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An Environmental Education, Science Based, Curriculum On Raptors, To Help Bring A Focus And Awareness To The Raptors Found In Minnesota

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AN ENVIRONMENTAL EDUCATION, SCIENCE BASED, CURRICULUM ON RAPTORS, TO HELP BRING A FOCUS AND AWARENESS TO THE RAPTORS FOUND IN MINNESOTA

by

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ABSTRACT

Damiano, K. An environmental education, science based, curriculum on raptors, to help bring a focus and awareness to the raptors found in Minnesota (2018).

The area of focus addressed in this capstone project was a curriculum on raptors, specifically raptors found in Minnesota. It documents one naturalist's creation of a science-based unit that implements different aspects of students' learning styles. Pedagogical concepts used in the development of this curriculum included the North American Association of Environmental Education's (NAAEE) guidelines (NAAEE, 1996) as well as Understanding by Design – the second part of the framework: "backwards design" (Wiggins & McTighe, 2011). The author uses related literature to construct meaning and justification to the study to help support the details of the unit. She focused on birds of prey for this curriculum for a few reasons. One, was to bring an awareness and understanding to children about raptors found throughout Minnesota. Two, because of their part in the ecosystem both as a keystone species and as a biological indicator; and three, because of their presence in cultures past and present. This curriculum is designed to be used in a formal school setting as well as a non-profit conservation-based organization specializing in education. The lessons that make up this curriculum address science standards only, but this curriculum is multidisciplinary, touching on different subjects throughout. (190 words).

Keywords: environmental education, raptor, biological indicator, keystone species, umbrella species, formal education, nature deficit disorder, environmental literacy, animal welfare

To my dad who continues to edit my papers even now and to my mom for the encouraging words along the way. To my sister for all of your help, guidance and advice in creating this curriculum; and to the rest of my family and friends for your love, encouragement and support throughout this whole capstone journey.

We cannot win this battle to save species and environments without forging an emotional bond between ourselves and nature as well - for we will not fight to save what we do not love.
~ Stephen Jay Gould

Education is the most powerful weapon you can use to change the world.
~ Nelson Mandela

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CHAPTER ONE

INTRODUCTION

My focus for this capstone project is a curriculum on raptors. Specifically, I created, *An environmental education, science based, curriculum on raptors, to help bring a focus and awareness to the raptors found in Minnesota* (Appendix A). Raptors – a term used informally to describe birds of prey – are great subjects to use for elementary environmental education lessons. Learning is increased with the inclusion of live animals and a sense of place is formed in creating a connection to the natural environment in which they live in (Sobel, 2004; Chawla, 2012). By sparking curiosity and generating questions for the audience, the student's attention is automatically engaged into what is being taught. This makes the experience more memorable and unforgettable – something beyond what is found in a book. We know that raptors are an important topic for conservation programming; in that birds of prey are appealing to children, making a presence in literature, art and films and playing important roles in cultural symbolism (Daston & Mittman, 2005).

As you read through this chapter, it will begin from the very beginning – where my love for birds started and eventually to my passion for raptors. I will share some experiences with you along the way and end with where I am at today, explaining how my current job has had an impact on me for creating this curriculum plan.

Where it All Began

On a nice chilly morning, there is nothing better than waking up to loons singing on a lake, or falling asleep to owls hooting back and forth to one another in an old growth forest, or hearing the distinct drumming call of a ruffed grouse. When I was just six years old, I witnessed this exact scenario for the first time while camping with my family in Northern Minnesota. Not all three at once, but I did get to hear loons singing and grouse drumming. This is where my passion for birds began. I was so fascinated with them that every time I saw a bird that I did not know, I went downstairs to my basement, grabbed the North American Bird book off the shelf and paged through it until I saw the bird. I still do this, to this day, and will continue to do it. You never know what kind of bird species you may see from day to day, let alone within an hour. This is what makes it so exciting for me. There are so many different types of bird species and each has an assortment of songs they sing. Hearing the calls of various birds singing simultaneously is very exciting. Observing birds flying to the different feeders to snatch some food and trying to identify the species that I see, is a goal I have each day.

Views from the Hunting Grounds

I was just five years old when I went on my first hunting trip with my dad, brother, and my identical twin sister. Although I could not actually shoot a gun yet, I sat in a blind, with my sister, waiting in anticipation for the ducks and geese to fly overhead. We waited patiently for the gun shots to go off and for the birds to fall from the sky. This trip would change my life for the better. I began to build my love for the outdoors and especially nature with the people that mean the most to me, my family.

Waterfowl hunting has been a way for me to enjoy nature in a different way. I cannot tell you all of the numerous times that I sat on a bucket in the bitter cold or laid in a duck blind waiting for geese or ducks to fly by; just observing the scenery around me, taking it all in, is a great reward. I watched all of the song birds playing with one another in the nearby trees, while singing their calls as they searched for food. Woodpeckers pounding away in the distance on old, rotten trees searching for insects and yummy treats to eat. Catching the thermals, the hawks and eagles would soar high in the sky. Searching for food, the squirrels and chipmunks scamper through the leaves on the ground. Nature at its best. Then there were the ravens. Excitement builds as you are thinking it may be a duck or a goose coming in to land but unfortunately it is not. It is just a raven flying by. With all of these exhilarating experiences happening, comes the times when the ducks and geese are actually flying right over you and your heart starts racing. You almost forget why you were there, because you are in awe. It is in these moments that I have witnessed hundreds of geese flying overhead making the sky look like it is moving. That, the pond in the cornfield is covered with ducks and then, with the snap of the duck blind doors opening, the ducks scatter and fall from the sky due to the pinpoint aim of the hunter.

Being able to go hunting with my sister, brother and dad has helped open my eyes to the beauty that nature can bring. When I shot my first goose, it was a joyous time. It allowed me to see what that bird looks like up close. I was able to feel how soft it was, admire all of the different colors and to see the different characteristics it has – webbed feet, long neck, flat bill, eyes on the side of it head, etc. With all of these moments: from just observing, to killing and harvesting my first goose, I long to learn more about birds,

specifically raptors, the habitats that they live in, and the important roles they play in the environment.

My Mentors Along the Way

Two very important men in my life have helped me to learn, love, and care for nature. These two men are and were my dad and grandpa. Ever since I was little, these two men have demonstrated the greatest kind of teaching and learning one can get, and that is leading by example. There are numerous times and experiences from hunting to fishing and crabbing to hiking, where I have been with my dad and or grandpa and I have come away with more awareness, knowledge and skills for the outdoors. My grandpa was an avid outdoorsman and because of this, he taught me everything he could about birds, squirrels, gardening, fishing and more. I thank my grandpa for this every day. He is one of the reasons that I chose the field I did – Environmental Education.

When my brother was in Boy Scouts my dad was their Scout Leader. Every time he took the troop camping, he brought my sister and me with them. I have learned more from him about the outdoors than I thought I ever would. I have learned survival skills, identification skills – of plants, trees, and birds, wood working skills, cooking skills, and so much more. I remember a time where he was teaching the scouts how to build a fire in the snow. He gave them a few guidelines and in the end, they needed to burn the string that was strung over the fire. My sister and I sat watching and waiting. Eventually we went up to our dad and asked if we could try. We were seven years old. My dad gave us the materials, and said good luck. In the end, we beat the boys!! We had the fire started and burned our string before any of the boys. The boys were mad. Two little girls just started a fire without disturbing the snow before any of the scouts could. It is these

memories, with these wonderful men, that my passion for the outdoors grew. They are the ones that laid down the stepping stones that sparked my interest in the outdoors.

I could go on and on about childhood memories that I have about the outdoors. However; it is not just these memories that I have, that drove me to the astonishing, beauty of the outdoors. When I left my parents' home for the first time to attend college, I never would have realized how important this move would be and the impacts it has left and continues to leave on me today.

Lake Superior – Northern Wisconsin

Four of the best years of my life were spent in the north woods of Wisconsin. While attending college, just blocks away from Lake Superior, I gained so much valuable insight, knowledge, experience, and hands-on learning. All of this learning and figuring out what I wanted to do with my life began during my freshman year. I had the wonderful experience of circumnavigating Lake Superior during the month of May. We paddled, hiked, camped and drove the one thousand and three hundred miles around the world's largest freshwater lake. The power that Mother Nature can have as the storms formed over the lake, the magnificence that she created as the Northern Lights danced across the night sky, and the beauty of nature in itself – from waterfalls, to beaches, to the wildlife was unbelievable. Something I will never forget. It was during this trip where my love for raptors grew even stronger. I remember paddling on Lake Superior. It was a warm, sunny day. We came around the bend, and there, sitting on a rock twenty feet in front of us, was a Bald Eagle eating a fish that it had just caught. It was amazing. You could see his sharp talons gripping tight around the fish, as it used its sharp, curved beak

to rip apart the meat. I could not believe what I was seeing. The whole trip was like this. Something new and exciting was seen or learned every day.

Sophomore Year to Senior Year

My following years at college were just like my freshman year. It was always exciting and there was never a dull moment. It was during my sophomore year where I grew a better understanding and appreciation for raptors. One of my best friends and I decided to take a course during our May term called Ornithology – the study of birds. We both had a passion for birds and we wanted to know and learn more about them. Little did I know, that I would get much more than I bargained for. I gained hands-on experience trapping, holding, banding, and identifying birds – both raptors and song birds – by sight and sound.

There are two memories from this class that I want to share with you. The first one occurred on a Thursday. It was cold, rainy and just miserable. Instead of traveling to a location to go birding, we just stayed on campus. We did not see much – a few robins, a couple of downy woodpeckers, and some sparrows. I mentioned to my professor that the day prior, I observed a whole bunch of song birds from my dorm window. She shared this with the class and stated that those of us that want to stay may, otherwise you are free to go. Well, of the fifteen students, six of us stayed and traveled to my dorm hall. There was a huge bay window that looked out into a forest with a creek flowing through. We did not see anything too exciting at first. We were sharing stories with one another and just sat there waiting to see birds, as the rain continued to fall. After about an hour, the rain finally stopped, the sun appeared through the clouds, and lo and behold the birds came out. It was like it was Christmas with all of the birds just appearing right before our

eyes. There were so many birds, I could not believe my eyes. The birds we were seeing, were known as warblers. They were making their migration south with a pit stop on my campus. I recall looking through my camera, using it as binoculars, scanning the trees and ground for birds. I happened to see a bird that I did not recognize and I asked my classmates and professor "What bird is black, white, and blue?" Immediately, with no hesitation, they all answered "Where? Where?" To my surprise, the bird that I found was a Black-throated Blue Warbler. We observed and witnessed over fifteen species of warblers that day. A day I will never forget.

Bird Banding. The second memory occurred while I was learning how to band birds. Bird banding is not harmful for the birds. A small individually numbered plastic or metal tag is placed around the bird's leg or wing for keeping track of the bird's movements and life history. While learning this whole process: writing down the sex, the wing span length, the length of bird, the weight and the individual number on the tag, I was able to get up close, observe and hold the birds we caught in the mist nets. One of my favorite birds we caught was the American Kestrel. Being able to hold this bird of prey in my hands, while learning all about it and knowing that it had talons and a beak that could do damage to me if I was not careful, was a nerve-racking but unforgettable experience. I now had a better understanding and a deeper knowledge of songbirds and especially with raptors which so many people are afraid of.

These are just a few experiences from college that have impacted my life, and I could share many more with you too. But what intrigued me the most to create this curriculum on raptors was the internship that I received after college.

Sometimes, Waiting is Worth It

When graduating from college, I did not land the dream job, nor did I really have any job for that matter. Yes, I was working little side jobs here and there to get some sort of an income, but it was not what I wanted to do. That was until I landed an internship at a nature center in central Minnesota. It was here, where I realized exactly what I wanted to do with my life, be a naturalist teaching environmental education. While interning at the nature center, I am able to develop my skills as a naturalist through participation in outreaches, program development, and public programming. I am given many different opportunities to teach a variety of classes such as "Bee Ecology" to "Animal Tracks and Signs" to "Sky Watching;" all while receiving guidance and feedback from other naturalists on staff. The progressive nature of this internship has allowed me to continuously develop my teaching strategy.

One of the best things about this internship is that I get experience in handling all of the educational animals. Educational animals refers to animals that are used for teaching purposes in an informal and formal classroom setting. For example, at the nature center, we have a variety of reptiles, amphibians, farm animals and raptors that we use to teach students about in terms of viewing, holding and observing. This has been a huge highlight for me. Not only do I get to feed all of the reptiles, amphibians, and raptors, I handle them as well and learn the proper ways to provide care. The raptors have been my main focus at the nature center along with teaching the many different classes to the children. There are four raptors that I help take care of and only one that I have had the privilege to teach with. The birds of prey include Shakespeare the Barred Owl, Bud the Bald Eagle, Caesar the Turkey Vulture and Sammy the Red-tailed Hawk.

The first thing that I do when working with the raptors is prepare their food. This includes gutting and cleaning the rats, fish, squirrels or rabbits they eat, weighing the food to make sure they get the proper amount so they do not become overweight, and finally labeling the containers so the right bird gets the right food. Once this part is done, then cleaning the mews – where the raptors stay – comes next, followed with feeding at the end. It is so fascinating to see how gentle these captive birds of prey can be. I have had the Eagle eat right from my hand, the hawk, catch his food in mid-air and then both the owl and vulture grab their food and protect it until I leave. It is because of the gentleness of the birds and my commitment to their well-being demonstrated through the care that I provide for them, that I have decided to work with the nature center to create: *An environmental education, science based, curriculum on raptors, to help bring a focus and awareness to the raptors found in Minnesota.*

Why Create this Curriculum?

The main reason behind choosing to create this raptor curriculum came to me while attending graduate school. Knowing, that in order to pursue my dream of being a naturalist, I would need to enrich my education by attending graduate school, I applied for graduate school in the spring of 2017 and was accepted into the Natural Sciences and Environmental Education Master's program at Hamline University shortly after. While attending, I have become good friends with one of my classmates and she is the one that convinced me to create this curriculum and to work with the nature center that I work at. I had a conversation with my supervisor at the nature center and we agreed that I would create a curriculum that schools could use before traveling to a nature center or zoo. I want to be able to share with people my love for raptors and the important role they play

in the environment and to educate them on some of the raptors that they may see here in Minnesota. By sharing this knowledge with others, they will be able to know how they can identify which raptors they are seeing and observing. This is important because "it" is not just "a bird." "It" is a raptor, a bird of prey, that has many cool and unique features, and being able to identify what specific bird it is, that you are seeing, makes your experience that much more memorable.

Summary

Nature and the outdoors has been a big part of my life while growing up and continues to be a large part of it today. It is from all of my experiences that I have created a bond with nature that can never be broken. This bond is built on passion, life lessons, knowledge and amazement as it follows me wherever I go. My willingness to share my knowledge and to teach others about raptors is what motivates me to create this curriculum on raptors. My aim is that it will help bring a better focus and awareness of the raptors that are found in Minnesota and our environment.

The next chapter will explain the history of environmental education, will illuminate why environmental education and environmental literacy is important for both children and adults in terms of teaching it, and how we can better understand the term Nature Deficit Disorder. Also, discussed we be three different teaching styles focusing on formal and nonformal teaching. Following this discussion, I will explain how educational animals are a great tool for teaching, and the roles that raptors play in past and present cultures. Also explained is animal welfare – specifically for raptors and the safety for the bird as well as the handler. Lastly discussed will be how raptors make great

subjects for environmental education programs. All of the above will contribute to create this curriculum.

CHAPTER TWO

LITERATURE REVIEW

This review of literature covers core concepts in environmental education and the use of raptors as the subject to build a curriculum for formal as well as informal teaching. Topics addressed include environmental education and environmental literacy, and the importance of how both of these terms play in all age levels of children and adult learning. Also, explained is the term Nature Deficit Disorder and how children are being affected by it. Further discussed, are the different teaching styles – formal, nonformal and informal.

Following this discussion of connecting children and adults to nature, I will explain the use of educational animals as an effective teaching tool and the roles that raptors have played in cultures in the past and present. Also discussed, is ethics, focusing on animal welfare, specifically for raptors and the safety for the bird as well as for the handler and the audience. Lastly, I conclude with discussing how raptors can make great subjects for environmental education programs by addressing their importance in the environment as a keystone species. All of this information addresses my topic for this paper: *An environmental education, science based, curriculum on raptors, to help bring a focus and awareness to the raptors found in Minnesota.*

History of Environmental Education

Before learning about environmental education, the term environment must first be defined. There are two ways in which the word environment can be described. (Hart, 1997). The first refers to the natural environment and the natural resources in an area– the flora and fauna. The second refers to the human environment – transportation, housing, nutrition – and how these things affect the environment in which we live (Hart, 1997). I will be referring mainly to the natural environment for this project and the importance of conservation, preserving and protection of the environment for the lives of the animals and for our sake (humans).

Environmental education is a fast emerging field and because of this, it can be difficult to determine its exact origin. What we do know is that the first seeds of environmental education were planted nearly a century ago. The writings of John Muir, Henry David Thoreau, and Aldo Leopold brought attention to the exhaustion usage of natural resources in our country and the damaging impacts that humans have on the environment (McCue, 2003). Louis Agassiz was one of the first people to bring light to the role that natural environments have in education (McCrea, 2006) and later shared his thoughts on experiential learning. He once stated, "Study nature, not books" (cited this way in McCrea, 2006, p. 1). Although none of these men can actually take credit for creating environmental education, they all played important roles in bringing attention to the study of nature. From this, three areas of nature study arose – Nature Education, Conservation Education, and Outdoor Education – all of which later formed the present-day environmental education (McCue, 2003).

Nature education brought an understanding of the natural world through observation and exploration of plants and animals, as well as expanding the teaching of biology, botany and other natural sciences (Monroe & Kransy, 2015). Conservation education brought awareness and protection for animals, parks, rivers, and other resources to people so they could help spread and educate those around them about these important features that are found in and throughout the environment. It was taught through the U.S. governmental agencies (Monroe & Kransy, 2015). Lastly, outdoor education focused on the methods of teaching rather than the subject. It convinced teachers to go outside to teach lessons in every subject area and brought an appreciation for the natural world (Monroe & Krasny, 2015). Not only did teachers teach classes in an outdoor classroom on subjects pertaining to nature but also to the arts, music, math and other subjects too (Monroe and Kransy, 2015; Quay, 2013).

All of these non-traditional approaches had their own purposes and goals, until 1960, when a man, named William Stapp PhD., saw that these educational practices were too limited, so he united them under one big branch known as environmental education (Monroe & Krasny, 2016). Stapp along with his students from the University of Michigan agreed that there was a vital need for a new area of focus in the environmental field, which took into consideration the whole environment and one that stressed a problem-solving style (Monroe & Krasny, 2016). According to Stapp, “Environmental education is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution" (McCue, 2003).

Stapp was not the only one that saw a need for a new area focus in the environmental field. In 1948, for the first time, the term environmental education was used in Paris during the International Union for the Conservation of Nature (IUCN) and Natural Resources (Taskin, 2003). Finally, in 1970, because Stapp and the IUCN brought attention to environmental education, a definition of environmental education was formulated:

> "Environmental education is the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter-relatedness among man, his culture, and his biophysical surroundings. Environmental education also entails, practice in decision-making and self-formulation of a code of behavior about issues concerning environmental quality" (Taskin, 2003).

Also, in 1970, the Tbilisi Conference in U.S.S.R., established a framework and provided goals as to what environmental education would look and be like (Monroe & Krasny, 2016; Taskin, 2003). This conference was the first Intergovernmental Conference on Environmental Education, which later formed the Tbilisi Declaration of 1977. The declaration states three main goals of environmental education which are:

1. To foster clear awareness of, and concern about, economic, social, political, and ecological interdependence in urban and rural areas;
2. To provide every person with opportunities to acquire the knowledge, values, attitudes, commitment, and skills needed to protect and improve the environment;
3. To create new patterns of behavior of individuals, groups, and society as a whole towards the environment (United Nations, 1977);

The declaration also states the objectives of environmental education which include awareness, knowledge, attitudes, skills, and participation (Monroe & Kransy, 2015). Many people, from the very beginning to today, saw the importance of environmental education. Because of this, environmental education was born and continues to be taught in many different forms today.

