the students again to define dominance. Dominance is the way that the two wolves that act as parents show the other wolves that they are in charge. Ask the students to discuss in their group how their parents show that they are in charge, or which of their parents is dominant. Ask the students to explain how we (people) communicate with each other. Then explain that because wolves cannot talk to each other with words, it is very important for them to communicate in other ways. Ask the students to explain ways that wolves communicate with each other. Explain that wolves communicate with each other by howling, through scent, and body language. Continue by asking the students to take a moment in their groups to figure out why this communication is important. Once the students have given their answer, explain that it is very important for wolves to know who is in charge and who is dominant; these communications/behaviors are essential to the survival and continuation of a wolf pack. Show the students the posters with different pictures of the wolf dominance behaviors. Begin by showing the students a few of the obviously different tail positions using the posters provided (the high tail, fully tucked tail, wagging tail, attacking body position, playing body position, fearful body position, etc.), have the students discuss with their groups what they think the wolves are saying, then have
the students also explain why they think so. Give the students the correct answers and explanations. Continue by showing the rest of the body positions and giving the explanations, when finished allow the students to review the tail position and body language flash cards within their groups. Once the students have had an opportunity to review the flash cards with each other. (5-10 min.)

**Tail Positions:**

This is a high tail position, it indicates that the wolf if a dominant wolf, probably one of the dominant pair, either male, or female.

This is a horizontal tail position, this typically means the wolf is ready to attack, or is hunting.

This wagging of the tail usually indicates the wolf is relaxed.
This low, drooped position indicates the wolf is relatively relaxed.

This low tail, drooped position also indicates that the wolf is relaxed.

This half tucked tail indicates that this wolf is submissive, and is being submissive to a more dominant wolf.
This fully tucked tail position, indicates either fear and/or is an act of submission.

**Body Positions:**

This body position shows a wolf that is attacking.

This is the body position of a wolf when it is defensive, or threatened.
This body position shows a more dominant wolf pinning the other wolf to the ground.

The body position of the bottom wolf is of the wolf being passive submissive.

This body position shows the wolf is playing.
This body position shows that this wolf is running and is fearful, and submissive. Note the tucked tail position.

The wolf that is on the left is approaching the other wolf, or responding to the other more dominant wolf in active submission.

This body position is of a wolf playing.
This picture shows a yearling, submitting to a fully dominant wolf.

This body positions indicates the wolf is feeling fear and/or aggressiveness.

Once the students have had an opportunity to learn and review the different tail and body positions, review the included DVD, and see if the students can identify the different behaviors that they have just studied with live wolves interacting with each other. If available it is also a good idea to recommend the students look at the website http://wolf.org to watch the wolf cams so they can see live wolves interacting. If there is time, it is also fun to take a few minutes to howl with the kids, or play the included Wolf Songs CD.

Assessment Options:
1) Give the students a handout with different pictures of wolf behaviors; students will be able to identify correctly (at least) 7 out of 10 of the dominance behaviors.
2) The students will be able to write a brief essay explaining the behavior that wolves demonstrate in a pack situation, and then compare and contrast these behaviors with the behavior that we as humans demonstrate within our families.

3) The students will be able to make a list comparing the different members of a wolf pack to the different members of our families.

Adaptations/Extensions/Enhancements:
This lesson could be adapted to involve different games or activities with the flash cards provided for the students. The teacher could create the games, or could adapt the flash cards to other traditional games such as a Jeopardy-type game, a memory game (two sets of the same color would need to be combined for this one), a charades-type game, or a Pictionary-type drawing/guessing game.

References:

   http://www.wolf.org/wolves/index.asp


   http://www.timberwolfinformation.org/kidsonly/posture/postures.htm

Lesson 3: Wolf Ecology and Conservation

Lesson Overview:
This lesson is an introduction to conservation and wolf ecology. The students will be engaged in activities that help describe why conservation is important. Students will also engage in activities that help to understand the basic predator/prey relationship, and the need for both predators and prey to create balance in the ecosystem. Students will be encouraged to look at the predator/prey relationship, and understand that predators are not mean by taking prey, they are trying to survive.

Standards:
Social Studies:
Standard II.2 Human/Environment Interaction

Mathematics:
Standard IV.2 Representation and Uses of Numbers
Standard V.1 Operations and Their Properties

Objectives:
The students will be able to have a basic understanding of conservation.
The students will have an understanding of predator/prey relationships and wolf ecology.
Students will be able to explain how conservation of wild lands will influence both predators such as the gray wolf, and prey such as the white tailed deer.

