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Leadership of identified gifted compared to high-potential students studying Iowa's natural history

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Results showed the creative, high-potential students outperformed their academically-gifted peers on the content knowledge posttest and throughout the lesson activities. They provided more responses during CoRT Thinking Skill activities, incorporated more creative strengths in their products, and connected content to their personal lives. All students showed task-commitment and responsible leadership during the creation and implementation of their Type III projects and creativity was present throughout the unit. The results of this project show that creative; high-potential students benefit from gifted programming and should be included with academically-gifted peers.

Leadership of Identified Gifted Compared to High-Potential Students Studying

Iowa's Natural History

A Graduate Project

Submitted to the

Department of Curriculum and Instruction

In Partial Fulfillment

Of the Requirements for the Degree

Master of Arts in Education of the Gifted

UNIVERSITY OF NORTHERN IOWA

by

Katie E. Broeg

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This Project by: Katie E. Broeg

Titled: Leadership of Identified Gifted Compared to High-Potential Students Studying

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has been approved as meeting the research requirement for the

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Abstract

At one time, students were only considered gifted if they received a score of 140 or higher on an IQ test. Renowned gifted researcher, Joseph Renzulli, challenged this notion with his three-ring conception of giftedness; an interaction between above average ability, creativity, and task-commitment in areas of passion. Renzulli also promoted the development of leadership and social capital through Operation Houndstooth.

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Chapter 1: Introduction

Academically gifted students can be recognized and identified within the school setting through standardized testing and content-related achievements. However, the talents and potential of students underachieving or with non-academic aptitudes may be overlooked when there is emphasis on these measures. Creative production and leadership talent is acknowledged within the federal definition of gifted and talented, but these attributes require alternative methods of assessment for identification. The unique characteristics of each of these talent areas prompt questions on how to foster them and determine their impact on learning.

The differences in learning for middle school identified academically gifted students and high-potential creative and leadership-oriented students were studied throughout an eight month Iowa Natural History unit focused on the preservation of the prairie ecosystem. Students participated in science and literacy activities to learn about small mammals, plant life, and interactions within the prairie ecosystem. They utilized this knowledge and their leadership skills to prepare projects to inform their school and community of the purpose and value of the prairie restoration and outdoor classroom project constructed in front of their school.

Importance of Authentic Projects for Students to Demonstrate Leadership

Joseph Renzulli, a prominent figure in gifted education reform and director of the National Research Center on the Gifted and Talented at the University of Connecticut, developed the Schoolwide Enrichment Model and the Enrichment Triad Model. The Enrichment Triad Model offers three levels of student enrichment opportunities with independence increasing from level one to level three. The first level of activities, called

"Type I" activities, are exploratory and introductory in nature. The second level, Type II activities, involve students in learning skills of professionals in the field related to the topic. Finally, Type III enrichment involves activities for students to become producers of their knowledge as opposed to just consumers. They are actively engaged in solving a real-world problem important to them or applicable to their local environment, but with a real-world audience.

Research on motivation has shown that students tend to be more engaged when they have interest or a connection to what they are learning. In reference to Renzulli's model, Davis and Rimm (2004, p. 167) suggest that gifted programming include experiences for students to apply their knowledge and creativity to solve problems, advance their content knowledge and skills in the related topic, and develop a sense of accomplishment through self-directed learning. The author's current study enabled the middle school participants to expand their knowledge of the prairie ecosystem and learn professional skills related to the products they created to demonstrate their learning. The activities culminated in many products with audiences beyond the students' classroom and therefore represented projects that addressed all three levels of enrichment activities.

Renzulli also introduced Operation Houndstooth (2002) to the gifted and educational community in his response to studying gifted students and what motivates them to take social action. He suggested the development of six characteristics to help students engage in developing social capital, as referenced in the next chapter, Renzulli defined as helping others with their collective needs and problems for the betterment of the world: optimism, courage, romance with a topic or discipline, sensitivity to human concerns, physical/mental energy, and vision/sense of destiny (Renzulli, 2002, p. 35-36).

Providing students with authentic problems and experiences in which they can independently learn to solve problems and utilize leadership skills to take action can help prepare them for life beyond school. The students had an opportunity to explore these concepts and their own attitudes toward the preservation of the prairie environment in their own school yard.

Personal Interest in the Topic

Students revolved-in for creative production and leadership services, at the middle school level, may not always demonstrate their talent or potential academically. However, they may demonstrate task commitment, unique idea development, and problem-solving capabilities while working on independent study projects or other enrichment opportunities within the Extended Learning Opportunities (name for gifted education services and programs in the author's school district) classroom. Classroom teachers who focus solely on testing and academic tasks miss opportunities to observe the individual talents of creative and leadership-oriented students and the value of their contributions to the classroom. Therefore, these students are recommended less often for enrichment services or have their participation questioned by many teachers. This study collected data to compare the differences in student learning in relation to students' unique talent areas, especially those areas less developed within the classroom setting to inform educators and other professionals within the educational field for future classroom differentiation.

The Iowa Natural History Unit focused on the prairie ecosystem and restoration project is an authentic topic for the students at Aldo Leopold Middle School. The Aldo Leopold Foundation based in Southeast Iowa procured funds to build an outdoor

classroom and prairie reserve in front of the one year-old middle school dedicated in honor of the late Aldo Leopold, a hometown native referred to as "the father of wildlife management and the U.S. wilderness system" (Aldo Leopold Foundation, n.d., para. 1).

Aldo Leopold was not only a conservationist, but also an educator and writer. Students utilized literacy skills to make connections and demonstrate their own leadership and creative skills to promote and inform the students and community of the purpose, value, and meaning of the prairie restoration project occurring on school grounds.

Statement of the Problem

Both identified gifted and high-potential students at Aldo Leopold Middle School had the unique opportunity to participate in projects that informed the public of the rich prairie heritage of this area. This research project focused on the following general question: How do students, unrecognized for academic achievement, yet who display high leadership or creative potential, perform as compared to the academically identified gifted students as reflected in content knowledge, attitude, creative process, creative products, and teacher and student assessment regarding community leadership in the prairie restoration project at Aldo Leopold Middle School? This general research question was divided into four more specific research questions. Data collected supports the findings of both the general and specific questions.

1. How do academically-identified gifted students compare to high potential students in content knowledge related to prairie heritage and natural history?

2. How do academically-identified gifted students compare to high potential students in attitudes toward prairie conservation and ecology, enjoyment of

learning and motivation to engage in the projects?

3. How do academically-identified gifted students compare to high potential students in creative process and creative products as assessed by self, peers, and teacher?

4. How do academically-identified gifted students compare to high potential students in community leadership in the prairie restoration project as assessed by student and teacher checklists?

Terms Related to the Study

Academically Gifted. A term applied to a student who has demonstrated high academic ability within at least three of the following criteria and met qualifications established by the district's child study team: scoring at the 95th percentile or above in Iowa norms on the Iowa Assessments in one of the following subtests: reading, vocabulary, math, or total core; attaining a standard score of 120 or above on the Cognitive Abilities Test (CogAT) (Lohman & Hagen, 2001) in one of these subtests: verbal, quantitative, and nonverbal; teacher recommendation with work samples and report card.

Aptitude. The characteristic of performing exceptionally in a specific skill area and therefore showing great potential for growth and future performance.

Authentic Learning. Students engaged in meaningful real-world tasks involving student choice to develop inquiry, metacognition, or problem-solving skills and construct relationships of discourse about the topic with others relevant to their lives (Rule, 2006, p. 1-2).