Defining Environmental Education

Environmental education is always changing and looks different to everyone who teaches it. Some see environmental education as a way of teaching methods and philosophes for all subject areas, while others see it as something that needs to be taught on its own (McCue, 2003). It does not help that there is not one clear definition of what environmental education is. This is because environmental education is always changing. There is new technology that is coming out that can be useful to help teach different topics in environmental education, and whether or not you are teaching in a formal or informal setting, this too will change in how you teach and the type of curricula you will use. Teaching environmental education in an area that does not have many natural areas versus an area that has hundreds of acres of different habitats will look and be taught differently as well. This is the beauty of environmental education – it is so versatile and unique.

The goals and objectives of environmental education are attained through experiential learning: "a process through which the learner constructs knowledge, skills, and values from direct experiences" (Hammerman et al., 2001). Experiential learning is direct, hands-on learning that involves the subject that is being studied rather than just thinking about the subject with no involvement (Gentry, 2007).

One definition to help better understand what environmental education is, comes from a passage from the book *Across the Spectrum* which reads as follows: "Environmental education is education *about* the environment (that is, the content), *for* the environment (that is, skill development to resolve environmental issues), and *in* the environment (that is, located outdoors)" (Biedenweg et al., 2016, p. 13). Although this definition is brief, it explains what environmental education is and the outcomes that are associated with it.

Another definition as defined by the federal statue, is that environmental education is an "education process dealing with people's relationships and their natural manmade surroundings, and includes the relation of population, pollution, resource allocation and depletion, conservation, transportation, technology and urban and rural planning to the total human environment" (McCue, 2003). No matter what the definition is, environmental education can take many forms and can be taught in many different ways.

Importance of Environmental Education

> *"As a child, one has that magical capacity to move among the many eras of the earth; to see the land as an animal does; to experience the sky from the perspective of a flower or a bee; to feel the earth quiver and breathe beneath us; to know a hundred different smells of mud and listen unselfconsciously to the soughing of the trees." -Valerie Andrews*

Environmental education is an evolving field that continues to grow. Not only is it a valuable field of study that teaches a variety of nature concepts, but it also benefits all age levels – from preschoolers on up to adults and senior citizens. It teaches children

about the environment while developing their skills in mathematics, science, art, and language (Rillo, 1985; Perry & Branum, 2009). Different activities allow the children to learn through experiential learning – active, hands-on, inquiry based teaching (Fortino et al., 2014; Rillo, 1985). It provides problem-solving skills, teamwork and a way to connect people with nature (James et al., 2017; Perry & Branum, 2009). Outdoor play areas allow children to explore in nature and to play with natural materials such as sand, trees and climbing platforms. These different natural materials provide children with physical challenges while playing but lets the children decide what kind of play they want to do (Perry & Branum, 2009).

Albert Einstein once said, "Play is the highest form of research." Children of all ages can relate to Einstein's statement. Every time a child gets the chance to just play, especially out in nature, they are learning, discovering, and exploring new things (Fortino et al., 2014). "During play, their own thinking, feelings, and experiences are tested again and again by the consequences of their actions" (Perry & Branum, 2009). Research is being done. The children are always learning. If a question is asked by a child, the teacher and or adult will do their best to answer it, and if not, research will be done to provide an answer.

Children in the early childhood years (ages 3-8) learn mainly through their senses – smell, taste, see, touch, and hear – as well as through experiences and discoveries (Fortino et al., 2014; Perry & Branum, 2009). It begins to build confidence, self-esteem, and an inner drive to learn more (Perry & Branum, 2009). These young children learn through play and exploration. They are starting to develop an understanding of why certain things are happening in nature and the world. This is the prime time when the

children are beginning to explore and discover things on their own. They are very curious and have as many questions as they do answers (Perry & Branum, 2009). Early childhood children see things from only their point-of-view and do not realize other's perspectives.

With the kids always being on the move and wanting to learn more, environmental education also provides these children the ability to learn through constructivism – knowledge that comes from an individual's interaction with the environment (Oltman et al., 2002). The feeling of excitement that comes with wandering in the woods, digging in the dirt, or playing in a stream must be encouraged and developed by teachers. These interactions within the environment provide these students with hands-on learning opportunities allowing the students to make discoveries on their own or in a group and by having them find their own answers to the questions they may have (Oltman et al., 2002).

When they are excited about what they have learned in class, they go home and tell their parents and friends. This is important because it allows the students to become "teachers" and share what they have learned with others because the students found it to be fun and engaging. It is important for teachers to remember to teach to the whole child – if you want something to stick in the brain, it must go through the body and heart (Oltman et al., 2002) – if not the kids may not listen and may not be engaged in what is being taught. We, as teachers need to also remember that we are not only teaching the students but we are teaching all those who the students share the information with as well.

As for the older students (middle schoolers – high schoolers), school to them may seem boring and they might think that it can only occur in a classroom, but it does not have to be that way. By not being in the classroom the whole time and teaching in an outdoor setting, it shows the students that learning can be fun and rewarding (Perry & Branum, 2009). A study performed by James et al. (2017), examined the significance of experiential outdoor education for school-aged children during school hours. What they found was that it is worth investing time and money into school-based experiential outdoor education. They mention that, "although often neglected as a part of the curriculum in our current era of high-stakes test-based accountability, it is definitely a necessity."

Environmental education provides many opportunities for the kids to participate in hand-on learning experiences and in some cases it provides them with opportunities to use different types of technology practices to answer and understand the concepts that is being taught better (Russ et al., 2015). Robin C. Moore and Herb H. Wong, have a great quote in their book *Natural Learning, Creating Environments for Rediscovering Nature's Way of Teaching* about hands-on learning. It reads:

> "Without continuous hands-on experience, it is impossible for children to acquire a deep intuitive understanding of the natural world that is the foundation of sustainable development. ….A critical aspect of the present-day crisis in education is that children are becoming separated from daily experience of the natural world, especially in larger cities."

While most kids these days spend too much time indoors playing on electronic devices, watching TV, and on the computer, by incorporating technology into the teaching, and

being outside and learning, it actually helps with human development and is essential for restoration of the body, soul, and mind (Russ et al., 2015).

Connecting adults and other people back to nature is also important. It is known that "direct exposure to nature is critical for the development and sustenance of an emotionally and physically healthy individual" (Monroe & Kransy, 2015). But, it is not just children that need to be reconnected with nature teens and adults do as well. Getting the whole family involved in outdoor activities allows for families to bond and enjoy the wonders of the natural world (Perry & Branum, 2009). When adults realize the benefits of environmental education for their kids, they will then be able to help support their child when they play; which in turn, helps with the learning value of the play being done (Perry &Branum, 2009).

Environmental education provides endless amounts of opportunities and activities for individuals to learn more about nature. In *Beyond Ecophobia,* David Sobel writes, "If we want children to flourish, to become truly empowered, then let us allow them to love the earth before we ask them to save it." In order to teach environmental education one needs to be environmentally literate and have an understanding of how things in nature connect, and teaching that connection to children and adults.

Understanding the Term "Environmental Literacy"

To begin with, let's first explain what literacy means. Two definitions come to mind: a) able to read and write and b) well educated, showing widespread knowledge, learning or culture (Roth, 1992). The word literacy no longer just means these two definitions though. It has evolved into science literacy, visual literacy, computer literacy, cultural literacy, etc. (Roth, 1992). It is from the second definition and the many other

definitions of literacy where the term environmental literacy came to be. Someone who is environmentally literate is aware of all aspects of the environment, from ecological to sustainability; and is willing to improve the environment in favor of other individuals and for the society and communities (Roth, 1992). This person helps the environment in any way they can by helping others to better understand how to care for it and recognize its diversity and unity.

Environmental literacy has three stages: (1) nominal – has basic knowledge of nature and the environment, (2) functional – is educated and comprehends the interactions between systems: human, social, and natural, and (3) operational – has a deep understanding and connection to nature, the environment and acquires skills (Hill, 2012). Being environmentally literate means you have an understanding of the connection between what people know and what they do; an understanding of the connections between sustainable societies, natural systems, and how individuals interact in them (Hill, 2012).

The North American Association for Environmental Education (NAAEE) published an article titled "Developing a Framework for Assessing Environmental Literacy: Executive Summary," that listed four components that someone should have to be environmentally literate. The four components are:

> 1. Knowledge and understanding of a wide range of environmental concepts, problems, and issues, 2. Cognitive and affective dispositions, 3. Cognitive skills and abilities, and 4. The appropriate behavioral strategies to apply such knowledge and understanding in order to make sound and effective decisions in range of environmental contexts (p. 3).

These components mentioned above are important because you need to have the knowledge in order to decide whether or not the actions you will make will have positive or negative effects on the environment, the abilities and skills to think fast if something goes wrong, and the understanding of what would be best for the society and the people living there. To best do this is to educate people so they can become familiar with different environmental issues, problems, and concerns, so they can help keep the environment healthy and growing, and by doing this, one can teach environmental education better because they have a more knowledgeable understanding of how to be environmentally literate.

Teaching Styles

In addition to the many different definitions of what environmental education is, environmental education can be implemented in many different ways and can take multiple forms while implementing environmental literacy in a variety of settings. When teaching environmental education, it can be categorized broadly as formal, nonformal, and informal (Monroe & Kransy, 2015). Although some activities may fit into more than one category, each one is different in its own ways and learners can be engaged with activities in any of the three formats.

Formal environmental education refers to teaching curriculum determined by the school or other institutional standardized school curricula. Most of the time, this teaching involves primary, secondary, and university education that will lead to graduation (Monroe & Kransy, 2015). Lessons are taught specifically to the schools' standards within the classroom as well as in schoolyard outdoor classrooms, natural areas and field trips to nature centers, zoos and museums (Monroe & Kransy, 2015).

Nonformal environmental education tailors the educational opportunities and objectives to the needs and desires of the learner. It includes extracurricular enrichment activities run by scout groups, museums, parks and nature centers (Monroe & Krasny, 2015). Nonformal environmental education targets any age level.

Lastly, informal environmental education can be similar to formal environmental education in that it can relate to classroom curricula, but is different from nonformal environmental education because it is short term and "often interpretive by nature" (Monroe & Kransy, 2015). Informal education can occur anywhere where educational information is displayed or taught. It can be taught in museums, nature centers, at educational fairs and agencies and organizations. Informal education provides many educational opportunities on a variety of topics for school groups as well as adult programs. Most of the time, background information is shared, an activity is conducted and then a wrap up is provided at the end (Monroe & Kransy, 2015).

There are many roles and venues that environmental education can take. The ultimate goal is to educate, encourage, engage and make people aware of the topics that are being taught. But it is hard to teach environmental education as well as environmental literacy when more people these days are spending more time inside and less time in the outdoors.

"Nature Deficit Disorder" – What is it?

In the past, many children were found wandering outside without any worries of being in danger. They would explore the natural world and discover new things on their own. An abundance of learning took place during this time; not all learning comes from being "stuck" indoors with four walls (Hart, 1997; Louv, 2005). In today's societies

however, many teachers and parents debate over the importance of having children spend time outside. Many adults do not see or know the importance of children needing time in nature. Richard Louv (2005), in his book *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder*, discusses a term known as "Nature Deficit Disorder." He describes this term as "the human costs of alienation from nature, among them: diminished use of senses, attention difficulties, and higher rates of physical and emotional illness" (p. 36). Louv states how it can be seen in individuals, families, communities, and even cities.

Play time in the natural world is being replaced by activities such as video games and television (Kirkby, 1989; Louv, 2005). Children do not see the need to spend time outside when governmental officials put rules into place in neighborhoods and when no trespassing signs are put up. This is causing play of children to be moved indoors (Nabhan & Trimble, 1994). But, governmental officials are not the only ones that contribute to children spending their time indoors. Parents are a factor as well. Parents guard their children with their lives and are responsible for where and when children spend their free time. Louv (2005), states that "parents are fearful to let their children venture too far outside because of the fear of traffic, stranger-danger, crime, and even nature itself." I do not blame them.

However, removing children from nature has its effects, which have been shown in different studies. One study showed that children between the ages of five to 16 spend on average, six hours and thirty minutes a day in front of a screen – whether that is watching TV, playing video games, on their cell phones, or on the computer (Wakefield, 2015). This is one of the primary causes of obesity in children – lack of physical activity

(CDC, 2012). Other studies have also shown that the physical, mental, emotional, and intellectual well-being of individuals can be impacted by not spending time in nature (Kirkby, 1989). When connection to the natural world is disconnected, these states of well-being suffer and mental illnesses often sets in. This is why it is important for children and even adults to spend time in nature at least once a week, if not more often.

Nature will help calm and relax the mind. Spending time in the outdoors also brings a feeling of peace, serenity, and happiness. Studies have shown that people have had more energy, felt less stressed, felt more productive on the job and have an increase in their sense of well-being (Louv, 2005 p. 7-9; Kirkby, 1989).

Welfare of Animals

There are roughly 26 billion animals, covering approximately 10,000 species that are kept in captivity. Whether in zoos, farms, conservation breeding centers, nature centers, households or research laboratories, these animals are captivate – no longer wild (Mason, 2010). When thinking about captive animals versus wild, captive animals tend to be healthier, longer living, and more productive; but for some of these animals, this is not true. According to the American Veterinary Association, animal welfare means "how an animal copes within the conditions it lives in" (AVMA, 2018). When thinking of animal welfare, there is not one true definition to describe it. Animal welfare emphasizes different areas of animal functionality as well as the animal-human or animal-environmental interactions (Mason, 2010; Mellor et al., 2009).

While assessing the welfare of animals, three general areas can be seen; 1. Biological function, 2. Affective state and 3. Natural state (Mellor et al., 2009). Biological function, for good state of welfare is, when welfare of the animal is healthy,

growing, safe, comfortable, well-nourished and reproducing well (AVMA, 2018). For affective state, sensory inputs emphasize the potential for animals to suffer or to have positive experiences and feelings. Good welfare for the affective state is when an animal adapts to situations without suffering and has positive experiences during interactions with people, other animals, and the environment (Mellor, et al., 2019). Lastly, natural state refers to when the animals' welfare may be compromised – when the animal can no longer express most of its natural behaviors and when the wild state of the species is deteriorating (Mellor et al., 2009).

When thinking about the welfare of animals, five different domains can be identified: nutritional, environmental, health, behavioral and mental (Mellor, et al., 2009; Mendl & Paul, 2004). Good welfare is when the animals' needs in all five domains are met. If not met the animal may suffer and potentially die. To start, if the nutritional needs of the animal are not meant, the animal may experience abnormal thirst, hunger, feelings of weakness and frailty (Mendl & Paul, 2004). If the environment becomes compromised from outdoor exposure to extreme weather or what conditions that might occur indoors, it may lead the animal to experience uncomfortableness, persistent distress, joint problems, skin irritations and pain (Mellor, et al. 2009; Wiepkema & Koolhaas, 1993). Next, when the health of the animal is compromised due to traumatic injury, diseases, toxins, etc., the animal can experience unpleasant sickness, pain, fear, distress and anxiety (Sandøe & Simonsen, 1992). Behavioral compromise can occur when space is restricted or from overcrowding. The animals may experience anxiety, fear, distress and loneliness (Mellor, et al., 2009, Mendl & Paul, 2004; Wiepkema & Koolhaas, 1993). The animal can also become stressed in such circumstances. For

raptors specifically, behaviors such as excessive bating, panting, droopy wings or gular fluttering are signs that the raptor is stressed (Arent, 2007). Lastly, the mental domain may be compromised when any of the four above domains are compromised as well (Mellor et al., 2009). By knowing these different welfare domains, we can take a closer look at the welfare of raptors in captivity.

A raptor in captivity usually means the bird cannot fully sustain itself out in the wild, due to some kind of injury it sustained at some point in its life (Arent, 2007). Many educational places such as nature centers, zoos, and environmental education learning centers take these injured birds and use them for either a display bird, a program bird – trained and displayed on a gloved hand, or a demonstration bird – flown in front of people (Arent, 2007). When handling a raptor or any kind of educational animal for that matter, knowing behavioral habits for the animal is essential. Behavior habits are "what an animal does in response to environmental conditions" (Arent, 2007). For raptors, behaviors include panting, bating (when a raptor attempts to fly from the fist or perch but is still attached to its leash), vocalizing, foot tucking, feathers slicked on head, etc. We cannot label bird behaviors as being aggressive, stubborn, or lazy because they all have many different meanings. Instead, we need to shift away from labels and describe behavior in terms related to environmental conditions (Gaibani & Csermely).

Many people who handle raptors say that the hardest thing about them is their refusal to step-up onto the glove (Arent, 2007). What this means is that you are trying to get the bird from the perch it is on to stand on your glove. This process can become difficult when the bird refuses and does not want to listen, causing the bird to become stressed out (Sandøe & Simonsen, 1992; Mendl & Paul, 2004; Arent, 2007). All too

often, we hear that the common practice is to chase the bird until it steps-up or to use tools to force it onto the glove. None of these practices expressed above are appropriate ways of retrieving a raptor from its enclosure onto the glove (Arent, 2007). The approaches above demonstrate poor welfare for the bird. It can be traumatic, physical harm to the bird may occur, and the bird could go into distress or become fearful (Arent, 2007). But with appropriate teaching and knowledge, handling a bird can be very rewarding and can be used for educational purposes for school groups or adult programs.

Raptors in Previous and Present-day Cultures

The relationship with living organisms and the natural world is shown through literature, cultural art and tradition (Snyder & Snyder, 2006). With their strong presence across past and present cultures and through traditions in North America, one group of animals to take notice of are raptors. Raptors (birds of prey), specifically eagles, hawks, owls and falcons, have important values in traditions and symbolism for many cultures in North America (Snyder & Snyder, 2006).

One group of people who gave raptors, especially owls, special meaning were the Ancient Greeks, (Arent, 2007). The owl was a companion to Athena, the goddess of wisdom and was a protector to Greek armies as they entered into war (Arent, 2007). Another group are indigenous people. The raptors that hold special meanings for them are eagles and hawks. In some creation stories of the Pueblo tribes and other American Indian tribes, the eagle is the leader of all birds and is the messenger to the creator (Redish & Lewis, 2015). Many American Indian tribes are seen with eagle feathers. These feathers must be earned. It is seen as a gift from above that is an emblem of bravery, trust, honor and strength (Daston & Mittman, 2005; Lanham, 2007). The use of

these feathers in traditional ceremonies by American Indians is recognized by the U.S. government by allowing the American Indians to harvest and possess these feathers with permits.

This is important because in 1918, the Migratory Bird Treaty Act was established, followed by the Bald Eagle Protection Act in 1940, making it illegal for anyone to possess, barter, purchase or sell and part of a migratory bird (Daston & Mittman, 2005; Lanham, 2007). But the value of these feathers that came from eagles and other birds in American Indian ceremonies, moved the federal government, that the government made an exemption for American Indian tribes. These feathers were to be used for spiritual practices, scientific uses, educational purposes and for exhibition (Daston & Mittman, 2005; Lanham, 2007).

The eagle does not just have powerful meanings to American Indian cultures, but for the U.S. Government, universities, and organizations, too. For the United States, the eagle is the national emblem, having the same meaning it did for the American Indians – bravery, honor, trust and strength (Daston & Mittman, 2005). Eagles are found on many flags of government officials, the president, the Air Force and more. Over 15 state flags also display an eagle (Daston and Mittman, 2005). At least 50 different colleges and university teams have raptors – hawks, eagles, owls or falcons – as their mascots and the highest rank one can achieve in the Boy Scouts of America is the Eagle Scout (Townley, 2009).

Children, teens and adults connect with raptors. This connection led people to keep birds of prey in captivity (Arent, 2007). This first started in Medieval Europe and

the Arab World with falconers – people who keep, train and hunt with falcons or another type of raptor (Arent, 2007). Falconry is still popular today.