Background:
The ecosystem is very delicately balanced, and although many times people see predators as mean, and assume that the predators are endangering prey by killing too many; the presence of predators has been shown to help the ecosystem to remain more balanced. It is important when examining the predator/prey relationships to look at the role of humans as predators, and to examine the nature of humans as being competitive with other animals such as wolves for food sources.

Procedure:
1) Vocabulary Development:
Have the students get into groups, and then ask them to explain the meaning of the different vocabulary words. Once the students have had an opportunity to answer, give them the correct definitions.
Conservation: noun the action of conserving something in particular. Preservation, protection, or restoration of the natural environment, natural ecosystems, vegetation, and wildlife. Prevention of excessive or wasteful use of a resource.

Predator: noun an animal that naturally preys on others

Prey: noun an animal that is hunted and killed by another for food

Carnivore: noun an animal that feeds on flesh

Herbivore: noun an animal that feeds on plants

Omnivore: noun an animal or person that eats food of both plant and animal origin

Endangered: (of a species) seriously at risk of extinction

Threatened: cause (someone or something) to be a vulnerable or at risk; endanger.

Extinct: (of species, family, or other large group) having no living members

Habitat: the natural home or environment of an animal, plant, or other organism.

2) Classroom Activity 1:
First, it is essential to review again the vocabulary at the beginning of the lesson plan. Begin by asking students what conservation means. Explain to the students that conservation means preservation, keeping things/lands/animals/anything safe from destruction. It is very important that we protect our wild lands, and that we protect things that are rare to us. If we destroy things such as wolves, and wild lands, and other predators, or prey just because we do not like them, what will happen. Have the students work in groups to brainstorm and then explain what they think would happen if we destroyed all of the wild lands, predators, etc. Explain to the students that everything has a purpose within the environment, the surrounding areas. Using the Prentice Hall overhead and handout, show the kids the blank overhead with the animals, and then ask the kids to label the different animals that act as and predators. Ask the students where humans fit into the predator/prey classification, are we predators or prey. Ask the students if we are being mean each time that we eat a hamburger, and ask them to remember that wolves cannot just run into a store when they feel like eating meat, they need to kill the animal themselves.

Explain that prey are essential to keeping plants from overgrowing and taking over everything, and predators control the prey from taking everything over. When there is an absence on one or the other, predators, or prey, the environment will not be balanced. Without predators, the prey will over-consume the plant life, and destroy
precious animal species, and without the prey the plant life will overgrow and predators will starve. Put up the handout from Discovering Wolves pages 10 and 11, and allow the students to see the pictures showing the landscape without predators, and the landscape with predators. Ask the students what the pictures may be different, the answer that you want to solicit from the students is that the picture with no predators has more deer, and more damage to the plant life because the wolves as a predator keep the number of deer down, and also cause the deer to spend less time grazing in one area because they need to keep moving to not be a target for wolves. Ask the students to explain how many deer and other prey wolves actually kill, try and get them to give you a percent. Now pull the wolf poker cards out of the trunk, and have the students choose cards at random one by one (The Wolf Poker cards are adapted from a game from the International Wolf Center). Ask the students to read their cards to the class as they draw them, and then have them place the card back into the deck. Make two categories on the board one labeled successful kill, and one labeled failure to kill, as the students read their scenarios place a mark under the correct category. This activity consists of 10 cards, each card contains a wolf hunt scenario; only two of the cards have successful kills are a scenario. This game should allow the students to see that although wolves are skilled hunters, they do not typically kill an animal each time they go out to hunt. When each of the students have had an opportunity to choose a card, and all cards are returned explain to the class again the idea that wolves are not always successful. Have the students calculate the percentage of success that our classroom hunts yielded. The percentage is calculated as follows:

\[
\text{Number of successful kills} = \frac{\text{percentage of successful kills}}{\text{Total number of students}}
\]

\[
\text{Number of failed kills} = \frac{\text{percentage of failed kills}}{\text{total number of students}}
\]

Explain that wolves typically only kill 20% of the prey they hunt. Have the students discuss the many reasons that wolves are not always successful when they hunt.

The final activity is the Deer Math worksheet. Explain to the students that there are many other things that kill deer, or other animals in the wild. The students will now take 10-15 minutes to complete the Deer Math worksheet. When the student have finished the worksheet, discuss with them that the wolf, the predator is not the major reason that deer are killed. That hunters, starvation/sickness, and cars kill more deer each season than the wolf does. Also explain that although this worksheet is for Wisconsin, the numbers are similar for Michigan, at this point, pass out the Wolves and Deer in Michigan handout to take home.
Assessment Options:
1) The students will be able to write an essay comparing and contrasting predators and prey. The students will be able to describe the similarities between predators and prey as well as the differences.