Creativity. A quality a person exhibits whether consistently or during moments of inspiration that has the following characteristics: intense curiosity prompting questioning;

generates wide range of ideas, many unique and unusual; risk-taker; openly shares opinions; humorous; non-conforming; manipulates ideas to make something new; and heightened emotional sensitivity (Davis & Rimm, 2004, p. 42).

Differentiation. Modifying content, process, and products during instruction of curriculum to provide students with the content and experiences they need to learn and progress (Tomlinson, 2001).

Federal Definition of Gifted and Talented. "Students, children, or youth who give evidence of high achievement capability in areas such as intellectual, creative, artistic, or leadership capacity, or in specific academic fields, and who need services and activities not ordinarily provided by the school in order to fully develop those capabilities." (National Association for Gifted Children, 2008).

High-Potential. Students not formally identified as academically gifted but demonstrate task commitment and productivity beyond peers within talent area and interests.

Insectivore. An animal that predominantly eats insects.

Iowa Definition of Gifted and Talented. Gifted and talented children include those children with demonstrated achievement or potential ability, or both, in any of the following areas or in combination: general intellectual ability, creative thinking, leadership ability, visual or performing arts ability, and specific ability aptitude" (Malek & McCurdy, 2009, p.1).

Leadership. A quality of students who demonstrate some of the following characteristics whether consistently over time or focused on specific causes of interest: engagement, persistence, organization and delegation of tasks, altruistic, integrity, resourcefulness, oral and nonverbal communication skills, and empathetic (Davis & Rimm, 2004, p. 191-

193).

Prairie. Open grasslands that historically spanned into southern Canada from Indiana across to the Rocky Mountains characterized by short and tall stem grasses and wildflowers with deep root systems to stabilize the plants and ensure their survival. The prairie in the central region, including Iowa, had a drier climate ("North American Prairie," n.d.).

Rodent. A warm-blooded animal that nurses its young, identifiable by its incisors that consistently grow and get gnawed down. There are many different kinds of rodents that range from small to medium-sized and live under and above ground (University of California Museum of Paleontology, n.d.).

Rubric. A chart that gives evaluative criteria with which to mark the levels of a student's performance in relation to meeting the criteria.

Social Capital. "Intangible assets that address the collective needs and problems of others" (Renzulli, 2002, p.34).

Underachieving/Underachievement. Discrepancy between the student's school performance and indication of actual ability through intelligence, test scores, achievement, or observational data (Davis & Rimm, 2004, p. 306).

Chapter 2: Literature Review

Preview

This study compared the learning of academic versus creative and leadership talented students while exploring prairie ecosystems and the importance of prairie restoration. Identification of gifted students varies by district and determines whether students with leadership and creative talent are serviced within programming. The literature on the debate of using only test scores for gifted programming identification is reviewed in relation to federal and Iowa state definitions of gifted children within the first section titled *Identification of Gifted Students*. The importance of identifying and servicing students with leadership and creative talent is further explored through the perspectives of various gifted researchers and authors in the next two sections *Importance of Creativity and Characteristics of Creative Work* and *Importance of Leadership Skills*. Literature on gifted instruction often touts the importance of using authentic project work. Articles and examples of authentic learning are reviewed in the next section, *Authentic Project Work*. Finally, the literature on the importance of prairie restoration and the impact of student attitudes toward conservation is explored in the sections *Importance of Prairies and Attitudes of Conservation* and *Previous Prairie Restoration Student Projects in the Literature*.

Identification of Gifted Students

A flexible identification approach is encouraged and often used today in gifted programming; however, this process has changed throughout the years and is still not reflected in all of the states' definitions of gifted and talented individuals. In the 1940s gifted students were initially those identified as having an IQ over 140. It didn't matter if

a student had an IQ of 139 or a similar close score, the student did not qualify unless his or her score reached 140. Not all educators agreed with this general requirement, but there is limited work documenting the challenges. In the 1960s, teacher observation was utilized in identification, but many professionals discouraged these practices because of the informal, flawed nature of subjective measurements (Delisle & Galbraith, 2002, p. 47). In 1978, Joseph Renzulli, researcher in the area of gifted education and later director of the National Research Center on the Gifted and Talented, proposed a new idea for identification of gifted students; a three-ring conception suggesting giftedness involved the interaction of above average ability, creativity, and task commitment. This idea was not readily accepted when introduced/at the time, but today is one of the most cited references in gifted education research (Renzulli, 2011, p. 61).

Intelligence tests and other academic testing may provide validity and reliability, but as researchers argue today, they do not capture the wide range of talents present within students across different cultures, experiences, and other exceptionalities. "When emphasis on formal assessments is reduced and more weight and credibility are given to talent spotting opportunities, more traditionally underrepresented students surface for consideration for programs and services" (Eckert & Purcell, 2006, p. 37). Standardized testing measures academic content knowledge and disregards artistic talent, creative thinking, task commitment, and leadership defined within the federal definition of gifted and talented students. Other assessment tools are needed to identify the talents of these students.

Current research suggests the importance of using multiple assessment tools to observe, assess, and document student information to determine the student's needs for

identification and programming. An identification team is often utilized to gather the necessary information and ensure that the range of student population is acknowledged and recognized within the process. Multiple tools include teacher recommendations, performance assessments, peer nominations, self-nominations, student portfolios, and student observations. (Eckert & Purcell, 2006, p. 37, 50)

The United States federal definition of gifted and talented students acknowledges evidence of high achievement in intellect, creativity, art, leadership, and specific academic fields (National Association for Gifted Children, 2008). The state of Iowa's definition reflects this definition, acknowledging students who demonstrate and show potential ability within these five areas (Malek & McCurdy, 2009, p.1). Utilizing various tools and focusing on student's needs can help gifted educators identify students with various talents across various backgrounds as indicated within the definitions of gifted and talented students. Renzulli (2011) reminds us of the importance of expanding our definitions: "Currently, there still tends to be disproportional emphasis on test scores at the expense of criteria that reflect creativity and task commitment. Developing high levels of creative talent and high motivation among all of our young people is essential for the continued economic and cultural advancement of our country (p. 61) Limiting the definition of giftedness to academics ignores the potential of students often underrepresented within gifted programming. Research within the gifted education field has broadened to explore the impact of more inclusive talent development; especially within the topic of creative production.

Importance of Creativity and Characteristics of Creative Work

"Creativity predicts future accomplishments better than intelligence or school

grades" (Zabelina, 2009, par. 3). In fact, highly creative, gifted students outperformed their highly intellectual peers at the university level (Cropley & Urban, 2000, p. 485). Davis & Rimm (2004) also reference the more recent research that stated those with a higher IQ and creativity surpassed those with just a high IQ and academic ability (p. 208). According to the professional literature, there are numerous indicators of the importance of creativity in achievement and world advancement. Today's workforce requires individuals with new ideas and the ability to problem solve. Creativity supports these skills. According to Starko (1995), there would be no advancement without creativity (Sak, 2004, p. 216).

What is creativity? "Creativity by definition is a complex and subjective phenomenon, about which human beings construct meaning out of their experiences" (Sak, 2004, p. 217). Csikszentmihalyi (1996) defined creativity as "any act, idea, or product that changes an existing domain, or that transforms an existing domain into a new one" (Fletcher, 2011, p. 38). There are many definitions for creativity and researchers have not been able to come to a consensus.