Raptors are found all throughout cultures from the past to the present. By using raptors as the primary subject for an elementary program, it opens the doors to more topics and discussions to occur.

When presenting a species for conservation, the cultural views should be considered in order to help make a deeper connection for individuals (Woodward et al., 1999). Ever since ancient times, birds of prey have played a big part in art, literature, traditions, and ceremonies worldwide (Snyder & Snyder, 2006). Feathers from these birds are important in that they have been used and still used today, in ceremonies and attire for many groups. Falcons have been represented in ancient Egyptian hieroglyphics and eagles and condors have been used in ritual ceremonies (Snyder & Snyder, 2006). These interactions with birds of prey, demonstrate and show the significance of the cultural connection between humans and raptors.

Raptors in the Environment

Raptors (birds of prey) help indicate a healthy environment. A term to help better understand how raptors help indicate a healthy environment is biological indicators. Biological indicators are organisms that help provide us information about the health of the ecosystem. Why is this important? Because raptors are a low-cost warning signal of ecological change (Noss, 1990; Spellerberg, 1991). These birds "provide a critical early warning system for environmental contaminants or population declines anywhere within their food web" (CRC, 2018).

Not only are raptors biological indicators, they are also a keystone species in the predator/prey population, as they help with balancing the food chain (Woodward et al., 1999). A keystone species "is an organism that helps define an entire ecosystem. Without its keystone species, the ecosystem would be dramatically different or cease to exist altogether" (National Geographic Society, 2017). Raptors impact different ecosystems relative to their abundance. They help keep some fish and rodent populations small, so they do not overpopulate (Tanecredi, 2002).

Birds of prey are also a part of adjacent environments known as an umbrella species (Snyder & Snyder, 2006). This term is referring to "animals that have large home ranges that cover multiple habitat types" (Boston University, 2014). Raptors are area-sensitive species that extend over six continents (Bildstein, 1998). By protecting these birds, other species of animals also benefit in protection some of which are even more challenging to monitor due to cost and accessibility (Bildstein, 1998).

There are many areas throughout the United States and the world where birds of prey are monitored. One specific organization, The Hawk Migration Association of North America (HMANA) has over 100 migration watch sites throughout the United States and Canada. These sites have over 400 volunteers that count hawk migration and document what hawks they see (Bildstein, 1998). All of this data is helpful because it can show population fluctuation from year to year; as well as alerting us when there is something unstable in the environment (Bildstein, 1998). Because raptors are sensitive to human disturbances and environmental contamination, this is one way in which they help indicate whether or not the environment is healthy. With the strong connection that raptors have with their surrounding environment, this makes them vital subjects for

discussing and bringing awareness to conservation and sustainability needs (Bildstein, 1998). Not only are birds of prey beneficial to the environment, but they are also a great focus for elementary students to learn about.

Raptors in Environmental Education

Raptors are a great subject to use for an elementary environmental education lesson. Many children have already had several interactions with observing or taking care of animals in the classroom or at home. Such animals may include hamsters, gerbils, cats, dogs, fish or rabbits (Vining, 2003). While most children are familiar with birds of prey – eagles, hawks and owls – many of them have not been able to experience them up close (Snyder & Snyder, 2006).

Many different raptors – eagles, hawks owls and falcons are recognized in works of literature and movies children read and watch. These birds are the center of attention, allowing children to connect with and understand their own thoughts and emotions better because they are able to relate to that raptor (Burke, 2004; Daston, 2005). It is known that many children, when listing the most influential/important person in their life, include animals (Melson, 2003). Children identify with animals, they relate and connect with them. By using raptors as the primary subject for an elementary program, it opens the doors to more topics and discussions to occur.

It is undeniable that humans have a bond that cannot be broken with animals and a desire to connect with wildlife. According to Melson (2001), over 50% of North American and European households have pets whether they are dogs, cats, birds, fish or hamsters and in America over $8.5 billion dollars are spent on dog and cat food alone, in a given year. In 1999, more families and individuals visited zoos and aquariums than

they did major league football, basketball, baseball, and hockey combined (AZA, 1999). In 2011, 29% of Americans partook in wildlife-related activities, demonstrating the yearning for individuals to connect with nature and wildlife (USFWS, 2011). They feel the need to be outside discovering and exploring the natural world.

The need to connect with other living organisms has been referred to by many different names. Wilson (1993) references it as the Biophilia hypothesis; Vining (2003) calls it the human-animal bond. Whatever you call it, there is significance to the relationship between humans and animals (Melson, 2001; Nelson, 1983; Vining, 2003). Individuals and families are starting to find their niche and connection with the natural world by viewing wildlife, participating in activities, visiting zoos and aquariums, and learning how to garden. This fondness for the natural beauty is prevalent (Kaplan, 1995; Ulrich et al., 1991; Wilson 1993).

Applying standards of environmental education to a raptor program can help it be more beneficial to the audience as well as make it more effective (NAAEE, 2000). Utilizing the *what, so what, now what* model can structure a program in a way that helps the learner to gain more out of what is being taught and allows them to process the experience better. The *what,* is explaining the animals natural history and showing its natural behaviors. The *so what,* is explaining the ecosystem it is in, as well as how it effects human interactions; and the *now what,* is explaining the conservation plans that are in affect to help protect and conserve these species and the environments in which they are found in (Landers et al., 2002).

Conclusion

Raptors are an excellent subject for an environmental education program. Learning is increased with live animals and a sense of place is formed in creating a connection to the natural environment in which they live in (Sobel, 2004; Chawla, 2012). By sparking curiosity and generating questions for the audience, their attention is automatically engaged into what is being taught, making the experience more memorable and unforgettable – something beyond what is found in a book. We know that raptors are an important topic for conservation programming, in that birds of prey are appealing to children, making a presence in literature, art and films and playing important roles in cultural symbolism (Daston & Mittman, 2005). All of these different qualities of raptors make them the perfect focus for a conservation, awareness-based program for children and adults.

CHAPTER THREE

PROJECT DESCRIPTION

Chapter Overview

In order to see birds, it is necessary to become a part of the silence.

~Robert Lynd

The purpose of this capstone is to address my topic: *An environmental education, science based, curriculum on raptors, to help bring a focus and awareness to the raptors found in Minnesota*. Chapter One provided my rationale for choosing this topic. It explained why raptors are important in the environment as well as in environmental education. Chapter Two explored the related literature on this topic. Topics included the history of environmental education, different teaching styles, how educational animals are an effective teaching tool, animal welfare – specifically on raptors, and raptors in cultures past and present. Next, the context described in Chapter One and Two will be explored farther, by creating an outline for the curriculum project. The curriculum framework for this project came from the curriculum-writing guide from the North American Association for Environmental Education (NAAEE, 1996).

I created this curriculum based on seven raptor groups– Eagles, Harriers, Osprey, Hawks, Falcons, Owls and Vultures– all of which are found throughout Minnesota. The

curriculum can be taught in a formal or nonformal educational setting – either indoors or outdoors, to bring optimistic, positive attitudes towards raptors and the environment in which they live in. Nonformal environmental education tailors the educational opportunities and objectives to the needs and desires of the learner (Monroe & Krasny, 2015); whereas formal environmental education refers to teaching curriculum determined by the school or other institutional standardized school curricula. Most of the time, this teaching involves primary, secondary, and university education that will lead to graduation (Monroe & Kransy, 2015). Nonformal environmental education targets any age level as well as adult audiences. Because environmental education creates experiential learning – active, hands-on, inquiry based teaching and provides problem-solving skills, teamwork and a way to connect people with nature, it is this, which is the basis for this curriculum design (Fortino et al., 2014; Rillo, 1985; James et al., 2017; Perry & Branum, 2009). Chapter Three discusses the rationale behind creating this raptor curriculum, the curriculum writing framework that I used to develop this project, the setting and audience, a project description and outline and a timeline of the project, from creation to end.

Rationale

Research has shown that raptors are an excellent subject for an environmental education program. Learning is increased with live animals and a sense of place is formed in creating a connection to the natural environment in which they live in (Sobel, 2004, Chawla, 2012). This curriculum that I have created is intended for teaching in a formal or nonformal educational setting, for third through fifth grade students. By sparking curiosity and generating questions for the audience, their attention is

automatically engaged into what is being taught, making the experience more memorable and unforgettable. We know that raptors are an important topic for conservation programming, in that birds of prey are appealing to children, making a presence in literature, art and films and playing important roles in cultural symbolism (Daston & Mittman, 2005). By keeping all of these different things in mind, my hope is that this curriculum will help bring a focus and an awareness to the raptors that are found in Minnesota and in our environment, in which we share with them.

Curriculum Framework

The curriculum materials that make up the bulk of this capstone will be developed using the curriculum-writing guide from the North American Association for Environmental Education (NAAEE). This curriculum-writing guide, from the NAAEE, highlights six main foci for an effective environmental education curriculum (NAAEE, 1996), that I used and followed when creating my curriculum on raptors. The six foci are as follows, including a description of how they were applied into my curriculum:

1. Fairness and accuracy- The activities that I created for this project are fair and accurate in presenting and describing a variety of environmental issues raptors can face. Students will be able to develop their own opinions about environmental issues through reflection and inquiry.
2. Depth- The project is age-appropriate and designed with cognitive abilities in mind. It raises awareness and importance of the raptors in the natural and built environment they live in, as well as an understanding to what distinguishes a raptor from other birds.

3. Emphasis on skills building- The project has an emphasis on building cognitive skills by figuring out how to address environmental issues to foster the students' critical and creative thinking skills.
4. Action orientation- This project promotes civic responsibility by building a sense of place plus responsibility in students. Students will learn how to use the knowledge they have gained and the personal skills they have developed on environmental issues as a guide, for their choice of action in the future.
5. Instructional soundness- The project provides an effective, safe, warm-welcoming and creative learning environment for the students to partake in. The lessons created are interdisciplinary with a variety of ways to learn, goal driven and provide a connection to the students' everyday lives.
6. Usability- Lessons are logical, adaptable and easy to use. The lessons are accompanied by instructions and support that anybody can pick up and teach.

In creating the lessons for this curriculum, I implemented five of Gardner's seven learning styles (1983). The lessons that were developed, addressed/responded to/supported the assortment of different student's learning styles. Visual learners are reached by showing a diverse number of images, artifacts and potentially a live bird. Kinesthetic learners are reached through showing artifacts and by playing different games. Aural learners are reached by playing different raptor sounds and by practicing their own raptor call themselves. Interpersonal learners are reached by working in groups to complete different games that allows them to reinforce raptor concepts through interaction with others. Finally, logical learners are addressed by using reasoning and mathematical concepts.

All of these different learning styles mentioned above shapes the delivery of the concepts being taught. These concepts are founded in the works of Nabhan & Trimble (1994). Their book explains the importance of creating a sense of place and how significant life experiences can shape future decisions. This curriculum is built around this concept. Students explore nature and wildlife on school grounds and are encouraged to explore nature and wildlife within their own neighborhoods. By these acts of exploring, children become aware of their surroundings and everything that may live in the same area as them, allowing the children to build a sense of place.

Understanding by Design (UbD) framework, created by Wiggins and McTighe (2011), was also used to create this raptor curriculum. I used the second part of this framework, "backwards design" to help with my curriculum design, which is broken into three steps; Desired Results, Evidence, and Learning Plan (Wiggins and McTighe, 2011). The first step, identifying the desired results allows the teachers to figure out what the outcomes are that they hope to achieve and helps teachers to prioritize the concepts that will be taught. What exactly should the students know, understand and be able to do after the curriculum is taught? The second step, evidence, requires the teacher to identify what assessments will be used to determine if the learning goals were met or not. The final step, learning plan, is where the curriculum is being formulated by the teachers, planning the different lessons that will help the students achieve the goals mentioned in the first two steps (McTighe & Wiggins, 2011).

Setting and Audience

The raptor curriculum that I created is written for formal and nonformal educational settings. It can be taught at any Minnesota public elementary school, nature

center, zoo or environmental learning center. The curriculum is specific to raptors found in Minnesota, therefore should only be taught to students in Minnesota. However, modifications can be made to accommodate other raptors, climates, environments and states. This curriculum is created for educators to teach during their science unit to students that are in third through fifth grade but modifications can be made to suit the audience that is at hand.

Project Description

The curriculum that was developed for this capstone project is designed to be as flexible as possible and made so any school, nature center, zoo or environmental learning center can pick it up and teach it. The reasoning behind this is that teaching environmental education in Minnesota can be challenging due to many factors; one such factor is weather. Teachers can adjust what activities they would like to teach based on what the weather conditions are like outside. This curriculum project hopefully demonstrates the endless amounts of opportunities one can teach and the benefits that environmental education can have both on the students and the educator. The curriculum that I created can be taught during anytime of the year and the lessons can be taught in any order. The goal of this curriculum is to bring a better focus and awareness to the raptors that are found in Minnesota.

The curriculum is to be taught in a formal or nonformal educational setting. This means that the curriculum is focused only on science standards but the curriculum may hit other areas of focus, too, allowing the curriculum to be multidisciplinary. This curriculum is used as a learning opportunity to get children outside more and to become more familiar with what can be found in the same area that they live in.

Outline

There are five lessons that make up this curriculum. The lessons and activities vary in length and some of the lessons can be completed in as little as one day or may take several days to complete. As mentioned earlier, the lessons can be taught in any order and during any time of the year that fits with what is being taught. The five lessons share a common ground in that all of them can be taught in a classroom or in an outdoor space. By doing this, the students will learn both in the classroom as well as the outdoors. Although these lessons have state specific standards, topics addressed can cover standards that are not mentioned. These lessons can also be modified to fit the state standards, in which this curriculum is being taught in.

Sample Lesson One: Lesson One focuses on background information of raptors. Students learn how to identify a raptor versus other predatory birds, what the main characteristics that most raptors have, the difference between predator and prey, the importance of raptors in our environment and the value that raptors have to humans. Different games and activities are used in order to get the students up and moving and to help them retain the information being taught.

Sample Lesson Two: This lesson focuses on what birds are found in the raptor group, specifically – Eagles, Harriers, Osprey, Hawks, Falcons, Owls and Vultures. Expanding over five to seven class periods, students learn where each raptor is found in Minnesota, what the raptor looks like and what they eat. Each day has an assortment of games and activities that was created to help the students better understand the information that they are learning.

Sample Lesson Three: The students in this lesson will have the opportunity to dissect an owl pellet. After learning about the raptors in the previous lesson, the students will be able to see what exactly owls eat. Students will learn why raptors regurgitate pellets and how the owl pellet is different from pellets from the other raptors. During this lesson, students will dissect an owl pellet, identify what bones they are seeing and the type of animal the bones came from.

Sample Lesson Four: During this lesson, the students will go on a field trip that relates to raptors in some way. Going on a field trip allows students to experience hands-on, inquiry-based learning.

Sample Lesson Five: The last lesson in this unit consists of a research paper and a project that the students will complete individually. The students will share their research paper and project with the class as a final wrap-up to the unit. This is a great way for the educator to see whether or not the students understood what was being taught and allows the students to show their creativity that they have.

Timeline

The timeline for this capstone project was completed in two semesters. The literature review and background for the capstone was completed during the fall semester – September 2017 to December 2017. The development of the project portion – the curriculum and reflection, was completed during the spring semester – February 2018 to May 2018.

Project Evaluation

This project will be evaluated after implementation. Conversations with the participating teachers and co-workers will provide feedback to see how effective the

lessons were and if any improvements need to be made. Such questions that can be asked include:

1. Are the students able to explain the differences between a raptor and a non-raptor/ predatory bird?
2. Are students able to identify what characteristics only raptors have?
3. What was successful in the owl pellet dissection? What did not work/could be done differently?
4. Was the field trip a success? Were you able to relate it back to the raptor curriculum just taught?
5. Did the habitat project and report show understanding of the raptor chosen by student?

The lessons are designed to be as flexible as possible and to bring an awareness to raptors found throughout Minnesota. In order to assess student understanding of the key concepts, they will create Venn diagrams to compare and contrast different kinds of raptors and they will complete the raptor report/habitat project. The students will be able to apply their knowledge and identify the importance of raptors.

Summary

Chapter Three described the rationale and process that was used to create this curriculum on raptors. It provided a thorough outline explanation of the curriculum that was developed on the topic: *An environmental education, science based, curriculum on raptors, to help bring a focus and awareness to the raptors found in Minnesota.* It also included the setting and audience for the curriculum and a timeline of completion for me to follow. Chapter Four includes my reflection on the capstone writing process. It

describes general conclusions made throughout the entire capstone and project process. Further discussed is the process that was used in the creation of the curriculum project: the two models that had the most impact on the development of the project. The last part of the chapter explains implications, adaptations, and limitations the project could have and ends with a final concluding section.

CHAPTER FOUR

REFLECTION & CONCLUSIONS

Introduction

This curriculum project was created with a single purpose to provide awareness and understanding to students about raptors through outdoor experiential learning. Experiential learning is direct, hand-on learning that constructs skills and learning from direct experiences (Hammerman et al., 2001). It also provides health benefits both physical, mentally and emotionally (Louv, 2005; Kirkby, 1989). Adding animals to this mix is also very beneficial. Learning is increased with live animals and a sense of place is formed creating a connection to the natural environment in which they live (Sobel, 2004; Chawla, 2012). Raptors are great subjects to incorporate into any environmental education lesson. They are appealing to children, making a presence in literature, art and films as well as having important roles in cultural symbolism (Daston & Mittman, 2005). Teachers can face challenges, such as weather, when teaching outdoors, but with preparation and resources, the challenges can be overcome. The following reflection contains my thoughts and experiences on the topic, *An environmental education, science based, curriculum on raptors, to help bring a focus and awareness to the raptors found in Minnesota.*

The first part of this reflection explains my overall experience during the capstone process, explaining my thoughts about the project as a researcher, writer and learner.

Highlights from my literature review will also be revisited, explaining the research that impacted my capstone the greatest. The next section, curriculum development, explores my thoughts and experiences as a curriculum writer and author. Pedagogical concepts used in the development of this curriculum included the North American Association of Environmental Education's (NAAEE) guidelines as well as Understanding by Design – the second part of the framework: "backwards design," both of which are explained in my reflection. The last two parts of this chapter addresses possible implications and limitations of my capstone.

General Conclusions

The whole capstone process was daunting, exciting and overwhelming, but in the end, I succeeded. This document and the curriculum attached in the appendix, represents the learning that took place throughout my time as a student in the Master of Arts: Education program at Hamline University.

Chapter One required me to think about all of the experiences that I have had and required me to reflect on my personal journey to see what experiences impacted me most in creating this curriculum. There were many experiences I could share, but it was during my youth and the years that followed that had the most impact. These experiences shared a common trend: spending time outdoors and learning while doing so. The capstone that followed was an effort to restore some of those memories and share them with students in a school setting.

Chapter Two was a struggle. It became very clear that environmental education had many subtopics and these subtopics would create or halt the literature review. If there were too many subtopics or the topics discussed were too broad, the literature

review would have been very overwhelming. On the flip side, if the topics were too narrow and there was not a lot of information to be found, the literature review would be incomplete and would not meet the requirements. While there is always room for improvement, the topics and subtopics I chose for this capstone were manageable and doable. Another challenge of the second chapter was the fact that not all the research was reliable. I had to do some digging to find reliable sources that were not all opinion-based. This made it challenging, but that much more rewarding in the end.

However, there were a few texts and articles that were written and researched well that contributed to the success of this capstone. One in particular was the book *Across the Spectrum.* The book begins with an in depth explanation of the history of environmental education. This was very beneficial as it gave me a foundation as to where to begin my capstone. With so many different interpretations and definitions of what environmental education is, the authors from *Across the Spectrum* described it as follows: "Environmental education is education *about* the environment (that is, the content), *for* the environment (that is, skill development to resolve environmental issues), and *in* the environment (that is, located outdoors)" (Biedenweg et al., 2016, p. 13). This definition of what environmental education is, is how I hope my project will be used to teach students about raptors. The literature review definitely was a struggle for me and was the most challenging part to this capstone, but it was most certainly worth it.