2) The students will be able to calculate the percentage of kill failure rate when given the numbers to plug into the equation. The students will also be able to complete a math worksheet with basic problems addressing deer kill numbers.

Adaptations/Extensions/Enhancements:
1) Pass around the scat included in the trunk. Allow the students to look at the scat and describe what it looks like to them. Ask them to point out the different things they can see in the scat. Explain to the students that because wolves are predators, they also swallow many things that could actually hurt them, or things that cannot be digested; the hair can become a protective coating over these types of things. The hair allows the wolf to get rid of the parts of their prey that they have eaten that could hurt the wolf if they did not swallow hair as well. Ask the students what they think they would find within a herbivores (preys) scat, and how they would differ. Use this opportunity to ask the students to define herbivores and carnivores. Then explain to them the definitions given above. When finished have the students write a brief essay in which they compare and contrast predators and prey; herbivores and carnivores.

2) Predator/Prey Game: (to be played outside) Divide the students into two groups, one group will become the prey (2/3) and one group will become predators (1/3). Put a can with scraps of paper in a central location. Explain to the students that they are going to need to find a place to hide until they hear the whistle. Then give the prey 5 min. to hide, and blow a whistle and then send the predators out to find the prey. Once they prey hear the whistle they will need to start their plan to find/get to the food. Once the game is finished, engage the students in a conversation about their experience. How did they feel in their role as predator or prey? What would/could they have done differently so that they could get the food? If they got the food, how were they successful in doing that? Using the responses from the students, explain that sometimes prey need to change their behavior so that they are less vulnerable to predators that may be aware of the eating patterns of the prey. Sometimes prey that are willing to sit in the open and eat/graze when there are no predators around will be less willing to engage in these behaviors when predators are around. Often people think that the predators make it so there are much fewer prey, but in reality although there are sometimes fewer prey, the prey are hiding more, and engaging in behaviors that will make them less vulnerable to predation.
References:

   http://www.wolf.org/wolves/index.asp


   Email: outreach@wolf.org
Producers

Primary consumers
Herbivores

Host

Consumers

Secondary consumers
Carnivores

Predator-prey relationships

Parasite

Host-parasite relationship

Third-order consumers

Prey

Predator

Omnivore

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SORRY!

You got kicked in the head by an elk hoof.

You’re alive, but what a headache!
SORRY!

The bull moose you were chasing was healthy and ran away.

You were too slow!!
SORRY!

The bison stood their ground and didn’t run, so you couldn’t attack.

My, what sharp horns they have!
SORRY!

You attacked an elk by the neck and it shook you off.

Better luck next time!
SORRY!

You tried to attack an elk calf, but mom protected her young.

What a tough momma!
SORRY!

You were hunting alone.

Better find some pack members next time!
SORRY!

It was a mild winter and the deer are healthy and ran too fast!

Hope for snow!!
SORRY!

You have mange and cannot keep up with the herd of elk.
Congratulations!

You have killed a bison calf!

Not too much food, good thing you’re the alpha!
Congratulations!

You have killed a 15 year old bull elk!

What an old elk! Eat up!
Lesson 4: Wolves in Michigan

Lesson Overview:
This lesson is an overview of the Endangered Species Act, and how wolf control policies affect the citizens and wolves in the State of Michigan. Students will engage in activities that help them to understand the policies that are currently in place within Michigan. Students will also be discussing several controversial wolf control issues and changes to the endangered species act. Students will be thinking objectively about how all of these practices will affect wolves in Michigan and throughout the country.

Standards:
Social Studies:
Standard II.2 Human/Environment Interaction
Standard III.1 Purposes of Government
Standard III.3 Democracy in Action

Objectives:
The students will have a basic understanding of current and possible future wolf management programs in Michigan.
Students should will a basic understanding of the Endangered Species Act and how it affects the people living in Michigan in regards to the Gray wolf.
Students will have a basic understanding of the role of the DNR for Michigan Wolf Management.