The idea of creativity has evolved with research studies in this area. Initially, researchers focused on creativity and the individual. E. Paul Torrance, an influential creativity researcher, is best known for his incubation model and developmental measures of creativity for gifted and creative children through the Torrance Tests of Creative Thinking (Fletcher, 2011, p. 38). The Torrance Tests of Creative Thinking, developed in 1966, measure thinking creatively with words and pictures. The six verbal components are asking questions, guessing causes, guessing consequences, product improvement, unusual uses, unusual questions, and just suppose. These components measure the mental

creativity characteristics of fluency, originality, elaboration, abstractness of titles, and resistance to premature closure. The three figural parts are picture construction, picture completion, and construction on lines/circles which measure thirteen creative strengths, among them fantasy and storytelling articulateness. Plucker (1999) used statistical procedures to reanalyze Torrance's 20-year longitudinal data and found the scores of the Torrance Tests of Creative Thinking differentiate between those individuals who go on to receive public acclaim for creative accomplishments in comparison with those that do not. The tests show test-retest reliability and are still used today in identification of creative students (Cropley, 2000, p. 73).

The idea of creativity shifted from the individual to a wider context in the 1990's. Csikszentmihalyi identified "Big C" as a new, influential creative contribution versus "little c" as everyday creativity that contributes to things previously established. "Big C" is influenced by events and individuals around the person. He also utilized the term "flow" to describe when a person is deeply absorbed in a task of interest and loses time.

Creative students have many traits similar to gifted students, such as intelligence, task-commitment in an interest area, and independence, but they are not the same. Sak's (2004) study of a gifted educator revealed her belief of the difference between gifted and creatively gifted students as "imaginative intelligence" (p. 220). She also found that her creative students were able to think "freely" and not so linearly like her intelligently-gifted students (Sak, 2004, p. 219-220).

Some common characteristics of creative persons first proposed by Frank Barron (69, 88) and Donald MacKinnon (78) include: increased self-confidence, adventurousness, curiosity, reflectiveness, enthusiasm, tolerance for ambiguity, a need for

alone time, independence, humor, risk-taking, intuition, and artistic or aesthetic interests. Additional traits include nonconformity, stubbornness, cynicism, questioning of authority, overactivity, sloppiness, and forgetfulness (Davis & Rimm, 2004, p. 40-43). It is important to note that these traits vary by individual (Neihart, et. al., 2002, p. 166).

Davis and Rimm (2004) describe creative abilities, some associated with the Guilford tests (1967) and Torrance Tests of Creative Thinking (1966). Fluency, generating many ideas; flexibility, utilizing different approaches and categories; originality, unique, nonconformist ideas; and elaboration, adding details, are the most commonly referenced. Additional abilities include problem finding, visualization, transformation, extending boundaries, evaluation, synthesis, analysis, resistance to premature closure, concentration, logical thinking, analytical thinking, and aesthetic thinking. There are other creative strengths identified with creative people, such as seeing structure within chaos, thinking critically, and adapting knowledge to new problems. Although not all creative people exhibit these strengths, they are typically identified within creative individuals (Davis & Rimm, 2004, p. 210-211).

Importance of Leadership Skills

Leadership talent is acknowledged within the federal and Iowa state definitions for gifted and talented children. However, it is often overlooked within identification and programming. Joseph Renzulli promoted the development of social capital to engage today's youth in civic responsibility in hopes of developing leadership and expanding the pool of identification (Renzulli, 2002, p. 55).

Later, Renzulli worked with other researchers on a project entitled "Operation Houndstooth" proposing that the interactive personality traits and environment of

students influence their abilities, creativity, and task-commitment. This theory aligns with positive psychology in which individuals begin to internalize positive traits to become more engaged and involved in the well-being of their community. Based on research, the components of this theory are optimism, courage, romance with a topic or discipline, sensitivity to human concerns, physical/mental energy, and vision/sense of destiny (Renzulli, 2002, p. 33-34).

These six components are termed "co-cognitive factors" because they interact with cognitive factors individuals use for success in school. They help individuals develop leadership traits. Optimism involves an attitude of hope and willingness to work hard. Integrity and strength of character to overcome difficulty are marks of courage. Romance with a topic or discipline includes motivation and passion to explore interests. Individuals with sensitivity to human concerns can comprehend others' affective needs and demonstrate their understanding through altruism and empathy. Individuals willing to expend high levels of focus and task-commitment to achievement show physical and mental energy. Vision/sense of destiny refers to people who are stimulated to plan and organize based on a combination of internal locus of control, motivation, volition, and self-efficacy (Renzulli, Koehler, & Fogarty, p. 17-18).

In 2000, Larson released a study that found average students were bored at least a third of the time. Suggestions to overcome the disaffection of students included civic and socially-engaging activities that he hoped would help promote leadership, creativity, altruism, and initiative (Renzulli, Koehler, & Fogarty, 2006, p. 17). Renzulli and other researchers of positive psychology have questioned: "What causes some people to mobilize their interpersonal, political, ethical, and moral lives in such ways that they

place human concerns and the common good above materialism, ego enhancement, and self-indulgence?" (Renzulli, 2002, p. 35). This question relates to the promotion of social capital. Renzulli defines social capital as "intangible assets that address the collective needs and problems of other individuals and of our communities at large" Renzulli, 2002, p. 34).

The promotion of social capital within schools is important to Renzulli because he believes it plays an important role in helping to shape positive values and virtues since family structure has changed and we are engaged in some type of schooling at least a fifth of our life (Renzulli, Koehler, & Fogarty, 2006, p.17). Through the review of literature, Renzulli and his colleagues have identified six different approaches to promoting the co-cognitive factors. *Rally-round-the-flag* is a cheerleading method where students are reminded of certain values and behaviors through the use of slogans, signs, banners, and bulletin boards. This approach is the least affective of the six, but having students get involved in the generation of the items can make the messages more meaningful to the students. *The gold star approach* uses positive reinforcement to provide students with badges, points, or tokens to exchange for prizes to reward positive behaviors (Renzulli, Koehler, & Fogarty, 2006, p. 19-20).

The more commonly used approach, *the teaching-and-preaching approach*, uses direct teaching through drills, dialogue, discussions, and debate of character issues. Teachers often use fictional books and films to explore some of the concepts. Character Counts, a program by Josephson Institute (2004) is a well-known example of this approach. Students are placed in situations similar to the expected behaviors for role-playing and dramatization to expand upon the teach-and-preach method in the *vicarious*

experience approach. This method begins to relate students to real-life experiences but they have no direct contact (Renzulli, Koehler, & Fogarty, 2006, p. 20-21).

The two most effective approaches involve direct contact with experiences where behavior is needed/expected: Direct Involvement I & II. Students engaged in Direct Involvement I participate in community service, internships, and other civic-community events. Direct Involvement II is the most effective approach because the student initiates the volunteer experience on his/her own, thus internalizing the co-cognitive factors. Students have taken on active leadership roles to bring about change. They are directly involved in the learning experience. "A deep internalization of positive attitudes and attendant behaviors will have a more enduring influence on developing wisdom, a satisfying lifestyle, and a lifelong value system than quick-fix behavioral changes that may result from experiences that do not culminate in action-oriented involvement" (Renzulli, Koehler, & Fogarty, 2006, p. 21-22).

Authentic Project Work

Renzulli, Koehler, & Fogarty (2006) found the most effective approaches for assisting students in their development of leadership and social capital were direct involvement in service and events (p. 21-22). Students need to be engaged in an authentic experience to learn the values and responses necessary to specific situations. This is referred to as authentic learning in education.