I enjoyed writing Chapter Three, as I was finally able to put all the pieces together: the learning, research and reflection - to create something of my own. In the next section, I describe how the five lessons that make up my raptor curriculum were developed.

Process used in Curriculum Development

Starting this capstone process, I had limited knowledge on raptors found in Minnesota. I knew of the more popular ones such as eagles, red-tailed hawks, and owls, but I did not know all the variety of each we had in the state. A lot of research and talking with colleagues inspired me to create this curriculum project. The pedagogical concepts used in the development of this curriculum included the North American Association of Environmental Education's (NAAEE) guidelines (NAAEE, 1996), as well as the Understanding by Design model (Wiggins & McTighe, 2011) – the second part of the framework: "backwards design." These two models were a great fit for the curriculum I created based on environmental education. The NAAEE model has six foci to follow when creating an environmental education curriculum. They are as follows: fairness and accuracy, depth, emphasis on skills building, action orientation, instructional soundness, and usability (NAAEE, 1996). Each of these foci are found in my Chapter Three, that I discuss in greater detail how they were implemented into my curriculum project.

The Understanding by Design model that I used to help create my curriculum is known as "backwards design" (Wiggins and McTighe, 2011). This "backwards design" framework has three parts to it – identifying the desired results the teacher hopes the students will know and understand, identifying acceptable evidence to know whether or not the learning goals were met or not and finally, designing the learning plan – formatting the lessons that will be taught and that will help the students to achieve the specific goals mentioned in the first two steps (Wiggins & McTighe, 2011).

Ideas and concepts also came from the nature center I currently work at. I was able to take some of the activities that they use in their raptor presentations and adjust them so I could implement the activities to fit into my own curriculum. For example, the nature center shows images to students of raptors to help the students see what that raptor looks like. I took that activity one step farther. In Lesson One: What is A Raptor?, the students are shown images of raptors as well as other predatory birds. This activity allows the students to distinguish between and identify raptors from other predatory birds. All of the lessons created, offer activities that suit each student and provides assessments for teachers to see whether or not the "acceptable evidence" is met; called for in the UbD model.

This next section will explore the implementation of this capstone and curriculum. The section will explain how this curriculum project can impact both the teacher and the students. It will also discuss future adaptation.

Implications

It is hard to guess the impact that this curriculum might have until it is taught for the first time to students. The intention of this project was to create a curriculum that can be taught both indoors and outdoors to help encourage experiential learning. This will hopefully help to keep students more engaged in the learning process and promote more hands-on, inquiry based teaching. As discussed in the literature review, "Without continuous hands-on experience, it is impossible for children to acquire a deep intuitive understanding of the natural world that is the foundation of sustainable development…" (Moore, et al., 1997).

They first step to implement this curriculum is to share it with my colleagues and allow for feedback from them to make the lessons work for all those that may teach it. By no means is this curriculum a finished product. It will constantly be adapted to help meet the needs of everyone. My hope is that this curriculum will help students to be able to identify raptors when perched and flying and that it will help them to understand the importance of raptors in our environment.

Adaptations. There are many areas within the curriculum project that could be adapted to fit the state in which this lesson is being taught in. Some of the raptors that are found in Minnesota are also found elsewhere, which allows for this curriculum to be flexible and revamped. Lessons can also be adjusted and adapted to fit the needs of the students better. The last part of this chapter, explains the limitations that this curriculum project might have.

Limitations

As with any curriculum, it will only work if the teacher feels comfortable teaching it and is willing to give it a try. The curriculum that was created only focused on science standards, but other standards definitely could be implemented as well, besides just science; such as art, music, history, math, etc. As teachers become more comfortable teaching in an outdoor setting, more of these core content areas can be implemented into the curriculum, creating a stronger unit that hits more than just one core area of focus.

Another limitation might be time. Time always seems to go by fast, especially when teaching. There never seems to be enough time to teach the material that the students need to know. The curriculum that I created can be as long or short the teacher wants it to be. The lessons were created to be taught during anytime of the year and can

be taught in whatever order the teacher feels is the best. Doing this allows for flexibility in the curriculum which is important when time is limited.

The last limitation this curriculum project could have is accessibility to materials. Although this curriculum I created does not require a lot of materials for the lessons, if the materials cannot be accessed, it will be that much harder to teach the lessons properly, or they may not be taught at all.

Conclusion

Throughout the development of my capstone and the project, I successfully provided information and research on the topic: *An environmental education, science based, curriculum on raptors, to help bring a focus and awareness to the raptors found in Minnesota.* We know, through the research, that environmental education helps students to build skills in problem solving, teamwork and discovery. We also learned that raptors are an important topic for conservation and the relationship that kids have with raptors and the natural world is shown through literature, cultural art and traditions which is why I created this curriculum on raptors.

I learned a lot about the history of environmental education, the welfare of animals, and the raptors that are found in Minnesota. I also learned a great amount about curriculum development and the research process. With not knowing a whole lot about curriculum development and creating one from scratch, I think I succeeded. I look forward to see how the students respond to the curriculum and I hope they are just as excited about it, as I was when creating it. I am curious to see where this project goes and how it gets modified over time.

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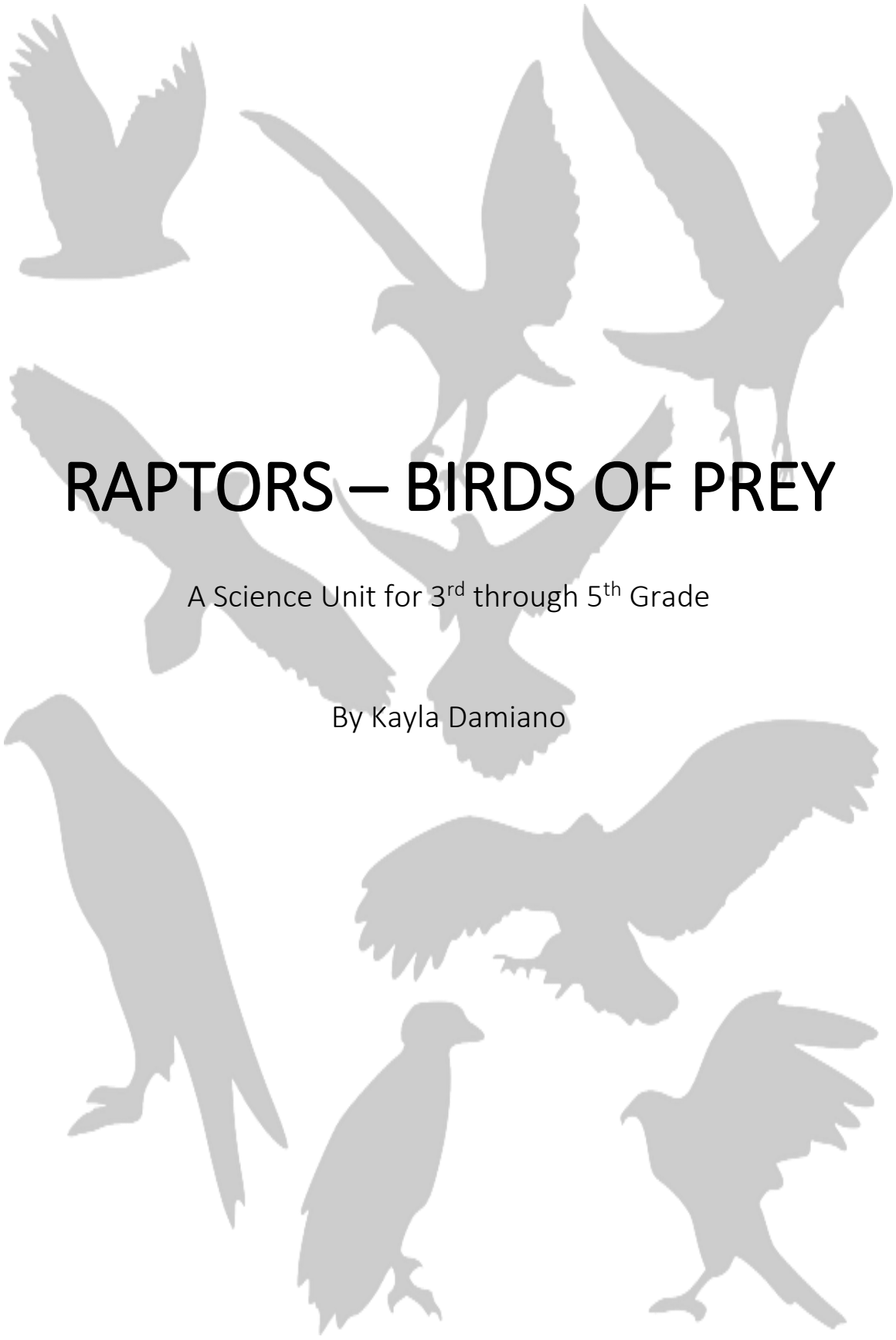
APPENDIX A: RAPTORS – BIRDS OF PREY CURRICULUM



RAPTORS – BIRDS OF PREY

A Science Unit for 3rd through 5th Grade

By Kayla Damiano

BACKGROUND INFORMATION

Why Study Raptors?

Young children are able to connect better with animals because of this sense of connection – that their bond between each other cannot be broken (Melson, 2001). One of the most effective ways of accomplishing many of the national science standards (interdependent relationships in their environment and in their ecosystems), according to the National Science Teachers Association (NSTA), is through student interaction with living organisms (NSTA, 2008). The NSTA states that, "observing and working firsthand with organisms can spark students' interest in science as well as a general respect for life, while reinforcing key concepts as outlined in the National Science Education Standards" (NSTA, 2008).

It is undeniable that humans have a bond that cannot be broken with animals and a desire to connect with wildlife. According to Melson (2001), over 50% of North American and European households have pets; whether they are dogs, cats, birds, fish or hamsters and in America over $29 billion dollars were spent on pet food: mainly dog food, just this last year in 2017 (APPA, 2018). That is a 2.9% increase than that from 2016. Pets are becoming more and more popular for families and individuals to have. In 1999, more families and individuals visited zoos and aquariums than they did major league football, basketball, baseball, and hockey games combined (AZA, 1999). In 2011, 29% of Americans partook in wildlife-related activities, demonstrating the yearning for individuals to connect with nature and wildlife (USFWS, 2011). They feel the need to be outside discovering and exploring the natural world.

The need to connect with other living organisms has been referred to with many different names. Wilson (1993) references it as the Biophilia hypothesis; Vining (2003) calls it the human-animal bond. Whatever you call it, there is significance to the relationship between humans and animals (Melson, 2001; Nelson, 1983; Vining, 2003). Individuals and families are starting to find their niche and connection with the natural world by viewing wildlife, participating in activities such as, visiting zoos and aquariums and learning how to garden. This fondness for natural beauty is prevalent (Kaplan, 1995; Ulrich et al., 1991; Wilson 1993).

The relationship with living organisms and the natural world is also shown through literature, cultural art and tradition. With their strong presence across past and present cultures and traditions in North America, one group of animals to take notice in, are raptors. Raptors (bird of prey), specifically eagles, hawks, owls and falcons have significant roles in traditions and are emblems of symbolism for many cultures in North America (Snyder & Snyder, 2006).

When presenting a species for conservation, the cultural views should be considered in order to help make a deeper connection for individuals (Woodward et al., 1999). Ever since the ancient times, birds of prey have played a big part in art, literature, traditions, and ceremonies worldwide (Snyder & Snyder, 2006). Feathers from these birds are important in that they have been used and still used today in ceremonies and attire for many tribes. Falcons have been seen in ancient Egyptian hieroglyphics and eagles and condors have been seen in ritual ceremonies (Snyder & Snyder, 2006). These interactions with birds of prey demonstrate and show the significance of the cultural connection between humans and raptors.

Indigenous people are just one group that have and hold special meanings for eagles and hawks. In some creation stories of the Pueblo tribes and other American Indian tribes, the eagle is the

leader of all birds and is the messenger to the creator (Redish & Lewis, 2015). The use of eagle feathers is very prominent in American Indian culture and traditions. The eagle is the leader of all birds and is the messenger to the creator. Many American Indian tribes are seen with eagle feathers. These feathers must be earned. It is seen as a gift from above that is an emblem of bravery, trust, honor and strength (Daston & Mittman, 2005; Lanham, 2007). In 1918 however, the Migratory Bird Treaty Act was established as well as the Bald Eagle Protection Act in 1940; making it illegal for anyone to possess, barter, purchase or sell and part of a migratory bird (Daston & Mittman, 2005; Lanham, 2007). But the importance of these feathers that came from eagles and other birds in American Indian ceremonies moved the federal government, that the government made an exemption for American Indian tribes. These feathers were to be used for spiritual practices, scientific uses, and educational purposes and for exhibition, if the tribes held the proper permits to harvest these feathers (Daston & Mittman, 2005; Lanham, 2007).

The eagle does not just have powerful meanings to Native American cultures, but for the U.S. government, universities, and organizations, too. For the United States, the eagle is the national emblem, having the same meaning it did for the Native Americans – bravery, honor, trust and strength (Daston & Mittman, 2005). Eagles are found on many flags of government officials, the president, the Air Force and more. Over 15 state flags also have an eagle representor (Daston & Mittman, 2005). At least 50 different colleges and university teams have raptors – hawks, eagles, owls or falcons – as their mascots. And the highest rank one can achieve in the Boy Scouts is the Eagle Scout (Townley, 2009). As one can see, raptors are very important for Indigenous People, the government, universities and other organizations, too.

Raptors' connection to human consciousness and their universal appeal makes them potent tools for generating interest in environmental education issues. Raptors help indicate a healthy environment. A term to help better understand how raptors indicate a healthy environment is biological indicators. Biological indicators are organisms that help provide us information about the health of the ecosystem. Why is this important? Because raptors are a low-cost warning signal of ecological change (Noss, 1990; Spellerberg, 1991). These birds "provide a critical early warning system for environmental contaminants or population declines anywhere within their food web" (CRC, 2018). Not only are raptors biological indicators, they are also a keystone species in the predator/prey population, as they help with balancing the food chain (Woodward et al., 1999). A keystone species "is an organism that helps define an entire ecosystem. Without its keystone species, the ecosystem would be dramatically different or cease to exist altogether" (National Geographic Society, 2017). Raptors impact different ecosystems relative to their abundance. They help keep some fish and rodent populations low, so they do not overpopulate (Tanecredi, 2002). Raptors are found all throughout the world extending to six different continents (Bildstein, 1998); making it easier for children to connect with them and other animals, too.

Raptors are great subjects to use for elementary environmental education lessons. Learning is increased with the inclusion of live animals and a sense of place is formed in creating a connection to the natural environment in which they live in (Sobel, 2004; Chawla, 2012). By sparking curiosity and generating questions for the audience, the student's attention is automatically engaged into what is being taught. This makes the experience more memorable and unforgettable – something beyond what is found in a book. We know that raptors are an important topic for conservation programming; in that birds of prey are appealing to children,

making a presence in literature, art and films and playing important roles in cultural symbolism (Daston & Mittman, 2005).

As mentioned above, many children have already had interactions observing or taking care of animals in the classroom or at home. Such animals may include hamsters, gerbils, cats, dogs, fish or rabbits (Vining, 2003). While most children are familiar with birds of prey – eagles, hawks and owls – many of them have not been able to experience them up close (Snyder & Snyder, 2006). With the strong connection that raptors have with their surrounding environment, this makes them vital subjects for discussing and bringing awareness to conservation and sustainability needs (Bildstein, 1998).

DEFINE LEARNERS

This science unit is designed for third through fifth grade students studying science in a Minnesota Public Elementary School. The unit can be adapt to fit the needs of the students in the different classes.

CONTENT STANDARDS

Minnesota State Science Standards

*** All Standards were retrieved from: Minnesota Department of Education, (2010). Minnesota Academic Standards: Science K-12, 2009. Retrieved from: http://www.scimathmn.org/stemtc/standards ***

3.1. The Nature of Science and Engineering 1. The Practice of Science 2. Scientific inquiry is a set of interrelated processes incorporating multiple approaches that are used to pose questions about the natural world and investigate phenomena. 3.1.1.2.3 Maintain a record of observations, procedures and explanations, being careful to distinguish between actual observations and ideas about what was observed. For example: Make a chart comparing observations about the structures of plants and animals.

3.1. The Nature of Science and Engineering 1. The Practice of Science 2. Scientific inquiry is a set of interrelated processes incorporating multiple approaches that are used to pose questions about the natural world and investigate phenomena. 3.1.1.2.4 Construct reasonable explanations based on evidence collected from observations or experiments.

3.4. Life Science 1. Structure and Function of Living Systems 1. Living things are diverse with many different characteristics that enable them to grow, reproduce and survive. 3.4.1.1.2 Identify common groups of plants and animals using observable physical characteristics, structures and behaviors. For example: Sort animals into groups such as mammals and amphibians based on physical characteristics. Another example: Sort and identify common Minnesota trees based on leaf/needle characteristics.

5.1. The Nature of Science and Engineering 1. The Practice of Science 1.Science is a way of knowing about the natural world, is done by individuals and groups, and is characterized by empirical criteria, logical argument and skeptical review. 5.1.1.1.3 Understand that different explanations for the same observations usually lead to making more observations and trying to resolve the differences.
5.1. The Nature of Science and Engineering 3. Interactions among Science, Engineering, Technology and Society 4. Tools and mathematics help scientists and engineers see more, measure more accurately, and do things that they could not otherwise accomplish. 5.1.3.4.1 Use

appropriate tools and techniques in gathering, analyzing and interpreting data. For example: Spring scale, metric measurements, tables, mean/median/range, spreadsheets, and appropriate graphs

5.4. Life Science 1. Structure and Function of Living Systems 1. Living things are diverse with many different characteristics that enable them to grow, reproduce and survive. 5.4.1.1.1 Describe how plant and animal structures and their functions provide an advantage for survival in a given natural system. For example: Compare the physical characteristics of plants or animals from widely different environments, such as desert verses tropical, and explore how each has adapted to its environment.

5.4. Life Science 2. Interdependence among Living Systems 1. Natural systems have many components that interact to maintain the living system 5.4.2.1.1 Describe a natural system in Minnesota, such as a wetland, prairie, or garden, in terms of the relationships among its living and nonliving parts, as well as inputs and outputs. For example: Design and construct a habitat for a living organism that meets its need for food, air and water.

LEARNING OBJECTIVES:

Students will be able to…

- Examine examples of raptors
- Be able to identify attributes shared by most raptors
- Ask and answer questions about raptors
- Know and retell one fact about each raptor shared
- Distinguish among and identify raptors from other predatory birds
- Know and be able to name the seven groups of raptors
- Identify at least one type of raptor from each group
- Successfully compare and contrast raptor groups
- Practice measurement skills using their arm length
- Make observations of the natural environment by using three of their five senses
- Dissect owl pellets and identify what the owl has been eating
- Learn new words and ask/answer their own questions that they may have
- Be able to observe and make connections to what they have learned in the classroom out in the “field”
- Gather research on a raptor of their choice from raptors learned throughout the unit
- Write an essay related to a general question
- Share their reports with the class
- Create a display of their raptor’s habitat
- Share their displays with their classmates
- Participate in questionnaire from their classmates and teacher regarding their displays

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MATERIALS:

- Photos of raptors (Appendix A)
- Raptor and bird pictures of (Appendix C):
    - Beak:
        - Raptor
        - Duck
        - Great Blue Heron
    - Foot
        - Raptor
        - Goose
        - Turkey
    - Skull
        - Raptor
        - Raven
        - Goose
- Raptor costume:
    - Towel
    - Tennis ball (cut in half for eyes)
    - Plastic knives (for beak),
    - Forks (for talons).
    - Ice cream gallon bucket – cut out the bottom so you are left with a circle frame
- Photos of non-raptor predatory birds (Appendix B)
- "Raptor and non-raptor" cards (Appendix D)
- What is a Raptor? Handout (Appendix R)
- Raptor images – all the raptors discussed in Lesson 2 (Appendix E)
- Identification and Silhouette handout (Appendix F)
- Eagle Handout (Appendix G)
- Osprey & Harrier Handout (Appendix H)
- Hawk Handout (Appendix I)
- Accipiters Handout (Appendix Q)
- Falcon Handout (Appendix J)
- Turkey Vulture Handout (Appendix K)
  Owl Handout (Appendix L)
- Butcher Paper
- Markers/Crayons
- Scissors
- Rulers
- Bird zip line
- Venn-Diagram worksheet (Appendix M1 & M2)
- Notebooks/Journals
- Pencils/Pens
- Owl pellets
- Blank sheets of paper
- Plastic sandwich bags
- Permanent markers
- Bone identification charts (Appendix N)
- Toothpicks or tweezers
- Permission slips (Appendix O)
- Computers or IPads
- Materials for habitat project
    - Cardboard/Shoe boxes
    - Markers
    - Color pencils
    - Paper plates
    - Construction Paper
    - Scissors
    - (Anything else the students bring from home)
- Grading Rubric (Appendix P)
- Raptor Game (Appendix R)

LESSON 1: WHAT IS A RAPTOR?