Background:
The Endangered Species act was created in 1973 as a result of several national and international efforts to protect animals from extinction both within their countries and worldwide. The endangered species act made it illegal to do anything that would jeopardize or destroy the critical habitat of a listed species. Over the last three decades several changes have been made to the original endangered species act. Many of the changes are related to recovery issues for listed species. Because Michigan’s wolf population has met its goal of having 100 wolves or more for over five years, the U.S. Fish and Wildlife Service has decided to remove Grey Wolves from the Endangered Species list, and change the status of the wolves in Michigan and Wisconsin to Threatened. This move to de-list the wolves from the Endangered Species list, was attempted in 2003, and the U.S. Fish and Wildlife Service had proposed to change the classification for not only Minnesota, Wisconsin, and Michigan, but for the entire Eastern Portion of the United States. Currently no wolves have been found residing anywhere else in the Eastern U.S. Two different court rulings stated that the U.S. Fish and Wildlife Service could not go through with the proposed delisting, and the U.S. Fish and Wildlife Service needed to change their
proposal. In March of 2006, the U.S. Fish and Wildlife Service submitted another proposal to de-list wolves from endangered status to threatened, however this time they have proposed to only de-list the Western Great Lakes Population Segment, which includes only Minnesota, Wisconsin, and Michigan. The Michigan Department of Natural Resources is responsible for coming up with the wolf control guidelines that will go into effect if this proposal is accepted.

Procedure:
1) Vocabulary Development:
Ask the student if they know or can define the vocabulary words. Once the students have had time to explain their answers, explain to them the actual definitions.

   Endangered: (of a species) seriously at risk of extinction
   Threatened: cause (someone or something) to be a vulnerable or at risk; endanger.

   Extinct: (of species, family, or other large group) having no living members

   Endangered Species Act: A law that congress passed in 1973 to “conserve the ecosystems upon which endangered and threatened species depend, and to conserve and recover listed species.” (USFWS)

   Michigan Department of Natural Resources: The Michigan Department of Natural Resources is a state governmental organization that is responsible for the stewardship of Michigan's natural resources and for the provision of outdoor recreational opportunities.

   Habitat: the natural home or environment of an animal, plant, or other organism.

Classroom Activity 1:
Start by discussing the purpose of the Endangered Species Act, and how this act protects all animals that are endangered of becoming extinct within the foreseeable future. Then have the students to explain what is going on with wolves in Michigan right now. Explain to them that because wolves in Michigan, and Wisconsin have meet their Wolf recovery goals, they government (U.S. Dept. of Fish and Wildlife) wants to change the status of grey wolves in certain parts of the United States from Endangered to Threatened. Ask the students to explain what the differences between threatened and endangered are, and write them on the board as the students answer. Explain to the students that changing the status of wolves will be really important to the people who live in Michigan. Ask the students what they think would happen if the status of wolves was changed from endangered to threatened in Michigan? Make a list on the board.

Put up the “Contiguous United States transparency/poster, and ask the students to draw with a dry erase marker where they think that wolves live in the United States.
The put up the “State of Michigan” transparency/poster, and have them draw with a dry erase marker where they think that wolves live in Michigan. Then tell the students that the USFWS has previously (2003) proposed that wolves be delisted, and a map was drawn to show the regions of the country where wolves were to be taken off of the endangered list, and placed on the threatened list. Show the students the “Eastern DPS” and show the students the regions that the country was split into. Ask the students to discuss within their groups why this proposal may have been rejected. Remind the students where the wolves are living in the U.S. by putting up the “Michigan Wolf Habitat Map” transparency/poster. Now have the students share their reasons why these boundaries may be a good idea, or why they may not be a good idea. Once the students have shared their ideas, show them the “Western Great Lakes DPS” map transparency/poster. Now have the students discuss in their groups why these boundaries may or may not be better then the previous ones. You may need to put up the “Eastern DPS” map transparency/poster again so you can refresh the student’s memories.

Inform the students that the original proposal was rejected because two courts ruled that the ruling was not acceptable because the boundaries were not representative of the locations where wolves were recovered, and did not provide adequate protections for wolves in areas where they could still have the opportunity to recover. Tell the students that the new proposal has not yet been accepted, there are a few things that need to happen first. Explain to the students that there is a public comment period where people can either write and send their comments to the USFWS, or where people can attend these public meetings and ask questions, make comments, and provide insight before the proposal is accepted as law. The public hearings are a wonderful opportunity for us to get involved with the laws and regulations that affect us. During these meetings the USFWS has said that comments that will help, and be effective in helping them to make a decision need to be factual and/or scientific, and must be a rational interpretations of the data available.

Ask the students how they would be able to comment if they could not attend one of the four meetings that are being held in the area for the Western Great Lakes DPS? Allow them a few min to discuss. Now, explain to the students that, although there are not a lot of meetings, there are still other ways. You can write or email your comments to the USFWS. Explain that the USFWS is looking for scientific reasons for your comments, and not emotional comments, have the students offer their opinions why they do not want “emotional” responses.