Authentic learning is a newer term in education, but its principles are not. Resnick (1987) and Collins (1988) touted the need for learning to be connected to real life and the work environment over twenty years ago (Rule, 2006, p. 1). Today with the development of common core standards, Iowa Core supports student-centered classrooms with six

universal constructs: critical thinking, complex communication, collaboration, flexibility and adaptability, productivity, and accountability (Iowa Department of Education, 2011). Authentic learning may engage students in the learning process and help them bridge the gap between the content they're learning and its importance to the real world within these constructs. Maina (2004) described how faculty and graduate students perceived authentic learning as activities with the learner in the center of instruction as they engaged in real-world situations beyond the classroom (Rule, 2006, p. 2). Callison and Lamb (2004) extend their definition of authentic learning to include seven components: student-centered learning, accessing of multiple resources beyond the school, students as scientific apprentices, the opportunity to gather original data, lifelong learning beyond the assignment, authentic assessment of process, product and performance, and team collaboration.

Rule (2006) identified four themes from a review of literature on authentic learning selected by her colleagues at the State University of New York at Oswego. These themes are considered important components to authentic learning; "real-world problems that engage learners in the work of professionals in the discipline with presentation of findings to audiences beyond the classroom; inquiry activities that practice thinking skills and metacognition; discourse among a community of learners; and student empowerment through choice." (p. 1). Real-world problems and audiences make learning more than an "exercise," meaning the students are more emotionally engaged and committed to the work they complete. They must ensure they complete quality work appropriate to their audience, not just what is suitable to the teacher. Renzulli (2002) suggested using speakers to deliver powerful messages that may inspire

students to explore personal interests in more depth (p. 37-38). Key features to these presentations are the passion and commitment of the speakers. Students could also visit locations where authentic research and creative productivity occurs for additional motivation (Renzulli, 2002, p. 38).

CoRT Thinking Skills

Activities that involve thinking skills and metacognition help students engage in real-world practices. Edward de Bono, leading creator of creative and lateral thinking tools, developed the CoRT Thinking Skills in 1974 to help individuals enhance their thinking ability. The ten thinking skills are shown in Table 1. There is no definite order when using the skills, but they do build upon each other during the thinking process. The CoRT Thinking Program involves the direct teaching of the skills to students within applicable practice opportunities to strengthen their thinking.

Table 1. Edward de Bono's ten CoRT Breadth thinking skills.

Abbreviation	Full Name of Skill	Brief Explanation of Skill
PMI	Plus, Minus, Interesting	Determine the positive things about an idea (pluses), the negative things or areas of improvement needed (minuses), and the interesting connections, consequences, or applicability without judgment (interesting).
CAF	Consider All Factors	Think about all the factors of a situation, considering different people's perspectives, settings, time (past, present, future), and less obvious contributors.
RULES	Rules	Generate a list of rules of behavior necessary for a situation.
C & S	Consequence and Sequel	Figure out the consequences and results of certain actions and events: immediate effects; short-term consequences (1-5 yrs.); medium-term effects (5-25 yrs.); and long-term effects (more than 25 yrs.).
AGO	Aims, Goals, Objectives	Determine the direction of your project (aim), what you would like to ultimately accomplish at the end (goals), and the specific reference points of success along the way (objectives).
PLANNING	Planning	Create a plan for a project or event that includes a title, materials needed, steps for completion, possible problems encountered, and suggestions for overcoming potential problems that are written into the plan.
FIP	First Important Priority	Think of the different consequences and factors and order them for importance to determine most influential.
APC	Alternatives, Possibilities, Choices	Consider as many different perspectives and options for a situation as possible before making a conclusion or taking action.
DECISIONS	Decisions	Think of all the different possibilities and which factors are most important to make a decision. A decision matrix may be used with questions to prompt evaluative thinking on the consequences of possible decisions.
OPV	Other People's Views	Think of the different perspectives of diverse people related to the topic and project.

Action research has been conducted at several schools to determine the results of using the skills with children in a natural, authentic setting. Students in Years 5 and 6 at the Maltese Primary Schools had 14 lessons ranging from 50 to 55 minutes long. Role

play was used with the students to engage them in a more realistic process, consistent with Renzulli, Koehler, and Fogarty's (2006) findings that the vicarious experience approach is more effective than just direct teaching for positive psychology (p. 21). Results showed that the CoRT Program was successful in making a mark on the children's thinking processes even though it was only utilized for a short time period. Teachers observed students' improved verbal and listening skills, increased awareness of their thinking processes, higher levels of autonomy in thought and actions, and greater perspective in problem-solving (Edward de Bono's Web, n.d.).

Importance of Prairies and Attitudes of Conservation

The rich prairie ecosystem began to develop between eight to ten thousand years ago. It once covered around 170 million acres across North America from the Rocky Mountains to east of the Mississippi River and Saskatchewan to Texas (National Preserve Kansas, n.d.). As settlers moved west, they began cultivating the land to grow crops. Prairie fires were a nuisance, so they devised ways to stifle them. However, these fires were beneficial to the grasslands, destroying the woody plants and other invasive species. As more people moved to the Midwest, urbanization began to take over the prairie (Garber et. al, n.d., loss). All these factors worked together and today it is estimated there is only one percent of the natural prairie standing (National Preserve Kansas, n.d.). Iowa had the largest percentage of prairie land coverage with over 30 million acres, but the state has lost 99.9% of its natural landscape (Iowa Prairie Network). There have been efforts to begin restoring the natural land and educating the public as to the importance of prairie restoration, but the notion starts with children.

Researchers have studied the connection and relationship between young children

and nature. They've discovered that young children utilize sensory perceptions to know and understand their world. Moore stated, "The exploring/creating child is not making 'art' so much as using the landscape as a medium for understanding the world" (Wilson, 2007, p. 3). This sense of wonder they develop may enable them to bond with the earth, which Pearce (1977) describes as critical to a child's developing brain and intelligence (Wilson, 2007, p. 1). Sebba's (1991) findings support Pearce's research; the interaction between children and their natural environment is "an authentic childhood experience that carries with it the original stamp of childhood and that will disappear with its passing" (Wilson, 2007, p. 1).

The early experiences that children have with nature help shape their attitudes and values toward nature. Humans appear to be born with a natural attraction to life, known as biophilia. However, if we are deprived of experiences to interact and explore the natural world, then we may develop an aversion to nature and non-man-made items, known as biophobia. Louv (2006) describes this phenomenon as a "Nature-Deficit Disorder," the effects of withdrawal of nature from children's lives (Cramer, 2008, p. 279). Kirkby (1989) and Sobel (1999) have found that children across cultures create nestlike structures during their play activity when they have access to the right materials and space, but many children today spend more time playing with manufactured toys as opposed to natural objects, such as sticks, rocks, and sand. Therefore, children may grow up objectively viewing nature as nothing more than a resource to be consumed (Wilson, n.d., p. 2-4).

Rule (2007) states, "Sometimes we forget that there are three parts to science learning: science knowledge and facts, science process skills such as observation,

classification, and inference-making, and attitudes toward science" (p. 299). Science (including nature study) attitudes can be intellectual and emotional.