Grades: 3-5
Duration: 2 Class Periods

OBJECTIVES

Students will:

- Examine examples of raptors
- Be able to identify attributes shared by most raptors
- Ask and answer questions about raptors
- Know and retell one fact about each raptor shared

PREPARATION

- Gather provided images of raptors and predatory bird characteristics.
- Gather the provided "cards" of raptors that students will use
- Photocopy the student hand-out "What is a Raptor?"

VOCABULARY

Key Words about Raptors:

- Carnivore, Diurnal, Facial Disc, Eagle, Species, Fledging, Food Chain, Predator, Prey, Habitat, Migrate, Nocturnal, Hawk, Raptor, Regurgitate, Pellet, Owl, Talons, Territory, Vulture, Falcon, Life Cycle, Gizzard

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MATERIALS

- Photos of raptors and or non-raptor predatory birds (Appendix A & Appendix B)
- Raptor and bird pictures of (Appendix C):
    - Beak:
        - Raptor
        - Duck
        - Great Blue Heron
    - Foot
        - Raptor
        - Goose
        - Turkey
    - Skull
        - Raptor
        - Raven
        - Goose
- Raptor costume
    - Towel, tennis ball (cut in half for eyes), plastic knives (for beak), forks (for talons), ice cream bucket.

OVERVIEW

- Begin by asking the students what they think of when they hear the term "PREY"?
    - Eventually, students will come to the conclusion that a prey is something that another animal eats.
- Ask if they know what a predator is. Or what a predatory bird is.
    - A predator, catches and eats prey / a predatory bird catches and kills its food.
        - Explain to the students that some predatory birds catch food with their beaks while others catch food with their feet. Show the provided images of the Great Blue Heron and the Eagle to help illustrate this better (Appendix A and Appendix B).
        - Explain that the Eagle and heron are both predatory birds, however the Eagle is also a raptor and the heron is not.
- Run through the three main characteristics that make up a raptor:
    - Sharp, curved, hooked beak: used to kill, rip apart meat and to pluck feathers and fur from their prey.
    - Strong grasping feet with sharp talons (like our fingernails, they are their nails on their feet) used to snatch the prey. The only group of birds that hunt with their feet.
    - Keen eye sight: can focus on objects far from them and sense movement from the tiniest of creatures.

    *** You can also mention that raptors are carnivores – meaning that they eat meat but that this is not a main characteristic exclusive raptors. This is because other birds besides raptors eat meat such as robins, herons, crows, etc. ***

        - Show images of feet, beaks and eyesight of different birds and raptors (Appendix C).
        - Explain that raptors catch and kill their prey with their feet, they use their beaks to help tear the food they caught into smaller pieces if they can't swallow it whole, and raptors can see two times better than that of humans and can pick up movement up to five times greater than humans.

DEMONSTRATION: RAPTOR COSTUME

Materials:

- Raptor Costume:
    - Towel or blanket
    - Tennis ball cut in half, attached with elastic
    - Plastic knives (two) made in the shape of a beak
    - Two metal forks
    - Ice cream gallon bucket – cut out the bottom so you are left with a circle frame

Instructions:

- Ask for a volunteer to come up in front of the class.
    - Explain to the student that you will be dressing them up as a raptor, so make sure they are okay with that.
- Begin by placing the towel or blanket over the student's shoulders. This towel/blanket represents the raptors feathers.
    - Plumage: The feathers on owls help them blend into the environment. This is known as camouflage.
    - Wings: Owls fly silently through the air. They have special feathers on their wings that allow them to do this.
- Then have the student put on the tennis ball eyes over their eyes. These tennis balls represent the keen eyesight that raptors have.
    - Forward Eyes: Large eyes that face forwards (unlike other birds, whose eyes are on the sides of their head). This eye placement gives them binocular vision and very specific depth perception. Their eyes are large and are locked in the skull, which means the owl has to turn its head in order to move its eyes. Owls have a range of movement of about 180°.
- Add the knife beak. This shows that raptors have a sharp beak that they use to rip apart their prey once caught.
- Next, place the two forks face down on the top of their shoes. These forks represent the feet and talons of the raptor. The sharp talons are used to help grasp, kill and tear apart the prey that they catch.
    - Foot Structure: Many owls have feathered feet to help with insulation and to serve as minor protection from the bites or scratches of captured prey. They have very sharp talons that they use to catch their prey.
- Lastly, place the circle frame over the student's face. This frame represents the facial disc that most raptors have.
    - Facial Disk: Owls have a large head. An owl's face is distinctly shaped with a disk-like structure that surrounds the beak and eyes. The beak is sharp to help rip apart food. The feathers of the facial disk also help to direct sounds towards the ear openings.

    *** You can have the student try to locate you by making noises. This will show that some raptors have to move their whole head in order to see. Such raptors include owls. Thank the student for coming up and move on to next activity. ***

    - Keen Hearing: While all birds have good senses, owls have especially acute hearing. Some owls have their ears placed asymmetrically on their heads, an arrangement that can help them triangulate prey position more quickly and accurately.

ACTIVITY: RAPTORS AND OTHER PREDATORY BIRDS

Class Activity:

Objective:

- Upon completion of this activity, students will be able to distinguish among and identify raptors from other predatory birds.

Materials:

- Photos of raptors (Appendix A)
- Photos of non-raptor predatory birds (Appendix B)

Instructions:

- The teacher will hold up different images while the students identify the images as being a raptor or non-raptor and will explain why.

Group Activity:

Objective:

- Reinforce the facts about and differences among raptors and other birds.

Materials:

- "Raptor and non-raptor" cards (Appendix D).

Instructions:

- Teacher will break students into groups of three to four.
- Teacher will handout "raptor and non-raptor" cards.
- Tell students to shuffle cards and lay them faced down in center of the group.
- Have the students take turns choosing a card and have them explain why they are placing the card into each pile – raptor or non-raptor predatory bird.
- Teacher will move about room asking student's questions and ask them why they placed "said bird" into the pile they did.

ACTIVITY: FOOD CHAIN/WEB CREATION

Group Activity:

Objective:

- Upon completion of this activity, students will be able to distinguish if an animal is a prey or predator and successfully illustrate that in a food chain/web.

Materials:

- White paper
- Markers/color pencils
- Pencils

Instructions:

- Begin by asking the students what does an owl or eagle eat?
    - Write the answers the students provide on the board.
- Keep doing this for all the animals the students list, until you make it down to plants/grass.
- Once you have a list, split the students into groups and have each group create a food web/chain of the animals listed on the board.
- Clarify which direction the arrows should point to so the food webs are consistent among all the groups.
- The students should include illustrations of the animals and label each with arrows as to who eats who.
- The teacher wanders around the room answering questions the students may have and to make sure the students are staying on task.

LESSON 2: TYPES & GROUPS OF RAPTORS

*** (All of the information about the raptors below came from Brinkley, E. S. (2007). *Field Guide to Birds of North America.* New York, NY: Sterling Publishing Co., Inc.) ***

Grades: 3-5
Class Periods: 5-7

OBJECTIVES

Students will:

- Know and be able to name the seven groups of raptors
- Identify at least one type of raptor from each group

PREPARATION

- Make photocopies for students of the handouts "Identification, Silhouettes, Owls, Eagles, Hawks, Falcons, Turkey Vultures, and Osprey/Northern Harrier."
- Gather provided images of the raptor groups

VOCABULARY

Key Words about Raptors:

- Nocturnal, Crepuscular, Stealth, Thermals, Stoops Carrion, Polygynous, Marmots, DDT Pesticide. Riparian, Spicules, Plumage, Vertebrates, Camouflage, Ear Tufts, Tarsi, Apex Predator, Thermoregulation.

MATERIALS

- Raptor images (Appendix E)
- Identification and Silhouette handout (Appendix F)
- Eagle Handout (Appendix G)
- Osprey & Harrier Handout (Appendix H)
- Hawks Handout (Appendix I)
- Falcons Handout (Appendix J)
- Turkey Vulture Handout (Appendix K)
- Owl Handout (L)
- Accipiters Handout (Appendix Q)
- Bird zip line
- Venn-Diagram worksheet (2 circle and 3 circle)

OVERVIEW

- Review the three main characteristics that ALL raptors have. *Ask if they remember what the fourth one is too.

    - Sharp, hooked beak, Talons, & Excellent eyesight; *Carnivore

- Explain to the class that they will be learning about seven groups of raptors found in Minnesota and the different species found within those groups. The groups include:
    - Eagles
    - Ospreys
    - Northern Harriers
    - Hawks
    - Owls
    - Falcons
    - Turkey Vultures

DAY ONE: Eagles, Osprey and Northern Harriers

- Today, the students will be learning about three of the seven raptor groups. The groups today include:

    - Eagles
        - Bald Eagles
        - Golden Eagles
    - Ospreys
    - Northern Harriers

- Hang up the images of the eagles for the students to look at (Appendix E). Pass out the eagle handout and the Identification and Silhouette handout to the students as well (Appendix F and Appendix G). Explain that two species of eagles can be found in Minnesota; the Bald Eagle *(Halaliaeetus leucocephalus*) and the Golden Eagle (*Aquila chryseatos*). These very large birds are found together in some habitats but are mainly found in different habitat types.

    *** Eagles, located at the top of the food web, are known as apex predators. Eagles have two eye lids and can see five times better than humans; and can also see five colors instead of the three basic colors like humans (Ferguson-Lees & Christie, 2001). ***

    - Bald Eagles: or "fish eagles" can be found almost anywhere in North America as long as there is water nearby. The Bald Eagle has been a spiritual symbol for many American Indian tribes for many years and has been the national emblem of the United States since 1782. These birds are currently listed as "least concern" after being hit hard from the DDT pesticide. Bald Eagles feed mainly on fish and waterfowl and occasionally on carrion (animals that are already dead). They are very distinctive with their "bald" head and tail and their brown bodies. The wing span of the Bald Eagle is roughly 6 feet long and it can take up to 5

years for a Bald Eagle to fully mature into an adult. They have keen eyesight, spotting a small rabbit from a distance of roughly two miles away!

- Golden Eagles: are a member of the "booted eagle" category, meaning that they have feathered tarsi (lower legs). Golden Eagles are located in remote habitat types ranging from tundra to desert, mountains to marshes. These birds hunt from the air killing prey such as large birds and mammals, which range from herons to marmots (woodchucks/ groundhogs). Golden Eagles travel through Minnesota mainly during their migration.

- Hang up the images of the Osprey *(Pandion haliaetus)* and Northern Harrier (*Circus cyaneus)* for the students to look at (Appendix E). Pass out the osprey and harrier handout to the students as well (Appendix H). Explain to the class that several raptor species belong in their own groups; such raptors include the Northern Harrier and Osprey.

    - Northern Harriers: have a cosmopolitan genus – extending its range to all or most parts of the world; specializing in open habitats along tundras, meadows, prairies, farm fields, and marshes searching for mice. Their bodies – wings, legs and tail are slender, an adaptation that makes them better at flying and foraging over high prairie fields. These raptors, like owls, have a facial disk, which helps them to detect prey by ear. Males tend to be polygynous (mate with multiple females and bring food to the nest of multiple mates.

    - Osprey – "fish hawk": were once threatened by the DDT pesticide, (just like the Eagles were), but today, they are thriving and can be found near riparian habitats – lakes, bays and rivers. These birds are large fish-eating birds. They make their nests on tall telephone poles, buoys, and channel markers and in large trees. Osprey love to hover around open water waiting to plunge down to grasp the fish out of the water with their open, sharp talons lined with spicules (barbs). The wing shape of an Osprey, is very similar to that of a seagull.

ACTIVITY: COMPARE & CONTRAST RAPTOR GROUPS

Group Activity:

Objective:

- By using a Venn diagram, the students will be able to successfully compare and contrast three of the seven raptor groups.

Materials:

- Let the images from the Raptor Group Lesson remain hanging up.
- Venn diagram handout (Appendix M1)

Instructions:

- Break up the students into pairs.

- Have them fill out the Venn diagram by comparing and contrasting the differences and similarities of the raptor groups they just learned about. (Can be any of the three. The students choose two to compare and contrast).

ACTIVITY: EAGLE CAM

Whole Class Activity:

Objective:

- To make observations of what the students notice about the Eagle being filmed.
    - Weather, how many Eagles present, how many eggs are there, nest, etc.

Materials:

- Journals
- Pencils
- Projector and Screen
- Eagle Cam Website
- Computer

Instructions:

- Ask the students to take out their journals and a writing utensil.
- Share with them that they will be making observations from a live Eagle Cam.
- Pull up the Eagle Cam on the big screen and give the students some time to make observations and any predictions on when the eaglets will hatch. Website below: https://www.dnr.state.mn.us/features/webcams/eaglecam/index.html

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ACTIVITY: EAGLE EYE

Instructions:

Eagle Eye is a great outdoor game for children. It is basically an elaborate variation of the game of hide-n-seek. It is an excellent game for teaching children how to be comfortable down in the undergrowth and dirt. Eagle eye is one of the truly amazing outdoor games for children because it can also help you teach children how to be still and quiet for extended periods and how to move about more quietly in the natural world. The rules are as follows:

- You, as the instructor, delineate a small area several meters in circumference that will be the "Eagle's nest." Use whatever material is available – sticks, rocks, pine cones, backpacks – to create a clear visual boundary as the edge of the nest. It can help to include a tree or large boulder as part of the edge of this circle so it can be leaned against, and faced into when counting.

- Announce how long you will be counting. As you count to between 40 and 60 seconds, face away from the children and if possible cover your eyes. At this time, the students go out and hide. When you are done counting, you can open your eyes and visually scan around to see if you can spot the students. You announce that you are done counting by

saying something to the extent of "the Eagle's eyes are open," or "the Eagle is awake." You can move to any place inside the boundaries of the owl's nest and look from there, but you may not step outside of that boundary at any time.

- The children must hide so that they are not seen or heard by you. They must, however, keep one eye on you – the instructor (or "Eagle") – no matter where they are hiding and at all times.

- Any children that are spotted by you come and sit quietly in the nest. They are not allowed to tell you nor point to where the other children are hiding. You can have them pretend to be Eagle chicks or pretend to be some kind of Eagle food, i.e. a rat, fish or bird.

- After about 1 to 2 minutes of visually scanning, you can turn around again and count. This time count 5 or 10 seconds less. It helps to announce what number you are counting to each time you count.

- At this time, the children have to move 5 steps closer to the Eagle's nest. With each consecutive time you count, they have to come closer to you by 5 steps. The goal for them is to get as close as possible to you without being spotted.

- The last child to be spotted becomes the new Eagle.

  *** This outdoor game for children is generally best played in a forested area with some undergrowth. Although the intention is to spot the kids, it can add a bit of fun to prolong the time which it takes you to spot them, even if, you can already see some of the children as you scan. Consider taking the opportunity before or after the game to talk about how many animals have to stay hidden to stay alive. ***

DAY TWO: Hawks

- Explain to the class that they will be learning about another one of the seven groups of raptors today. This time the focus will be solely on hawks, which include:

  - Hawks
    - Northern Goshawk
    - Coopers
    - Sharp-shinned
    - Broad-winged
    - Red-shouldered
    - Rough-legged
    - Red Tailed

  *** Accipiters Handout (Appendix Q) ***

- Hang up the images of the accipiter hawks for the students to look at (Appendix E). Pass out the hawk handout to the students as well (Appendix I). Explain that there are two

sub groups of hawks that can be found in Minnesota; the Accipiters (woodland hawks) and the Buteos (soaring hawks). The accipiters hawks include the Northern Goshawk *(Accipiter gentilis*), Coopers Hawk (*Accipiter cooperii),* and the Sharp-shinned Hawk *(Accipiter striatus)*; while the buteos are the rest of the hawks. These birds are built for speed and can maneuver extremely well. Soaring hawks tend to have broader wings with more of a fan shaped tail. These features allow the hawks to stay higher up in the air, catching a ride on thermals (warm rising air) for a longer period of time.

- Explain Accipiters. Accipiters are forest-dwelling hawks with short, rounded wings and long tails. These raptors tend to flap and glide when they migrate. Pass out handout to the students (Appendix Q).

    - Northern Goshawks: are raptors that are typically found in coniferous and mixed woodlands. Goshawks are large, heavy bodied birds and agile hunters; hunting anything from grouse to hares to other small mammals. Females tend to be very aggressive around their nest and have been known to attack humans if they get too close. When identifying this raptor, it often gets confused with Coppers Hawks and young Red-shoulder Hawks. Goshawks are mainly grey in color with black barring on the tail and a prominent white streak above the eyes.

    - Coopers Hawks: also known as the "chicken hawk"; prey on small birds, often making a surprise presence at bird feeding grounds. Males tend to be smaller than females. These hawks are found in urban cities, forests and prairies. They have a golden and white speckled belly and grey wings. The underside has dark brown streaks, with trailing edge of wings straight and a broad white tail tip. Tail is much broader than that of the Sharp-shinned Hawk.

    - Sharp-shinned Hawks: are about the size of a robin. These hawks can be found in forests and prairies. Often more rare than Coppers, Sharp-shinned Hawks are also mistakenly identified as Cooper Hawks. Sharp-shinned Hawks are much smaller than a Coopers Hawk, but they both have roughly the same plumage; although the Sharp-shinned has a square-tip tail unlike the Coppers Hawk. Sharp-shinneds prey mainly on small birds that are found near bird feeders and will occasionally feed on small vertebrates.

- The next hawks that will be explained fall under the species of Buteo, meaning soaring hawks. Hang up the hawk images for this group (Appendix E).

    - Broad-winged Hawks (*Buteo platypterus)*: feed mainly on small vertebrates and insects, located within the canopy cover of mixed and deciduous forests. The Broad-winged Hawk has dark-tipped wing tips, the wings are rather short when soaring, and it has one white tailband visible. The hawk is brown above with barring, speckling below.

    - Red-shouldered Hawks (*Buteo lineatus)*: are one of the smaller hawk species, commonly found in mixed and mature deciduous forests, woodland swamps and near fresh water. It is here, where the hawk does most of its hunting, feeding mainly on amphibians, reptiles, rodents, snails, and fish. The youngsters often

get confused with Goshawks and Coppers, but the Red-shoulder Hawks have translucent primary crescents – two distinctive underparts or the wings.

- Rough-legged Hawks (*Buteo lagopus)*: are one of the larger hawk species. This hawk is from the Arctic coming to Minnesota during the winter season as well as during its migration. It feeds almost exclusively on rodents and can be found in open habitat types, hovering over marshes or fields in such of food. These raptors have distinctive black patches on both wings, black wing tips and tail feathers, large chocolate belly patch and white underside.

- Red-tailed Hawks (*Buteo jamaicensis)*: one of the most common raptors found in Minnesota. It is also the most variable and widespread raptor in North America. These birds are found in virtually every habitat type, ranging from the tundra to forests, deserts to marshes. This hawk, feeds mainly on rodents from perches or in the air. Red-tailed Hawks get their name from their famous red/copper tail. They are mainly white underneath with a few dark marks in the belly and black wing-tips. Their back side ranges in shades of brown and white and their legs and feet are fairly large and unfeathered.