3) Classroom Activity 3:
Explain to the students that the Michigan DNR has a lot of responsibilities, and when/if the proposal goes through to delist the wolf in Michigan from endangered to threatened the primary responsibility for control of the wolves, will fall to the Michigan DNR. Tell the students that there are often a lot of challenges to wolf
control, and when you are trying to make decisions about wolves. Ask the students to list in their groups the different challenges that they think the Michigan DNR may experience. Tell the students that currently the MDNR is trying to develop a new control plan for the change in status of the wolf from endangered to threatened. This change in status and in control will allow for more freedom to the MDNR to use lethal means if necessary to get rid of animals that are threatening other people, and/or killing livestock. Pass out the "Wolves and People Map" to the students and put up the transparency/poster.

**Assessment Options:**
1) The students should be able to fill in the blanks to the following statement. The federal organization responsible for policies about wolves is ____________, and the organization in Michigan responsible for wolf related decisions is ____________.

2) Students should be able to explain what MDNR stands for, and what USFWS stands for, as well as explain their roles in wolf recovery.

**Adaptations/Extensions/Enhancements:**
1) The students will be able to write a short essay explaining how they would make the decisions for wolf control, based on the "Wolves and People Map" provided.

**References:**


http://www.fws.gov/endangered/
Status of the Gray Wolf in the Contiguous U.S.

1. Western Distinct Population Segment
2. Eastern Distinct Population Segment
3. Southwestern Distinct Population Segment (includes Mexico)

- Endangered
- Threatened
- Not Listed
- Nonessential Experimental Populations
- DPS Boundary

SW DPS Extends Into Mexico
In 2003 the U.S. Fish and Wildlife Service changed the classification of the gray wolf (Canis lupus) under the Endangered Species Act (ESA). As a result of that change there are now three separate ESA listings for the species which correspond to three geographic areas in the lower 48 states where there are ongoing gray wolf recovery programs. In the eastern and western U.S., wolves were reclassified from endangered to threatened because wolf recovery programs are nearing their recovery goals. The definition of “threatened” is “likely to be on the brink of extinction in the foreseeable future,” and is a more appropriate classification than “endangered” because those recovery programs have succeeded in reducing threats to gray wolves and increasing their numbers and range in the eastern and western U.S. This change to “threatened” status allowed Federal protections to be relaxed in those areas. In the Southwest, where gray wolf recovery is in the early stages, wolves remain classified as endangered. “Endangered” means they are on the brink of extinction.

To reclassify wolves in the eastern and western U.S. from endangered to threatened we listed the geographic areas where there are ongoing gray wolf recovery programs as Distinct Population Segments (DPS). The map below shows the areas included in the Eastern Gray Wolf DPS, the Western Gray Wolf DPS, and the Southwestern Gray Wolf DPS, where the gray wolf continues to be listed as endangered.
Wolves And People

Cities  Wolf habitat  Livestock/farms
Sure Jessica..

I know that my stuff is posted all over and it is meant to be shared.... but, it is nice to get credit & I appreciate your asking me for permission .. Please note I gave credit to Zimen and Fox who pioneered so much of that behavior work that my charts are based upon. Let's make sure all the credits are correct. I did some new drawing ... in fact, I am not sure what website is that has my things posted and what version .. can you send me the link? Where you saw it .. etc. You may need a better copy to work from?
I have a written education package too.....track pack book and many graphic charts and materials used for the big wolf boxes. I am always glad for folks learning more about the wolf and too help ... if only knowledge translated to the politics of wolves.
Are you going to the Wolf Stewards meeting April 26-27 in Michigan?

Yours, Karlyn
May 8, 2006

Jessica Wesel
4411 Hemmingway Dr.
Kalamazoo, MI 49009

Dear Jessica,

Dog-Eared Publications grants you permission to use the two activities we discussed on the phone for your project for your current degree.

I would like you to acknowledge each activity with the following words on the exact page (not just as an acknowledgement in the back of the curriculum):

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I also request the opportunity to see the pages with our materials prior to your using them with teachers.

We discussed your including our catalog or flyer when you do a wolf box. I will put in a few catalogs. However we do come out with a new catalog about once a year, so in the future you could get in touch with me to update your supply.

It was fun hearing your enthusiasm for your wolf project. I wish you the best as you bring this project to completion and move on to other exciting educational efforts.

Best Regards,

Nancy Field
Publisher/Wildlife Biologist
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2006 Proposal to Delist the Gray Wolf Western Great Lakes Distinct Population Segment (Date Retrieved: September 25, 2006)