Restoration projects can be wrought with controversy as people lack information or knowledge as to the natural benefits to prairie restoration. Marler and others (2005) noted the importance of public outreach when conducting restoration projects. They devised several opportunities to connect the project with the community to ensure a successful restoration movement (p.29). These projects proved helpful when the residents voted to tax themselves to support invasive plant management (Marler et. al, 2005, p. 33). Miles, Sullivan, and Kuo (2000) found that many of the volunteers surveyed about prairie restoration in the Chicago area were pleased that they were taking part in something meaningful and experienced other satisfactions (p. 225). Although the participants in that study were adults, these satisfactions might be developed earlier and continue on into adulthood. Adolescents can still regain their connection to nature and assume leadership roles by becoming involved in restoring the prairie and inspiring others to get involved.

Previous Prairie Restoration Student Projects in the Literature

Jordan (2003) stated: "By combining restoration activities with opportunities that link self-reflection, self-discovery, and meeting learning objectives, we can inspire a new communion with nature while restoring native ecosystems" (Cramer, 2008, p. 281). As Louv (2006) and Wilson (2007) have explained, children need exposure to nature to develop an appreciation and connection in hopes of restoring and preserving the land. Students need opportunities to interact and become stewards of the land, so schools have partnered with various universities and ecological organizations to restore the prairie and natural ecosystem.

Artists, such as Landa Townsend, have worked with students to help restore the natural land while creating aesthetically pleasing art. Elementary students helped Townsend place her willow spheres along the banks of San Geronimo Creek in Marin County, California. The spheres eventually sprouted into shrubs and brought some of the natural vegetation to the area. Other artists have promoted the importance of science and art combining together to help in the restoration process (Lambert & Khosla, 2000, p. 112-113).

Two middle school students from Amery Middle School in Amery, Wisconsin and two high school students from St. Croix Falls High School in St. Croix Falls, Wisconsin worked with their teachers to research how the characteristics of a restored prairie impacted monarch butterflies in comparison with an abandoned corn field. The results differed from their original hypotheses and they were unable to capture butterflies as they had hoped to gather numbers, but overall the students reported learning more about the butterflies and prairie ecosystem. They were surprised to learn that there were more milkweed plants within the restored prairie which attracted more of the female monarchs to this location. The students were engaged in authentic research as they sought to learn more about the interaction between these insects and the plants (Rochester et al, 1999).

The Restoration and Reintroduction Education Partnership (RARE) through the Institute for Applied Ecology has partnered with local middle and high schools in Corvallis, Oregon to restore the natural prairie. Students engage in authentic problem-solving as they plant threatened and endangered plant species in a school greenhouse and then help outplant them in the natural environment. Hands-on science techniques, applied

research, and the importance of native plants were explored through this place-based educational service-learning experience. "As a restoration ecologist and concerned citizen, I am worried that children who lack connection with nature are less likely to exert energy to protect it" (Cramer, 2008, p. 279). The objective is to help promote positive land stewardship so that students will continue to protect the land as adults (Cramer, 2008, p. 279-281).

The Sierra Club's Building Bridges to the Outdoors program through the Boys and Girls Clubs of Chicago have students participate in prairie-restoration work days throughout the year at Theodore Stone Forest Preserve. Even during the cold of winter, they bundle up to go out and cut down buckthorn, an invasive species. The middle and high school students are crammed into city districts and rarely have interaction with nature. The program enables them to get outside and help preserve the land. "It's cool because people are cutting down trees instead of spending Saturday playing video games," thirteen-year-old Eric states (Bertulfo, 2009, p. 36). The students enjoy being able to do things they can't normally do in school or their neighborhood (Bertulfo, 2009, p. 36).

In 2009, an endangered prairie on the campus of Fort Worth Country Day in Texas was threatened due to highway construction. A group of high school students founded Project Prairie to help save the natural ecosystem and restore its native plants. Students worked to identify the natural and invasive species to determine what to take out and what to plant. They set up a green roof to help the plants begin to grow before moving them to the prairie site. Biology students were able to monitor the plants as they began to grow. Another focus of the project was to educate the community on the

importance of prairie restoration and the preservation of the natural ecosystem. Surveys found that student interest and attitudes had changed as they become more involved in helping with the planting. The original leaders have graduated but new leadership took over and the project continues today (Alame, 2012, p. 9).

Summary

Criteria for the identification of gifted and talented students has changed in many states to incorporate students with creative, leadership, and artistic talents as indicated in the United States' federal definition. Renowned gifted researcher, Joseph Renzulli, reminds us of the importance of creative productivity and social capital to the progression of our nation. Students need direct engagement in the learning process to develop the skills necessary for the future to ensure our environment and its people can survive. Authentic experiences, such as helping to restore a prairie and influence others' attitudes toward conservation can help students reconnect to nature and become stewards of the land. Robert Barker's (1993) words remain a powerful reminder: "Vision without action is merely a dream. Action without vision just passes time. Vision with action can change the world!" (Renzulli, Koehler, & Fogerty, 2006, p. 15).

Chapter 3: Methodology

Participants and Research Setting

Twenty-seven middle school students participated in the study. Sixteen were identified gifted students and 11 were not previously identified as gifted, but showed the potential for being gifted. Table 2 shows the demographics of the sample population. Pseudonyms were used for all student names referenced.

Table 2. Demographics of the Sample Population

Group	Male	Female	8th Grade	7th Grade	6th Grade	Total Number
Identified Gifted Students	8	8	5	2	9	16
Unidentified high potential Students	3	8	3	4	4	11

Permission to conduct the study was obtained from the University of Northern Iowa's human subjects review committee and from the middle school's principal. All students and parents agreed in writing to participate.

Aldo Leopold Middle School has over 432 students in grades six through eight, with 65% of the students qualified for free/reduced-price lunch. The building opened in August of 2010. In the spring of 2011, local members of the Aldo Leopold Foundation proposed a plan to build an outdoor classroom and prairie restoration area in front of the school. The plan was approved and the process began in August 2011. Students were able to help in the planting and spreading of plants and grass seeds in September and October 2011. The area is still in development and will grow through the years as more funding is secured. Students are now able to reconnect with nature in honor of the school's namesake.

Data Collection and Analysis

Two assessments were given as pretests and posttests. The content information

pretest-posttest assessed student knowledge about prairie ecosystems and Aldo Leopold who studied them. This instrument contained the following questions:

1. Tell three major life accomplishments of Aldo Leopold.

2. List five different interactions of animals with animals or animals with plants/ soil of the prairie ecosystem.

3. Why is the restoration of prairie important to the Midwest?

4. Name three prairie plants and tell one way each is adapted to living in the prairie.

5. Name five small animals that live in the prairie ecosystem and for each explain two unique body adaptations for survival.

Table 3 shows an additional objective test given to assess content knowledge.

The pretest-posttest attitude surveys allowed students to rate their like/dislike of prairie animals and common pets (as a control comparison) and place themselves on an attitude continuum related to prairie and ecology topics. The form for rating one's attitude toward various animals is shown in Table 4. Additional attitudes toward wildlife were assessed with the form in Table 5.

Student creative process and the products resulting from the lessons were analyzed in the following two ways: (1) Teacher observations of the approaches of the students of the two different groups were made and recorded for later analysis. The teacher observed which groups generated more numbers of ideas and more unusual ideas. She also observed which groups were more open to off-the-wall ideas. (2) Products were scored using rubrics developed for the assignments.