ACTIVITY: COMPARE & CONTRAST RAPTOR GROUPS

Group Activity:

Objective:

- By using a Venn diagram, the students will be able to successfully compare and contrast four of the seven raptor groups.

Materials:

- Let the images from the Raptor Group Lesson remain hanging up.
- Venn diagram handout (Appendix M1)

Instructions:

- Break up the students into pairs.
- Have them fill out the Venn diagram by comparing and contrasting the differences and similarities among the raptors, using the raptor groups they have now learned about. (Can be any of the four groups learned so far, but the groups should be different from the ones they compared and contrasted yesterday. The students choose two to compare and contrast).
- Teacher should move about the room and answer any questions the students might have.

ACTIVITY: HAWK TAG

Instructions:

- Explain to the students that a game of tag will be played. Pick one student to be the "Hawk" and the rest of the students are mice.
- The "Hawk" is trying to tag as many mice as he/she can within the allotted time the teacher provides them.
- Count the "mice" that the "Hawk" has caught and then pick a new "Hawk." Continue playing until period is over.

  *** After playing several rounds, explain to the students what the words predator and camouflage mean. Share with them that animals use camouflage to help them blend into their surroundings/habitat in order to make it hard for predators to find them. ***

DAY THREE: Falcons and Turkey Vultures

- Explain to the class that they will be learning about two more groups of raptors today. This time the focus will be on Falcons and Turkey Vultures.
  - Falcons
    - American Kestrel
    - Merlin
    - Peregrine
  - Turkey Vultures
- Hang up the images of the falcons and pass out the falcon handout to the students (Appendix E and Appendix J). There are three different species of falcons that can be seen in Minnesota – Peregrine, American Kestrel and Merlin. These birds are known for their speed and grace in the air, with their long, pointed wings and tails; which help them maneuver quickly in order to catch their prey. Falcons are unique in that they have a tomial tooth, known as the "killing tooth." This special tooth that is a part of their upper beak, is used to sever the prey's spinal column. Falcons kill their prey with their beaks unlike other raptors that use their feet.

  *** In falcons, and some other raptor species, females tend to be the larger and bolder of the sexes. For falcons, females are preferred for the sport of falconry (Weidensaul, 2000). ***

  - American Kestrels (*Falco sparverius):* are one of the most colorful raptors there are. It lives in open habitats, nesting in cavities made from woodpeckers or in nest boxes created by humans. Kestrels feed mainly on mice but will often hunt small birds, bats, insects, reptiles and sometimes fish. They are seen often perching on fence posts and utility wires, awaiting prey. Kestrels have two black stripes on their faces, have black spots on their tan bellies, and males have blue and red/orange colored wings and back. Their tail has a thick black band near the end of it.

- Merlins (*Falco columbarius):* are seen in Minnesota during the winter and summer months and during their migration. These raptors are a small falcon nesting in boreal forests and muskegs. Merlins hunt their prey while flying, accelerating to fast speeds, snatching small birds to eat later. Their plumage consists of a gray tone above with a heavily marked brown belly. When flying, the Merlin's underside – wings and tail, are banded black and white.

- Peregrine Falcons (*Falco peregrinus):* are the fastest animal on planet, reaching speeds of up to 200 miles per hour while they are in their stoops (dives). This bird catches all of its prey while in the air, mainly feeding on birds, killing them instantly with its tomial tooth. Peregrines have pointed wings, a narrow, long tail and large yellow feet, and orbital ring. They are grey-blue above and much paler below. Commonly found in cities, nesting on skyscrapers or near high cliff embankments. In Minnesota, they are seen during their migration, during the summer months and are a permanent resident near the Twin Cities.

- Hang up the image of the Turkey Vulture and pass out the Turkey Vulture handout to the students (Appendix E and Appendix K).

    - Turkey Vultures *(Cathartes aura):* are seen in Minnesota during the summer months soaring high in the sky, over open fields in search of food. The majority of their diet consists of mainly carrion (dead animal carcasses), which they use their keen sense of smell to find. These birds are large. Mainly black/brown in color with a featherless red head and featherless feet. When flying, they appear to look as if they are drunk and their wings make a distinct "W" shape.

    *** The featherless head of the Turkey Vulture is to help keep the head clean when feeding so bacteria and infection won't grow. It's also believed that their featherless heads help with thermoregulation – "a process that allows your body to maintain its core internal temperature" (Holland, 2016). Vultures also urinate straight down their legs to help with cooling themselves down (Weidensaul, 2000). ***

ACTIVITY: COMPARE & CONTRAST RAPTOR GROUPS

Group Activity:

Objective:

- By using a Venn diagram, the students will be able to successfully compare and contrast all of the seven raptor groups.

Materials:

- Let the images from the Raptor Group Lesson remain hanging up.
- Venn diagram handout (Appendix M2)

Instructions:

- Break up the students into pairs.

- Have them fill out the Venn diagram handout by comparing and contrasting the differences and similarities the raptors have, by using three of the raptor groups they have learned throughout the week.
- Teacher should move about the room and answer any questions the students might have.

ACTIVITY: STUDENT AND RAPTOR WINGSPANS

Group Activity:

Objective:

- To practice measurement skills by using their arm length.
- To compare sizes of raptors by comparing their arm span to raptor wingspans.

Materials:

- Butcher paper
- Markers or crayons
- Scissors
- Rulers/Yard Sticks

Instructions:

- Work in pairs and draw the life-size wingspan of the raptor of your choosing. (Teacher will make sure each group is doing a different raptor).
- Have the students color their wings, the color that the raptor is they chose.
- Have the students cut their wings out.
- After all groups are done, hang the wings up throughout the classroom and allow students to move about to see what raptor they are closely related to, when spreading their arms out.

*** This is a great illustration to show the students just how big the wingspans of some raptors are. ***

DAY FOUR: Owls

- Explain to the class that they will be learning about the last of the group of raptors today. The focus will be entirely on owls. Such owls include:
    - Owls
        - Short-eared
        - Long-eared
        - Great Horned
        - Great Gray
        - Snowy
        - Barred
        - Boreal
        - Northern saw-whet
        - Northern Hawk
        - Eastern Screech
- Hang up the images of the owls for the students to look at (Appendix E). Pass out the owl handout to the students as well (Appendix L). Explain that owls can be both active during the twilight (before sunrise or sunset) hours (crepuscular) and during the night

(nocturnal). When an owl hunts, it relies mainly on stealth (silence) in order to be successful, and swallows their prey whole once caught, if it is small enough; otherwise they will use their beaks and talons to rip and tear the prey apart to consume. The majority of owls have what's called a facial disc. This disc is used to help move sound waves to the owl's ears, to help them locate their prey. Now, owl ears are not like ours (humans). Most owls, especially nocturnal owls, have asymmetrical ears – ears that are offset from one another; this placement, helps them to locate sounds much quicker and faster – 200 microseconds faster.

*** Owls have large, forward facing eyes which are fixed in their sockets, so they must turn their entire head in order to change view. Owls also can only rotate their head roughly 180 degrees Fahrenheit, and not 360 (Weidensaul, 2000). ***

- Short-eared Owls (*Asio flammeus)*: are commonly found in areas of open habitats – savannas, grasslands, marshes, prairies and agricultural fields. They feed frequently on rodents, hunting at night. Short-eared Owls have a streamlined body, with brown and straw colored patches above with a belly and wings lighter cream color below. It is during their migration that you may see one of these owls in Minnesota.

- Long-eared Owls (*Asio otus):* are much darker in color than that of the Short-eared Owls. They are nocturnal, rarely found foraging before dark, feeding on rodents and small mammals, in coniferous/deciduous forest habitat. Long-eared Owls are larger than Short-eared Owls and they have long ear tufts on the top of their heads. They have an orange facial disc with dark internal borders. The plumage of this bird is different shades of brown, orange and black. They have a narrow stance, which is typical of a roosting bird (one that sits in trees). You are more prone to see one of these birds during the summertime unless you live in the southeast corner of the state; then you may see them year round.

- Great Horned Owls (*Bubo virginianus)*: are a large, powerful owl found in all habitat types. It is a resident (stays year round) from the tundra edge to deserts and into tropical America. It fills the ecological niches occupied by the Red-tailed Hawks by hunting right at dusk, into night time. The owl feeds on just about anything for prey – skunks, opossums, snakes, and scorpions; as well as other owls, and birds such as grouse and American Bittern. It can carry prey that is three times its own weight. The plumage of the Great Horned Owl ranges in colors of brown, greys, blacks and whites. They have a distinctive white collar and two ear tuffs on the side of their head. These tufts are not actually ears, but rather tufts of feathers to help them blend into their surroundings better (camouflage).

- Great Gray Owls (*Strix nebulosi):* are permanent residents of the boreal forests, high mountain meadows, and muskegs. In Minnesota, they are seen during the winter season and in Northern Minnesota, they are a resident for life. One of the main food sources for these owls are rodents which they hunt during the evening through early morning. However, in winter, they will hunt during the day, plunging through the deep, deep snow catching its prey that they detect by ear. They make deep, low muffled hoots when calling. Great Grey's have large heads

with circles inside facial disc, making their eyes look tiny. It is one of the biggest owls in the owl family.

- Snowy Owls (*Bubo scandiacus):* are found in Minnesota during the winter season at airports and farm fields. They love lemmings (type of rodent), and will often prey on other rodents, small mammals, and birds, including grebes, ducks and sometimes gulls (if traveling well south of its range). Snowys can be seen hunting during the day in open terrain and are very well recognized by their plumage. Some Snowys are all white in color, while others can be seen with black markings all over. Snowy Owls are smaller than that of the Great Gary Owls but can weigh almost two times as much. Females have been known to weigh over four pounds.
- Barred Owls (*Strix varia):* are commonly found in mixed woodland and swamp forests, feeding on insects, rodents, vertebrates and favors amphibians. These birds are a permanent resident of Minnesota. They roost mainly during the day and hunt for prey at night. Barred Owls are different shades of brown and white, with dark brown eyes and a yellow beak. The belly of the bird is horizontally and vertically streaked with brown bars on a white background; head and tail are rounded. Barred Owls make a very distinctive call that sounds like "*Who cooks for you, who cooks for you-allllllll?"*
- Boreal Owls *(Aegolius funereus):* are found in the upper northern part of Minnesota, during the winter season. They love boreal, coniferous, and mixed-high mountain forests. Boreal Owls roost during the day in thick cover and catch prey at night that include vertebrates, which they consume later. If the prey is frozen, they will warm it up against their body. These owls have a heavily spotted crown and back and are shades of brown, white and grey. They have a lighter color belly and a white facial disc framed in dark brown with a pale beak. Their eyes are golden yellow.
- Northern Saw-whet Owls (*Aegolius acadicus):* are small, widespread birds that are found throughout Minnesota during the winter and summer seasons and can be seen during their migration. They like deciduous and mixed forests; feeding mainly on rodents and small birds they hunt during the night time hours. Northern Saw-whet Owls have lightly spotted underparts – wings and belly and they have a brownish facial disc framed with white streaks.
- Northern Hawk Owls (*Surnia ulula):* are found in the northern part of Minnesota during the winter season. They like spruce forests and muskegs. These birds are diurnal hunters, feeding on rodents mainly. They spend the majority of their time perched in spruce trees. Hawk Owls have a barred chest with brown bars, a long tail and their plumage is browns, blacks and whites. Unlike most raptors, males and females Hawk Owls are similar in size.
- Eastern Screech Owls (*Megascops asio):* are a permanent resident of Minnesota found in diverse habitats – river valleys, savannas, Midwestern orchards and suburban parks. They tend to nest in nest boxes and raise young close to houses where there is an ample supply of prey – mice, birds and large insects. These birds come in two morphs – a red morph and a grey morph, and both morphs

have ear tufts on the side of their head. They have relatively large eyes, a pale beak and are quite small compared to other owl species.

ACTIVITY: COMPARE & CONTRAST RAPTOR GROUPS

Group Activity:

Objective:

- By using the information that the students have learned throughout the week, they will be able to successfully compare and contrast the seven raptor groups.

Materials:

- Let the images from the Raptor Group Lesson remain hanging up in the room.

Instructions:

- Have the class work independently writing a paragraph that compares and contrasts two or three of the raptors that they have now learned.
- Teacher should move about the room and answer any questions the students might have.

ACTIVITY: OUTDOOR OBSERVATIONS & RAPTOR GAME

Group Activity: Outdoor Observations

Objective:

- Make observations of the natural environment by using three of the five senses.

Materials:

- Notebooks and pencils

Instructions:

- Head outside with your class and have the students observe their surroundings.
    - Have them record what they see, hear and smell.

*** The hope is that birds will be seen and potentially a raptor flying over. This activity allows the students to get outside and use their senses while making observations. ***

*** You can also teach the students how to make a Barred Owl call. Explain to the students that a Barred Owl call sounds like: "Who cooks for you? Who cooks for you allllllll?" Have the students try several times and share with them, that when they are hiking near dusk next time, to try the call and see if they can all in a Barred Owl. ***

Whole Class Activity: Raptor Game

Objective:

- Students will be able to answer the questions based on the information they learned throughout the lesson on raptors.

Materials:

- Raptor Game handouts (Appendix R)

Preparation:

- Print the Raptor Game handouts ahead of time.
- Find a place outside (preferably) that you can place the "post" handouts in a circle formation.

Instructions:

- Explain to the class that they will be playing a Raptor Game. This game is more of a review of the information that they learned about raptors.
- Explain that there are seven post throughout the area you have chosen, that have true and false statements on them about six different raptors.
- The idea is that you will be in teams. Each team will be handed a piece of paper of where they will be starting and what raptor they have, that they will answer the questions for.
- If your team answers the question wrong, go back to the previous post to see what post you need to travel to for the next question.
- Once your team answers all the questions and you complete the course, go back to your teacher and she/he will hand you another raptor course to complete.

ACTIVITY: BIRD ZIPLINE

Group Activity:

Objective:

- To identify raptors and non-raptors while flying

Materials:

- Fishing line
- Bird cutouts attached to cardboard with a hook to attach the fishing line to
    - Raptors and non-raptor cutouts

Instructions:

- Have the students create two lines, lying on the floor head to head.
- The teacher will be at one end of the line and a student or aid or assistant teacher will be at the other end.
- The teacher will have his/her end higher than the other side to create a "zipline" for the birds to travel down right over the Student's heads.

- Students should have their eyes closed as the teacher is attaching the bird to the line and eyes stay closed until the bird is released.
- The teacher will load each bird and let it go.
- The students will try to identify the bird as it travels down the line.
- Once the bird reaches the other end, call on a student to share what bird it was.
- Continue to do this until all birds are gone.

LESSON 3: OWL PELLET DISSECTIONS

Grades: 3-5
Duration: 1-2 Class Periods

OBJECTIVES:

Students will:

- Dissect owl pellets and identify what the owl has been eating
- Learn new words and ask/answer their own questions that they may have

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VOCABULARY

Key Words about Raptors:

- Regurgitate, Pellet

MATERIALS

- Owl pellets
- Blank sheets of paper
- Plastic sandwich bags
- Permanent markers
- Bone identification charts (Appendix N)
- Toothpicks or tweezers
- Disinfectant

PREPARATION

- Order the owl pellets from https://www.homesciencetools.com/biology/life-science/owl-pellets/ (or from a different place).
- Print out the Bone Identification Chart so there are enough copies for the students to use when dissecting their pellet.

OVERVIEW

- Ask the students to name foods eaten by owls.
    - **Answer:** diet includes invertebrates (such as insects, spiders, earthworms, snails and crabs), fish, reptiles, amphibians, birds and small mammals.
        - You can draw these animals on the board if you'd like to help the kids better understand what they look like.
    - Screech Owls feed on insects mostly, while Barn Owls eat mainly mice, shrews and voles. Larger Owls such as the Eagle Owl will prey upon hares, young foxes and birds up to the size of ducks and gamebirds. Some species have specialized in fishing, such as the Asian Fish Owls and African Fishing Owls.
    - Although certain species have these preferences for food type, most owls are opportunistic, and will take whatever prey is available in the area.

- An owl pellet dissection lab is a memorable and fun way to learn about the eating habits of birds of prey— birds such as owls that eat rodents and small birds.

- What are owl pellets?
    - They are the regurgitated remains of an owl's meal; including all the bones and fur of the animal it ate. Owls usually swallow their food whole – if it is small enough to do so, digest the edible parts, and then expel the indigestible parts through their mouth as a pellet.

- Owl pellets versus other raptor pellets
    - Pellets from other kinds of raptors do not contain as much bones and fur as owl pellets do. The other raptors are able to digest some of the bones but still produce a pellet of fur. Owl pellets are more interesting in that you can dissect them and see the actual bones and fur from the animal it consumed.

ACTIVITY: OWL PELLET DISSECTIONS

Instructions:

1. To do this lab, you'll need an owl pellet. Carefully inspect the outside of the pellet and note its size, whether there are any feathers visible, and whether there are any clues to where the pellet was found. Guess how many different animal skeletons the pellet contains.

2. Next, gently pull apart the pellet, being careful not to break any of the bones inside it. Use toothpicks or your fingers to separate the bones from the fur or feathers. Use the Bone Identification Chart (Appendix N) to help you separate the bones you find. Be careful when removing the skulls and jawbones, since they are the best way to identify the animals that the owl ate. Group similar bones together. When you've finished sorting the bones, roll the last bits of fur between your fingers to find little bones or teeth that might have been overlooked.

3. Once you've found all the bones, try to reconstruct the skeletons of the animals. Use the chart provided (Appendix N) to help with this. Owls usually eat more than one rodent before regurgitating the remains, so you should be able to find multiple bones that are similar.

   *** Can you distinguish between the bones of different kinds of rodents based on their size? ***

4. How many different kinds of animals did you find evidence of in the pellet? How many animals were there in total? What can you conclude about the eating habits of the owl that made your pellet?

5. Once everyone is done, take the sheet of paper that has all the fur on it, and carefully dispose of it into the trash.

6. Spray disinfectant on the area where the dissection occurred.

LESSON 4: FIELD TRIP

Grades: 3-5
Duration: 1 Class Period

OBJECTIVES:

Students will:

- Be able to observe and make connections to what they have learned in the classroom out in the "field"

VOCABULARY

Key Words about Raptors:

- None

MATERIALS

- Journals
- Pencils
- Permission slips (Appendix O)

PREPARATION

- Schedule a field trip for your students that is related to raptors in some way.
    - Make permission slips for parents to sign (Appendix O)
    - Plan what your day will look like while on the field trip
        - Where you will eat lunch (if doing so)
        - How long will you be away
        - Group students with adults

OVERVIEW

- Find out what kinds of raptor facilities are available in your area. Try nature centers, rehabilitation centers, natural history areas or science museums. See if you can schedule a tour or meet a raptor if they have one. You could even raise money for a donation to wherever you go, if you decide to do so.
- On the field trip, have the students keep a journal of what they see and do. They can draw or jot down notes in their journals.
    - Ideas the students can jot down in their journals:
        - List five behaviors you observed a raptor doing.
        - Sketch a raptor. Include details about its beak, feet, and the color patterns of its feathers.
- Upon arrival back to school, the students will write a one page paper about their time on the field trip.

ACTIVITY: REFLECTION ABOUT FIELD TRIP

Instructions:

- Upon arrival back to school:
    - Students will, in detail, describe what they saw, felt, heard, smelled, and anything else they found exciting worth writing about from the field trip they just went on.
    - The students will work independently on this assignment.
- The papers will be due by the end of the school day or the following day-depending on when arrival back to school is.
- To meet needs of students, PowerPoint presentations, oral presentations, songs, plays, etc. are possible ways for kids to share what they saw and experienced during the field trip, besides writing a paper.

LESSON 5: RAPTOR REPORT & HABITAT PROJECT

Grades: 3-5
Duration: 3-5 Class Periods

OBJECTIVES:

Students will:

- Gather research on a raptor of their choice from raptors learned throughout the unit
- Write an essay related to a general question
- Share their reports to the class
- Create a display of their raptor's habitat
- Share their displays to their classmates
- Participate in questionnaire from their classmates regarding their displays

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VOCABULARY

Key Words about Raptors:

- None

MATERIALS

- Computers
- Notebooks
- Pencils/pens
- Materials for habitat project
    - Cardboard/Shoe boxes
    - Markers
    - Color pencils
    - Paper plates
    - Construction Paper
    - Scissors
    - (Anything else the students bring from home)
- Grading Rubric (Appendix P)

PREPARATION

- Reserve the computer lab for your students to use

OVERVIEW

CULMINATING ACTIVITES:

- RAPTOR REPORT:
  Have the students create a raptor report which would be shared with the class. Keep it simple and have the students answer one question. For example: How do raptors care

for their young? The students can use books and the internet to answer their question that they have chosen. Reports will be shared with the class after they finish their raptor habitat project.

- RAPTOR HABITAT PROJECT:
  After finishing their raptor report, students will be given a week to work on their raptor habitat project. This project can be made from anything the students want to use – paper plates, shoe boxes, cardboard, etc. The hope is that the students will be creative and that they will create a habitat for the raptor that they chose to do their report on. The students will be sharing these projects with the class as a final assignment to end the unit on raptors. A rubric will be used to grade the students on their projects (Appendix P).

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APPENDIX A: PHOTOS OF RAPTORS

American Kestrel https://www.raptor.umn.edu/our-research/conservation

Osprey http://minnesotabirder.com/featured/osprey-flies-with-sheephead-breakfast/

Rough legged Hawk http://minnesotabirder.com/category/birds-of-prey/

Bald Eagle http://minnesotabirder.com/category/birds-of-prey/

Barred Owl http://www.startribune.com/surveying-the-owls-of-minnesota/245432701/

Peregrine Falcon http://www.mnhs.org/event/5646

Northern Harrier https://www.sdakotabirds.com/species_photos/raptors/northern_harrier.htm

Turkey Vulture http://www.boulderaudubon.org/birds-of-boulder-county/turkeyvulture1/

APPENDIX B: PHOTOS OF NON RAPTOR PREDATORY BIRDS

Great Blue Heron https://americanexpedition.us/learn-about-wildlife/great-blue-heron-facts-info-and-pictures/

American Robin https://www.allaboutbirds.org/guide/American_Robin/id

Shrike https://www.allaboutbirds.org/guide/Loggerhead_Shrike/id

American Pelican https://www.allaboutbirds.org/guide/American_White_Pelican/id

Loon http://nhpr.org/post/something-wild-loon-facts-and-fate#stream/0

Belted Kingfisher https://www.allaboutbirds.org/guide/Belted_Kingfisher/id

American Crow https://www.allaboutbirds.org/guide/American_Crow/id

Black-capped Chickadee https://www.allaboutbirds.org/guide/Black-capped_Chickadee/id

APPENDIX C: RAPTOR & NON RAPTOR IMAGES OF SKULLS, BEAKS, FEET & EYES

Beaks and Skulls

Raven Skull http://www.thedarkstore.com/en/gothic-decoration/1341-raven-skull-corvus-alchemica-.html

Great Blue Heron Skull https://cabinetcuriosities.deviantart.com/art/Grey-Heron-Skull-363636966

Eagle Skull https://www.etsy.com/market/eagle_skull

Feet

Bald Eagle http://www.laurenswildliferescue.org/this-week-in-wildlife/santa-brought-lwr-a-bald-eagle-for-christmas

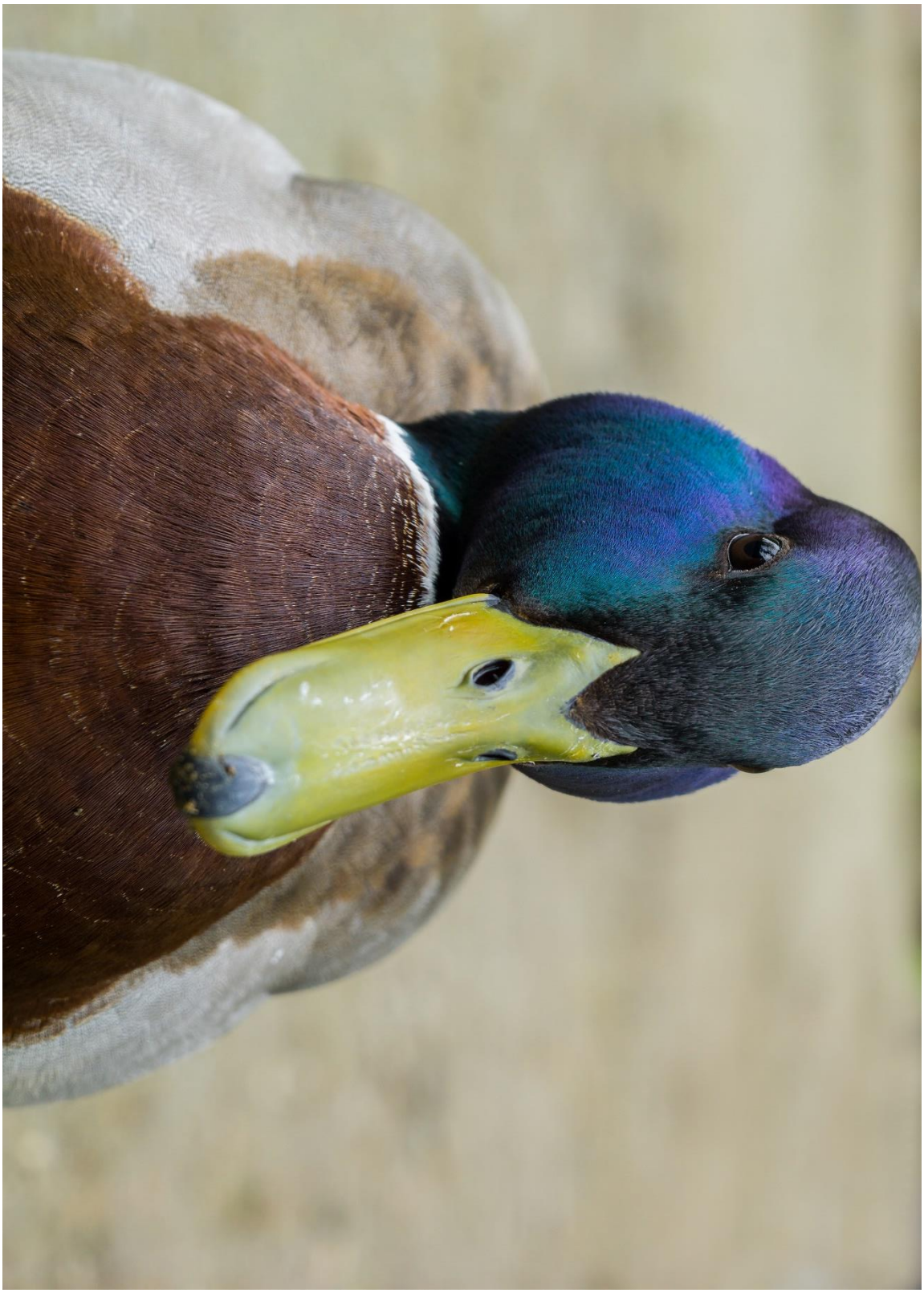
Canada Goose http://favimages.com/image/269471/

Wild Turkey Feet
https://thewildgamechanger.auctivacommerce.com/Product.aspx?ProductId=2758200

EYES

Red-tailed Hawk http://blog.al.com/spotnews/2013/01/a_hawk_eyes_you_today_in_pictu.html

Great Blue Heron https://dinascitywildlife.com/tag/baby-bird/



Mallard Duck https://nypost.com/2017/05/06/dont-be-fooled-ducks-are-sadistic-raping-monsters/

APPENDIX D: "RAPTOR & NON RAPTOR CARDS'

*** All images came from All About Birds https://www.allaboutbirds.org/ ***

APPENDIX E: RAPTOR IMAGES

*** All images came from All About Birds https://www.allaboutbirds.org ***

Adult Bald Eagle

Juvenile Bald Eagle

Adult Golden Eagle

Juvenile Golden Eagle

Adult Osprey

Adult Osprey

Adult Male Northern Harrier

Adult Female Northern Harrier

Adult Northern Goshawk

Juvenile Northern Goshawk

Adult Cooper's Hawk

Juvenile Cooper's Hawk

Adult Red-tailed Hawk

Adult Sharp-shinned Hawk

Juvenile Sharp-shinned Hawk

Adult Broad-winged Hawk

Adult Red-Shouldered Hawk

Adult Male Rough-legged Hawk

Adult Female Rough-legged Hawk

Adult Male American Kestrel

Adult Female American Kestrel

Adult Male Merlin

Adult Peregrine Falcon

Adult Turkey Vulture

Short-eared Owl

Long-eared Owl

Great Gray Owl

Great Horned Owl

Barred Owl

Adult Female/Immature Male Snowy Owl

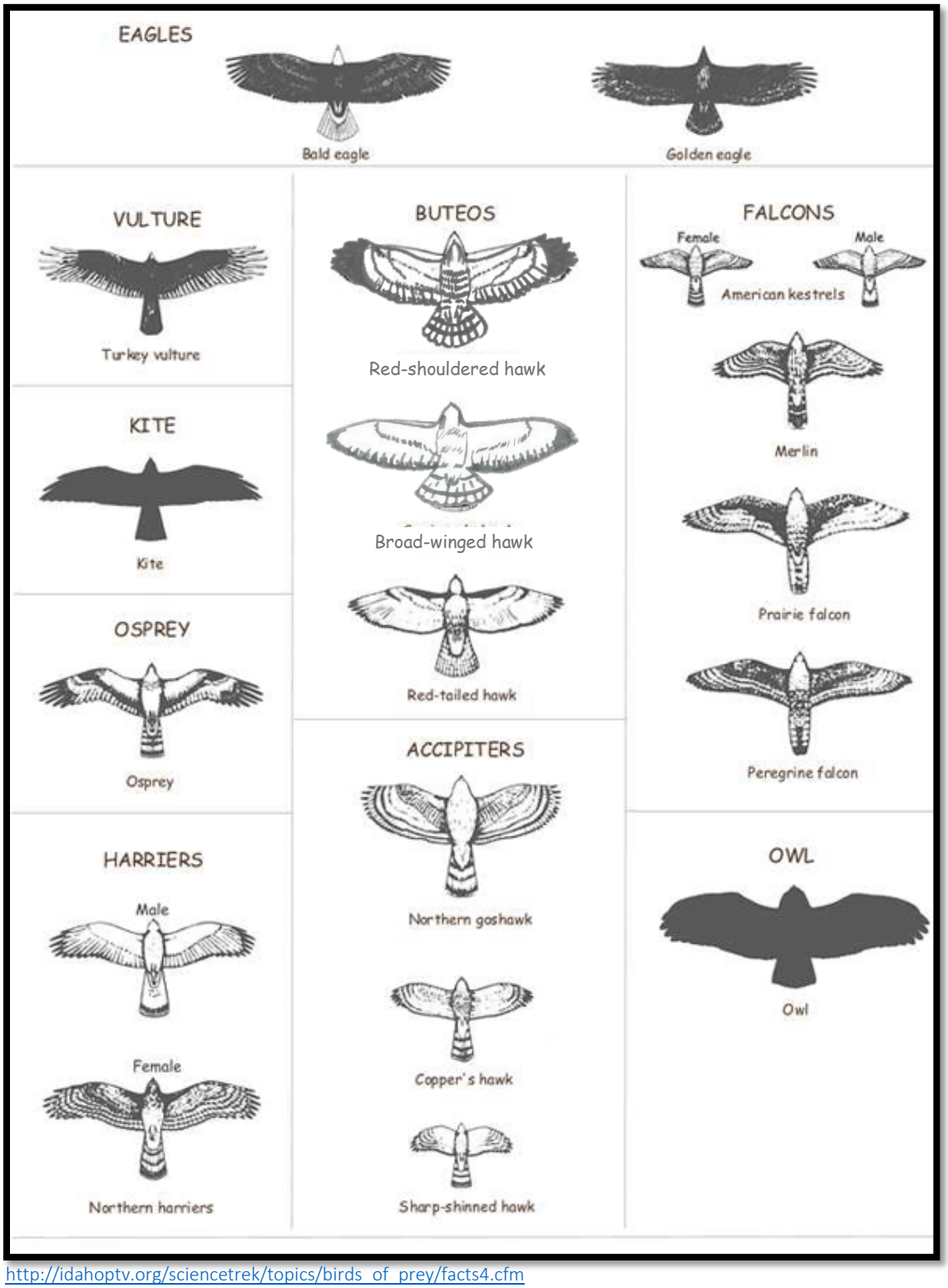
Eastern Screech Owl

Northern Saw-whet Owl

Boreal Owl

Northern Hawk Owl

APPENDIX F: IDENTIFICATION AND SILHOUETTE HANDOUT



http://idahoptv.org/sciencetrek/topics/birds_of_prey/facts4.cfm

APPENDIX G: EAGLE HANDOUT

EAGLES

Eagles are the largest raptors by body size and by body mass. In Minnesota, you can find two species of eagles – Bald Eagle and Golden Eagle.

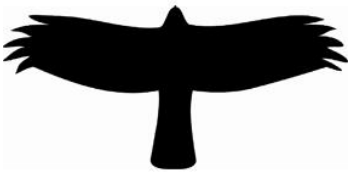
Fishing Eagle – This eagle is found near bodies of water such as lakes and rivers. They can be seen soaring high in the sky, perched high on trees and diving into water to catch fish – their main food source.

Species – Bald Eagle (*Haliaeetus leucocephalus)*

The Other Eagle – This eagle is not as common in Minnesota, only traveling through the state during its migration. They are found in more open areas of vegetation catching prey such as hares, marmots and birds.

Species – Golden Eagle (*Aquila chryseatos)*

Immature Bald Eagle (left) and Immature Golden Eagle (right). https://www.allaboutbirds.org/guide/Golden_Eagle/id



HARRIERS and OSPREYS

Northern Harriers – A group of raptors that are known for their acute hearing when hunting for prey. They don't just rely on their vision alone. Although known to hunt during the night, harriers are better hunters during the daytime hours soaring over fields of grasslands and marshes in search for prey.

Species – Northern Harrier (*Circus cyaneus)*

https://www.allaboutbirds.org/guide/Northern_Harrier/id

Ospreys – Are found nesting on high telephone poles or nest platforms. They are a large fish-eating bird seen near water, soaring over lakes and rivers awaiting to dive down and catch fish with their talons.

Species – Osprey (*Pandion haliaetus)*

https://www.allaboutbirds.org/guide/Osprey/id

APPENDIX I: HAWKS HANFOUT

HAWKS

Hawks are put into two different groups:
Accipiters – Woodland Hawks and Buteo – Soaring Hawks.

Woodland Hawks – These hawks are built for flying in and out of trees and shrubs. They tend to have long tails and short wings which allow them to maneuver through the forest easier.

Species – Sharp-shinned Hawk (*Accipiter striatus*), Cooper's Hawk (*Accipiter cooperii*), Northern Goshawk (*Accipiter gentilis*)

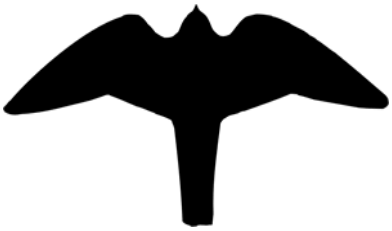
Soaring Hawks – These hawks are built for soaring. They have shorter tails and broader wings.

Species - Rough-legged Hawk (*Buteo lagopus*), Red-tailed Hawk (*Buteo jamaicensis*), Red-shouldered Hawk (*Buteo lineatus*), Broad-winged Hawk (*Buteo platypterus*)

Red-tailed Hawk (Buteo)
https://www.allaboutbirds.org/guide/Red-tailed_Hawk/

Sharp-shinned Hawk (Accipiters)
https://www.allaboutbirds.org/guide/Sharp-shinned_Hawk/id

APPENDIX J: FALCONS HANDOUT



Falcons

Known for their speed and steady flight, these raptors are found in open areas such as grasslands and plains. Falcons are easily recognized by their long and narrow tail and wings. They also have a special tooth on their upper beak known as a tomial tooth (killing tooth).

Species - American Kestrel (*Falco spaverius*), Merlin (*Falco columbarius*), Peregrine Falcon (*Falco peregrinus).*

American Kestrel – Males are one of the most colorful of all the raptors. Both males and females are seen often perching on fence posts and utility wires awaiting for prey such as: mice, reptiles, small birds and insects.

https://www.allaboutbirds.org/guide/American_Kestrel/id

Peregrine Falcon – These raptors are the fastest animal on Earth, reaching speeds of up to 200 miles per hour while they are in their stoops. Catches all of their prey while flying in the air, the raptors can be seen nesting on skyscrapers or near high cliff embankments.

https://www.allaboutbirds.org/guide/Peregrine_Falcon

Merlin – Are a small falcon nesting in boreal forests and muskegs. They hunt their prey while flying, accelerating to fast speeds, snatching small birds to eat later.

https://www.allaboutbirds.org/guide/Merlin/id

APPENDIX K: VULTURES HANDOUT

Vultures

These raptors are not like the other raptors. They are more closely related to Storks and Herons than they are to raptors. Turkey Vultures have a great sense of smell and only eat carrion (dead animal carcasses).

Turkey Vultures – The majority of their diet consists of dead animal carcasses in which they use their great sense of smell to find. These birds are large, mainly black/brown in color with a featherless, red head, as well as featherless feet. When flying, Turkey Vultures tend to look as if they are drunk when flying and their wings make a distinctive "W" shape.

https://www.allaboutbirds.org/guide/Turkey_Vulture/id

APPENDIX L: OWLS

OWLS

The groups of raptors that are active during the day (diurnal), during the twilight hours (crepuscular) and during the night (nocturnal). These birds rely deeply on hearing and their quiet flying when searching for prey.

Species – Great Horned Owl (Bubo virginianus), Long-eared Owl (Asio otus) Short-eared Owl (Asio flammeus) Northern Saw-whet Owl (Aegolius acadicus), Great Gray Owl (Strix nebulosa), Snowy Owl (Bubo scandiacus), Barred Owl (Strix varia), Boreal Owl (Aegolius funereus), Northern Hawk Owl (Surnia ulula), Eastern Screech Owl (Megascops asio).