Table 3. Objective Pretest-Posttest Assessment

Questions with Correct Responses Marked with an Asterisk	
1. Which example is **NOT** a common prairie plant: a. Little Blue Stem b. Wild Lupine c. Sideoats Grama d. Willow	2. Which example is **NOT** a common prairie plant: a. Little Blue Stem b. Wild Lupine c. Side Oats Grama d. Willow
3. The grasshopper mouse is unique because it… a. has strong legs for jumping b. is a great swimmer c. is a carnivore by habit d. has flat molars	4. The short-tailed shrew uses (its) _____ to help explore its habitat. a. whiskers b. echolocation c. elongated snout d. forefeet
5. Which one of these descriptions does **NOT** describe the pocket gopher? a. Fur-lined pouches outside of the mouth store food b. Sparsely-haired tail acts as radiator for warmth c. Stamps its foot like a rabbit if threatened d. Uses whiskers and tail to guide it underground	6. Which one of these descriptions does **NOT** describe the pocket gopher? a. Fur-lined pouches outside of the mouth store food b. Sparsely-haired tail acts as radiator for warmth c. Stamps its foot like a rabbit if threatened d. Uses whiskers and tail to guide it underground
7. Another name for the woodchuck is a _____. 8. The Franklin's Ground Squirrel hibernates for _____ months. 9. Describe a unique feature of the southern bog lemming. 10. Describe an adaptation the mole uses for aid in daily behaviors and survival. 11. How do the gray and fox squirrels help the environment? 12. Compare and contrast the meadow vole and deer mouse. What makes them similar and different from each other? 13. Give one positive attribute for the mole and one negative.	14. List as many characteristics that describe the following animals by placing the appropriate letter that corresponds to its description next to the animal's name: B = Burrowing; I – Insectivore R = Rodent; H —= Hibernating eastern chipmunk eastern mole pocket gopher meadow vole deer mouse short-tailed shrew Franklin's ground squirrel gray squirrel fox squirrel woodchuck southern bog lemming grasshopper mouse

Table 4. Attitude Survey toward Animals

Tell how much you like or dislike each animal by circling a number for each one.									
Animal	Dislike			Neutral				Like		
cat	1	2	3	4	5	6	7	8	9	10
garter snake	1	2	3	4	5	6	7	8	9	10
mole	1	2	3	4	5	6	7	8	9	10
skunk	1	2	3	4	5	6	7	8	9	10
dog	1	2	3	4	5	6	7	8	9	10
bat	1	2	3	4	5	6	7	8	9	10
woodchuck	1	2	3	4	5	6	7	8	9	10
meadow vole	1	2	3	4	5	6	7	8	9	10
chipmunk	1	2	3	4	5	6	7	8	9	10
rabbit	1	2	3	4	5	6	7	8	9	10
gopher	1	2	3	4	5	6	7	8	9	10
deer mouse	1	2	3	4	5	6	7	8	9	10
hamster	1	2	3	4	5	6	7	8	9	10
shrew	1	2	3	4	5	6	7	8	9	10
grasshopper mouse	1	2	3	4	5	6	7	8	9	10
13-lined ground squirrel	1	2	3	4	5	6	7	8	9	10
bog lemming	1	2	3	4	5	6	7	8	9	10

Table 5. Additional Attitude Survey

Circle whether you strongly agree, agree, are unsure, disagree or strongly disagree with the following statements. Please add an additional comment below your response to explain.				
1. People should set traps, poison, or shoot to kill ground squirrels, voles, shrews, gophers, moles, and other creatures that are digging holes or tunnels on their property.				
Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
Comment:				
2. Prairies are basically overgrown weed fields that are not much use to anyone. It would be better to do something else with the land.				
Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
3. Prairies do not support the rich level of animal life that a forest supports.				
Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
Comment:				
4. Squirrels are a nuisance trying to get into bird feeders, so it's ok to shoot them with a BB gun or run them over with a vehicle if they are in the street.				
Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
Comment:				
5. It would be better to have landscaped bushes, trees, and mowed grass in front of our school than prairie plants.				
Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
Comment:				

Table 5. Additional Attitude Survey *Continued*

Circle whether you strongly agree, agree, are unsure, disagree or strongly disagree with the following statements. Please add an additional comment below your response to explain.				
6. It is important to keep/restore a variety of habitats/ natural environments for various animals and plants in Iowa, even when we don't use, enjoy, or regularly see the plants or animals. Comment:				
Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
Comment:				
7. Prairies should only be restored out in the open country and not within a town or city.				
Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
8. Little animals like mice, moles, voles, shrews, gophers and ground squirrels are not as important as larger wild animals; we don't really need them and would be much better off without them.				
Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
Comment:				
9. Prairie restoration at a school can inspire leadership and create a sense of community.				
Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
Comment:				
10. Prairie grasses are better than mowed lawn grasses for the environment.				
Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
Comment:				

Lessons

Students participated in approximately nine lessons related to prairie restoration at their school and completed some products related to the lessons. Table 6 shows the sequence of lessons related to the prairie, the components that made them authentic lessons, and the products that fit the gifted education requirements of Type III authentic products. The ways in which de Bono's CoRT Thinking Skills were integrated into the lessons are also shown.

Table 6. Literacy-integrated Prairie Exploration Lessons

Type I Exploratory Lesson	Type II Skill-Based Lesson – Professional Skill	Activity and Choice	De Bono Thinking Skill	Community of Learners Component	Type III Project – Authentic Product
1. Lesson on Aldo Leopold and his writings about prairie conservation	Looked at symbols for other organizations and products to determine why they are meaningful or powerful.	Students chose an aspect of Leopold to research and a symbol to represent him and his work.	CAF Consider all the Factors related to Aldo Leopold and Prairies	Students presented the symbol they created for the prairie project and explained how it relates to Aldo Leopold.	Research additional information about Aldo Leopold and produce a symbol for the prairie project.
2. Lesson on Why Prairies are Restored	Guest Speaker from Aldo Leopold Foundation-the creator of outdoor classroom-explained nature and the purpose of outdoor prairie classroom	Chose a type of newspaper article or piece to create.	APC Alternatives, Possibilities, and Choices of what type of newspaper piece one might make.	Students worked alone or in small groups to create a newspaper piece and edit each other's work.	Article for Hawkeye Newspaper (editorial, political carton, comic, word search or puzzle or crossword, etc).
3. Look at electronic slideshow of nature pictures of prairie plants. Introduced names of common prairie plants.	Mini-lesson on photography techniques. Local nature photographer came and spoke to students about nature photography.	Go out in prairie area, choose a plant, make observations, take photos.	PMI Plus, Minus, Interesting of Photography Techniques	Students give 2 best photos to teacher and an anonymous slide show is made. Student say plus, minus, interesting aspects of photos.	Photograph a particular specimen plant. Explain its role in the prairie. Select some for nature trail booklet. Also make beautiful slide show for school. Hang some photos in the halls.