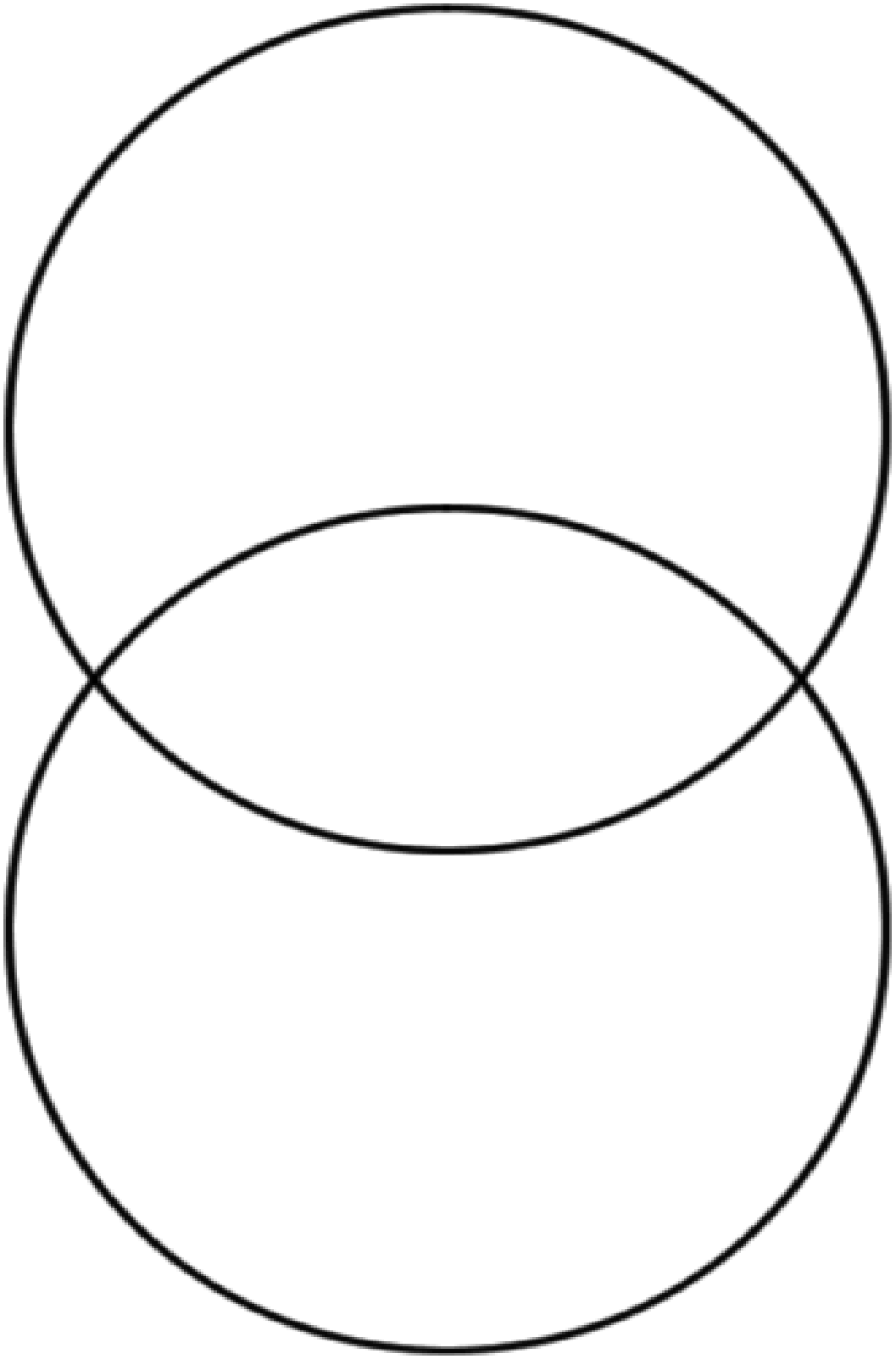




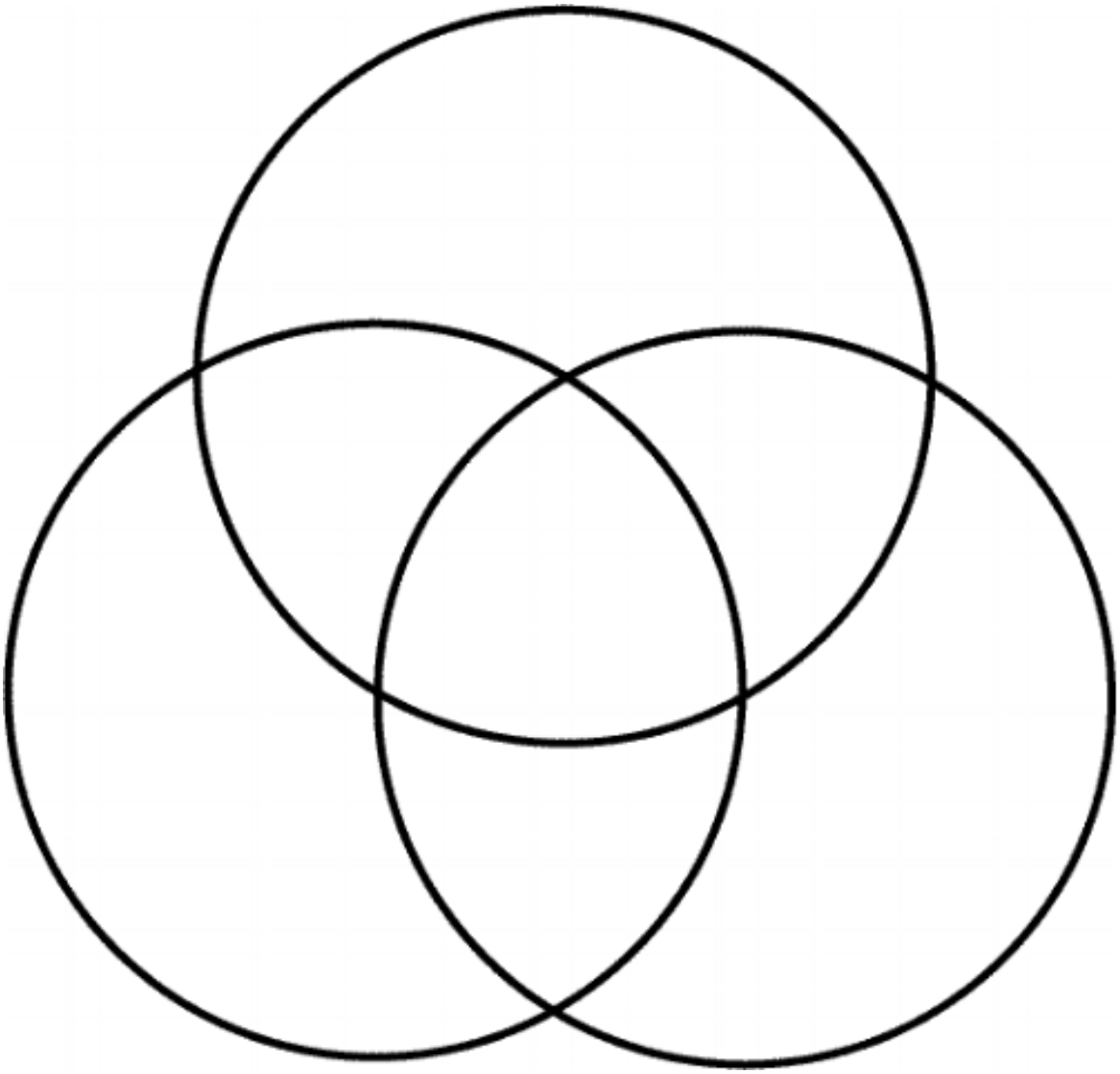

*** All images came from All About Birds ***
https://www.allaboutbirds.org/

APPENDIX M: VENN-DIAGRAM HANDOUTS (Students can make their own too, this is an example).

1.



2.



APPENDIX N: BONE IDENTIFICATION & SORTING CHART

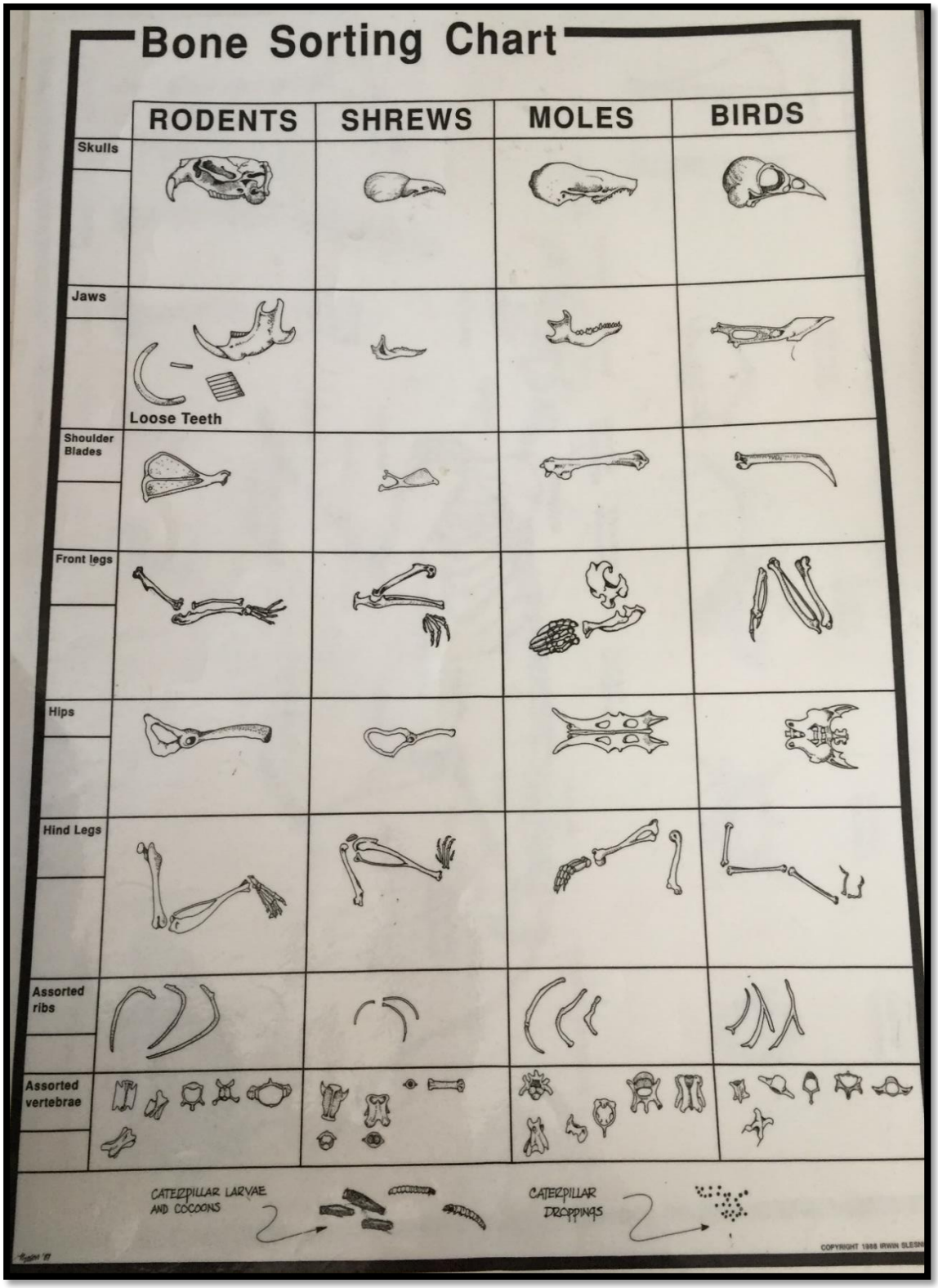


Chart from Carolina Biological https://www.carolina.com/teacher-resources/Interactive/science-notebooks-owl-pellet-dissection-inquiry/tr10859.tr

APPENDIX O: EXAMPLE OF A PERMISSION SLIP FOR THE FIELD TRIP

Field Trip Permission Slip

*** (Can change highlighted parts to day that works best for your school) ***

Dear Parent/Guardian,

We will be taking a field trip to the_____. It'll be a great opportunity to be able to observe and see these raptors in person!

- This event will take place on _____at the _____.
- It will cost _____ per student to attend the field trip.
- We will be leaving the school at _____.

Your child will need to pack a sack lunch as we will be gone during the lunch period.

Please cut off and return this form and the money needed to attend this trip by _____.

Thanks!

I give my child _____ permission to go with his/her class to the _____ on _____.

Parent Signature _____

Total enclosed: _____

APPENDIX P: RUBRIC FOR RAPTOR HABITAT PROJECT

Student's Name: _____ **Total: /25**

RAPTOR HABITAT PROJECT

Project: The student will create a diorama out of a shoebox or cardboard, or whatever material the student wants to use to model the raptor's habitat. The raptor for this project will be the same raptor that the student chose to do their raptor report on. The habitat must show the area that the raptor lives in, the name of your raptor with picture or sculpture and the most common food it consumes.

	5	4	2	1
Neatness	Diorama is very neat and organized.	Diorama is neat.	Diorama has wandering marks and looks as if it was put together last minute.	Diorama is messy and incomplete.
Accuracy	Diorama is very accurate and shows the raptor's habitat and food it consumes.	Diorama is missing one component.	Diorama is missing two components.	Diorama is not accurate and is missing all the required components.
Creativity	The student used varied materials to create a very creative diorama of the raptor's habitat.	The student constructed a creative diorama.	The student could have put a little more effort in creating their diorama.	The student did not use available materials to create their diorama.
Presentation	The student presented his/her diorama to the class accurately and explained the raptor's habitat in great detail.	The student presented his/her diorama to the class but could have explained the raptor's habitat in more detail.	Student did not explain the raptor's habitat when presented to the class.	Student did not present their diorama to the class and did not explain raptor's habitat.
Color	Student used accurate colors to model the raptor and its habitat.	Student mostly used accurate colors to model the raptor and its habitat.	Student rarely used accurate colors to model the raptor and its habitat.	Student did not use accurate colors.

APPENDIX Q: ACCIPTER HAWK HANDOUT

Accipiter Identification

North American accipiters—Sharp-shinned Hawk, Cooper's Hawk, and Northern Goshawk—can be tricky to identify while on the wing. Size can be unreliable, because it is difficult to judge the size of birds in the air, especially among species exhibiting such pronounced sexual dimorphism in size (for example, female Sharp-shinned Hawk is nearly as large as male Cooper's Hawk). Hawkwatchers concentrate on four aspects of flying birds: tail, wings, head, and belly.

Tail

The tails of the three species are all relatively long, but they are differently shaped and patterned. Sharp-shinned Hawk has the shortest tail of the three, with a squared end that often shows a central notch. Cooper's Hawk has a long, narrow tail by comparison, usually with a broad, rounded end that shows a fairly wide pale terminal band. Northern Goshawk's tail appears shorter and broad by comparison and has four dark zigzag bands when seen from above (the others have three bands). There are exceptions, including some Sharp-shinneds with rounded tails and rare Cooper's with squared tails.

Wings

The wings of accipiters differ as well: Sharp-shinned and Northern Goshawk have rather broad or full-looking wings for their sizes, with a sinuous S-curve along the trailing edge, while Cooper's Hawk has narrower, lanky-looking wings that taper more gradually toward the tip. Sharp-shinned flaps its wings quickly, Cooper's employs slower and more graceful wingbeats, and Northern Goshawk uses deep and impressively slow strokes.

Head

Sharp-shinned's head looks quite small and neckless, with eyes set in the middle. Cooper's Hawk has a large, long, and flexible head, with eyes set farther forward (and unlike the other accipiters, immature Cooper's tends to have a tawny nape). Northern Goshawk's stout head recalls a buteo's.

Belly

The belly is an important identifying feature of immature birds: Cooper's has a very pale, almost unmarked lower belly, while Northern Goshawk and Sharp-shinned are heavily marked from the breast well into the belly.

Brinkley, E. S. (2007). Field Guide to Birds of North America. New York, NY: Sterling Publishing Co., Inc. (p. 188).

APPENDIX R: RAPTOR GAME

Raptor Key of Where to Start

Bald Eagle Course

Start at Post 1

Peregrine Falcon Course

Start at Post 2

Red-tailed Hawk Course

Start at Post 3

Turkey Vulture Course

Start at Post 4

Great Horned Owl Course

Start at Post 5

Snowy Owl Course

Start at Post 6

Raptor Post Signs

Post 1

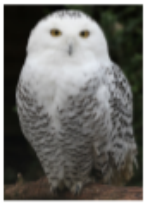
Juvenile Bald Eagles have brown heads.
True - Go to Post 4.
False - Go to Post 7.

Congratulations! You've found all the correct answers for the Peregrine Falcon course. Go back to the naturalist to get another set of questions.

Correct!
Next statement: In movies, Red-tailed Hawk's vocal sound are usually substituted for Bald Eagles.
True - Go to Post 6.
False - Go to Post 4.

Wrong! Go back to Post 4.

Wrong! Go back to Post 6.



Wrong! Go back to Post 6.

Post 2

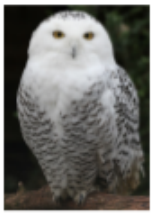
Wrong! Go back to Post 6.

Peregrine Falcon's favorite food are birds.
True - Go to Post 3.
False - Go to Post 5.

Correct!
Next Statement: Red-tailed Hawks are one of the most common raptors in Minnesota.
True—Go to Post 1
False—Go to Post 7

Correct!
Next statement: Turkey Vultures catch rabbits and mice for food.
True - Go to Post 6.
False - Go to Post 7.

Congratulations! You've found all the correct answers for the Great Horned Owl course. Go back to the naturalist to get another set of questions.

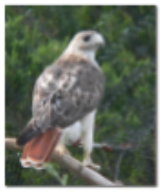


Wrong! Go back to Post 7.

Post 3

Wrong! Go back to Post 4.

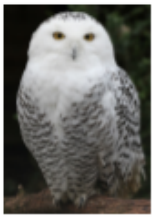
Correct!
Next statement: Peregrines now often lives and hunts in cities.
True—Go to Post 7.
False - Go to Post 6.



Males and females look very different.
True - Go to Post 5.
False - Go to Post 2.

Wrong! Go back to Post 7.

Correct!
Next statement: Great Horned Owls can turn its head all the way around.
True - Go to Post 4.
False - Go to Post 2.



Correct!
Next statement: Snowy owls are shy and unapproachable, unlike many other owls.
True—Go to Post 7.
False - Go to Post 4.

Post 4

Correct!
Next statement: Minnesota has one of the largest eagle populations in the lower 48 states.
True– Go to post 6
False—Go to post 3

Wrong! Go back to Post 7.

Wrong! Go back to Post 1.

Turkey Vultures are the only type of bird that uses smell to hunt .
True - Go to Post 2.
False - Go to Post 1.

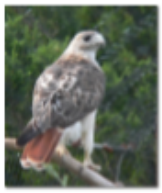
Wrong! Go back to Post 3.

Wrong! Go back to Post 3.

Post 5

Congratulations! You've found all the correct answers for the Bald Eagle course. Go back to the naturalist to get another set of questions.

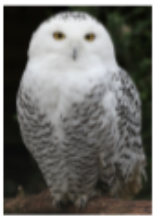
Wrong! Go back to Post 2.



Wrong! Go back to Post 3.

Congratulations! You've found all the correct answers for the Turkey Vulture course. Go back to the naturalist to get another set of questions.

Females are slightly larger than males.
True - Go to Post 7.
False - Go to Post 6.

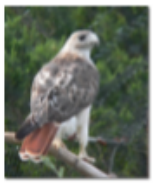


Congratulations! You've found all the correct answers for the Snowy Owl course. Go back to the naturalist to get another set of questions.

Post 6

Correct!
Next statement: Bald eagles build a new nest every year.
True - Go to Post 2.
False - Go to Post 5.

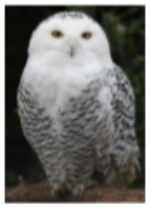
Wrong! Go back to Post 3.



Congratulations! You've found all the correct answers for the Red-tailed Hawk course. Go back to the naturalist to get another set of questions.

Wrong! Go back to Post 2.

Correct!
Next statement: Great Horned owls do not make a nest; instead they use old crow's nests
True - Go to Post 3.
False - Go to Post 1.



Snowy Owls can be different colors.
True - Go to Post 1.
False - Go to Post 3.

Post 7

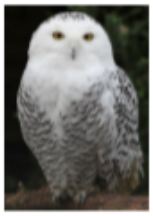
Wrong! Go back to post 1.

Correct!
Next statement: Peregrine Falcons builds a nest in a tall tree.
True - Go to Post 4.
False - Go to Post 1.

Wrong! Go back to Post 2.

Correct!
Next statement: Turkey Vultures will urinate on its legs to cool itself.
True - Go to Post 5.
False - Go to Post 3.

Correct!
Next statement: Great Horned Owls do not make a nest; instead they uses old crow's nests.
True - Go to Post 3.
False - Go to Post 1.



Correct!
Next statement: Male Snowy Owls will feed the females while they are sitting on eggs.
True - Go to Post 5.
False - Go to Post 2.

Answer Key for False Questions

Raptor Game
(and why an answer is false)

Bald Eagle: Start at Post **1**

(They use the same one year after year many times)

Peregrine Falcon: Start at Post **2**

(They lay their eggs on ground, edge of cliff)

Red-tailed Hawk: Start at Post **3**

(They look the same)

Turkey Vulture: Start at Post **4**

(Eats carrion (dead things))

Great Horned Owl: Start at Post **5**

(Can only turn head roughly 270 degrees)

Snowy Owl: Start at Post **6**

(Our only white, rarely confused with others)