Table 6. Literacy-integrated Prairie Exploration Lessons *Continued*

Type I Exploratory Lesson	Type II Skill-Based Lesson – Professional Skill	Activity and Choice	De Bono Thinking Skill	Community of Learners Component	Type III Project – Authentic Product
4. Explore poetry books on nature poetry (Jane Yolen, Thomas Locker).	Lesson on several different types of poems (haiku, cinquain, diamante, couplets, free-form)	Students wrote a few poems, using the various styles.	AGO – Determine aims, goals, objectives of the poem (peace, beauty, the prickles of a thistle, etc)	Students shared poems and received peer feedback.	Chose some poems for website and poetry plaques in prairie garden.
5. Students match jointed prairie animals to descriptions. Organize information learned about features in chart using facts, sketches, and/or analogies.	Teacher reviews online research skills for finding more information about the small prairie animals.	Students research an animal and write a description, telling its value and interactions in the ecosystem.	C & S – Consequence and Sequel of having the animal in the prairie ecosystem	Students work with a partner or small group. Peer review of writings.	Make an online guide to the prairie- Who lives here? Select some animal descriptions for the website or a brochure.
6. Students read about the human control of small mammals.	Teacher reviews critical reading for nonfiction as well as point of view in problem solving.	Students choose from article about the control of shrews, moles, or thirteen-lined ground squirrel to read and analyze for perspective.	PMI-Pluses to human control of animal, minuses to control, compromise option for both?	Students worked together to analyze the perspective of humans vs. the animals.	Students created a bulletin board to gather student opinions on the trapping and management of small mammals and to broaden discussion and perspective on the issue.
7. Look at rules at other places – Starrs Cave Nature Center, Zoo, Parks.	Principal or Conservation specialist talks about importance of rules.	Students choose an aspect that needs rules.	RULES - Rules for the prairie nature walk and outdoor classroom	Students work in small groups to develop rules and present a rule and their rationale.	A posted set of rules for the prairie and outdoor classroom. Post on school website.
8 & 9. Major student-led project.	Refresh students in the planning process.	Students develop a major project related to the prairie.	DECISIONS – Choose a project idea. PLANNING – Plan the final project.	Students work in groups to design a project with a real-world audience.	Possible projects include: plywood sign or mural; a play with actors or puppets,

Chapter 4: Results and Discussion

Authentic Student Projects Related to the Prairie Ecosystem

Table 7 shows the authentic prairie-related projects the students developed and implemented at the conclusion of the unit. The projects were meant to be Renzulli's Type III, organized by the students and presented to an authentic audience. Audience reactions, teacher observations, and the students' own reflections are included to provide multiple perspectives of the projects.

Four eighth grade students worked together to create and perform a play for the sixth grade literature and language arts classes related to preservation of the prairie. An eighth grade academically-gifted student who struggles with independent learning worked to create a model of the prairie with facts about prairie animals in the margins. Two eighth grade boys used their computer programming skills to create a computer game so players could earn points to buy plants for a prairie restoration effort. Four sixth grade students prepared a presentation game show for students at their former elementary schools and a seventh grade student used his experiences as a puppeteer for his church to prepare and present a puppet show about the prairie for the neighboring four-year-old preschool. Four seventh-grade students prepared a display case at the school related to the prairie and the outdoor classroom. Other students created poetry for the poetry rocks that will be made for the outdoor classroom and prepared websites to inform the public of the prairie and outdoor classroom environment.

Table 7. Authentic Student Projects and Participant Reactions, Part 1

Students' Authentic Projects	Audience Reactions	Teacher Observations	Student Reflections
Students 01, 03, 06, & 08: Prairie play about a developer trying to dig up the restored prairie lands to build a mini-mart. Students wrote the script, prepared the scenery, and performed to two sixth grade literature/language arts classes and other ELO students.	-Teachers individually thanked the students for the presentation and commented on the information that they provided. -Sixth grade students clapped at the end. -Three students approached the girls at the end of the play to ask them questions about the prairie animals they had shown on their scenery.	-Students prepared their project both in and outside of the classroom over a three week time period. -They invited the teachers and students with invitations they created. -Content related to prairie grasses, animals, and ways children can become involved in preserving the prairie. -Script involved three young girls and a developer, which made the topic more relatable to the students and how they could possibly take action.	St. 01: Plus-Our voices projected across the stage, good acting Minus-needed to do better with memorizing lines and incorporating more prairie facts Autonomous learner insight-I learned we could work together, I could create a more factual-based play, and let loose a little. St. 03: Plus-We got the point across that not everyone appreciates the prairie. Minus-more facts Autonomous learner insight-You have to be focused to succeed. St. 06: Plus-taught about prairie preservation, worked together Minus-forgot some lines and didn't move around much Autonomous learner insight-I work better under pressure. St. 08: Plus-It got the point across about prairie conservation. Minus-The play could've been longer and we didn't have much time to memorize our lines. We could've given more facts. Autonomous learner insight-I learned that I work well with others.

Table 7. Authentic Student Projects and Participant Reactions, Part 2

Students' Authentic Projects	Audience Reactions	Teacher Observations	Student Reflections
Student 02: Created a model of the prairie landscape to display within the school. Contains animals and plants with facts about some prairie animals along the edges.	-Students commented on how there were too many trees to be a prairie. -They liked the facts included along the sides to give information about the animals portrayed.	-Student completed this project within first three weeks of discussing- usually does not complete a project until last minute or does not complete a project at all -The scene is pretty accurate without so many trees but animals were correct -Factual information was accurate and aided understanding of scene	Pluses-descriptive, detailed Minuses-need to have less trees Autonomous learner insight-If I try I do better.
Students 04 & 05: Prairie Scratch Game: Published online through the Scratch website, players must defeat the bulldozers and use money earned to buy plants to restore the prairie landscape.	-Classmates enjoyed playing the game. -Some of their peers helped test it out before they finished providing helpful feedback. -The students had some positive reviews on the website. -Showed sixth grade science teacher and she was interested in allowing students to play game as part of conclusion to their study of the prairie and plants.	-Students worked within the classroom and at home to complete game. -They referenced images and research when creating the game. -Incorporated the flowers planted in the outdoor prairie classroom. -Topic is authentic and simulates what they had learned while using their talents of computer programming. -Students were task committed because they enjoy making computer games.	St. 04-Plus-You get to act like you're building a prairie. Minus-Any glitches, needs better graphics Autonomous Learner-I learned that I like the prairie St. 05-Plus-Build a prairie through the game. Minus-Improve our glitches and graphics Autonomous Learner-I learned the prairie is important.
Students 09, 15, & 16: Prairie website		-Students did not finish their project.	

Table 7. Authentic Student Projects and Participant Reactions, Part 3

Students' Authentic Projects	Audience Reactions	Teacher Observations	Student Reflections
Student 02: Created a model of the prairie landscape to display within the school. Contains animals and plants with facts about some prairie animals along the edges.	-Students commented on how there were too many trees to be a prairie. -They liked the facts included along the sides to give information about the animals portrayed.	-Student completed this project within first three weeks of discussing- usually does not complete a project until last minute or does not complete a project at all -The scene is pretty accurate without so many trees but animals were correct -Factual information was accurate and aided understanding of scene	Pluses-descriptive, detailed Minuses-need to have less trees Autonomous learner insight-If I try I do better.
Student 11: Prepared a puppet show about the prairie and presented to four-year-old preschool class next door. The student borrowed the prairie board the play group used so they could hide behind it and give the students a related visual instead of a curtain. The show ended with the students singing "The Green Grass Grows."	-The teachers were so pleased that they asked if we could form a partnership. The head teacher is sending a schedule of themes and activities to use for next year in planning experiences. -The painted scenery board helped provide the children with an aid when trying to determine the plants and animals they might see in a prairie. "Snakes, skunk, butterflies, deer." -The children interacted with the puppets by identifying animals and what they saw. -The children were engaged making comments, giggling, and focusing on the puppets during the show.	-Student wrote the script and gathered puppets from his puppet group. -Script engaged the audience members by asking the teachers to give their thoughts on what a prairie is and by asking the preschool children if they knew what animals could be found in the prairie. -The song at the end was also appropriate to make a connection for this audience. -Students were studying gardening this week, so it helped expand beyond that topic to nature's natural garden.	St. 11-Plus-It was really fun for us and the kids. Minus-It could've gone more smoothly. Should have practiced more. Autonomous Learner-I like performing.

Table 7. Authentic Student Projects and Participant Reactions, Part 4

Students' Authentic Projects	Audience Reactions	Teacher Observations	Student Reflections
Students 17 & 20: Elementary game show presentation on prairie to 3rd, 4th, and 5th graders who will be going to Aldo Leopold in future	The principal mailed a thank you note to the students for their presentation and commented on the wealth of knowledge they provided and their presentation skills. 5th grade teacher: "This was such a great presentation. We are headed up to the Putnam Museum in a few weeks and the students will have some background knowledge before we tour Iowa's history." "The girls did such a nice job leading the gym of students in this game show. The students were so engaged, they loved it."	-Leadership was shown from the creation of the letter to ask principal for permission to present to the students to the actual presentation -Students worked for several weeks in and outside of class to put the PowerPoint presentations together and create the Jeopardy board game. -Research and facts given were accurate -Gave information on animals, plants, the importance of fires, Aldo Leopold, and prairie preservation-so a variety of information was provided -Organized the groups of students to keep them engaged and participating as well as finding a way to get another opinion without offending students -Presented with loud, enthusiastic voices	St. 17: Plus-The kids really liked it and we kept their interest until the very end. Minus-The computer kept messing up. Autonomous learner insight-I like presenting things to kids. St. 20: Plus-We taught little kids about the prairie. Minus-I messed up on the hyperlinks. Learned-You cannot do a long presentation without kids getting bored.

Table 7. Authentic Student Projects and Participant Reactions, Part 5

Students' Authentic Projects	Audience Reactions	Teacher Observations	Student Reflections
Students 19 & 21: Prairie game show presentation to 4th & 5th graders at former elementary school to raise awareness of information about the prairie and prairie restoration project at Aldo Leopold-their future middle school.	-One of the teachers nominated the girls to present for the "Good News" section of the following school board meeting. -School board members wrote a thank you note to the girls for their presentation complimenting them -Teachers thanked the students and the elementary students said thank you as they left the gym	-Leadership was shown from the creation of the letter to ask principal for permission to present to the students to the actual presentation -Students gave a variety of information related to Aldo Leopold, the outdoor classroom project, flowers, animals, conservation, what a prairie is and why it's important -Students spoke a little too soft so it was difficult to hear but teacher found microphone for them to use and they repeated information -successfully formed teams and kept the students engaged and participating	St. 19: Plus-lengthy, creative, lots of information Minus-wasn't as loud, could've used more facts about prairie restoration Learned-I can achieve anything and I need to talk loud and clear St. 21: Plus-long, creative and informational Minus-I didn't talk loud enough Learned-I don't talk as loud as I thought
Students 18: Prairie website	-Other students viewed the site and gave a thumbs up for the video on prairie dogs -Student shared with sixth grade teacher and teacher allowed him to share with students in science classroom.	-Student worked on project within and outside of the classroom -Facts and information provided about animals and plants of the prairie -Would've liked to see more information and more student work -Needed to site references better	St. 18: Plus-videos on prairie dogs Minus-too many pictures, maybe not enough information Learned-If I work hard I can get things done.

Table 7. Authentic Student Projects and Participant Reactions, Part 6

Students' Authentic Projects	Audience Reactions	Teacher Observations	Student Reflections
Students 22 & 24: Prairie poetry for outdoor classroom	-Sixth grade language arts teacher praised students for their poems and their connection to the theme. -The poetry was also approved by the students' classmates. -The students are still awaiting word from the Aldo Leopold Foundation on whether they can be included on the poetry rocks.	-Students continued to write and rewrite their poems to convey what they wanted to say. -Poetry captures the prairie environment and its importance. -Students moved beyond their academic strengths to experiment with creative poetry but were still focusing more on the facts as opposed to emotions and feeling. -Would've liked to see them contact the Aldo Leopold Foundation to make the poetry rocks a reality.	St. 22: Plus-get to put on the rocks and people can see my work Minus-I could've spent more time on the poems Learned-poems are hard and not easy for me St. 24: Plus-I made it creative because I decorated it with different materials. Minus-It was gluey. Learned-Poems aren't that hard to make.
Students 23, 26, & 27: Prairie website	-Another student from somewhere in the world wrote a comment to thank the students for the helpful information for his/her report for school -Other students commented positively on the site and its information	-Site covered a variety of topics but could've used more information. -The importance of prairie restoration was evident and contributed to the overall theme of the site. -The images used were helpful and supported the information given. -Incorporated concepts of people's adverse views to nature and how they can reconnect to nature.	Students completed reflection together: Pluses-The information on prairies and the importance of restoration. Minuses-We could have put in more facts and developed more pages about our own outdoor classroom. Learned-We could work together to create a website even though we had different ideas and preferences.

This was the first experience with Type III projects for these students. However; they showed task-commitment and engagement as they worked on a project of interest to them. Time was spent by all of the students outside of the classroom to work on the development, showing dedication and motivation to complete their objective. The students weren't just learning about leadership skills, but utilizing them as they made

important contacts and communicated with teachers, principals, and community members to establish their audience. I facilitated, providing helpful hints on communication with adults and consideration of their audience when preparing projects. Creativity was evident within the projects as most groups contained a mix of creative, high-potential and academically-gifted students. This mix appeared to help provide a balance of factual information and creative expression.

Pretest – Posttest Results Regarding Student Content Knowledge

Table 8 shows the pretest and posttest mean scores on the objective content test for the identified gifted students in comparison with the unidentified high potential students. The mean scores increased for both groups of students from the pretest to posttest.

Table 8. Identified Gifted Student and Non-identified High Potential Student Scores on Objective Content Test

Group	Points out of 23 Possible Points	
	Pretest Mean Score	Posttest Mean Score
Identified Gifted Students	1.31 (2.0)	8.63 (3.7)
Unidentified high potential Students	0.45 (0.8)	11.27 (3.3)

Note: Standard deviations are shown in parentheses

As indicated by the data in Table 6, the difference in student scores on the pretest was not significant; a t-test showed the posttest scores were significantly different ($p = 0.03$) with Cohen's d effect size of 0.76, a large effect size. This indicates that although students of the high potential group had not been identified as gifted, they were able to perform on this project at an academic level surpassing their identified gifted peers. Previous research has documented similar results with university students (Cropley & Urban, 2000, p. 485).

The lessons balanced academic and creative activities to provide varied learning opportunities for the students. Student choice appeared to be effective for motivating the students to complete the projects and explore the ideas presented. The creative, high-potential students were typically engaged in student choice activities that enabled them to utilize the information visually or through creative expression of ideas. Several of these students created cartoons for their newspaper piece, drew out the animals on their organizer, photographed and sketched the plants and insects in the outdoor classroom, and completed nature poetry. Some of the academically-gifted students struggled to provide a focus for their photographs, instead just pointing the camera and shooting without thinking of what they were trying to show. They also preferred to write out the information they learned and write articles giving facts.

The creative, high-potential students also provided a greater variety of responses when using the CoRT thinking skills. While determining Alternatives, Possibilities, and Choices (APC) for a newspaper piece; nine of the 15 (60%) sixth-grade responses, 15 of the 21 (71%) seventh-grade responses, and 12 of the 19 (63%) eighth grade responses came from creative, high-potential students. These students were also noting more unique features of the newspaper; coupons, lottery numbers, crosswords, for the record, and horoscopes. A similar trend occurred during the development of rules for the outdoor classroom. Seven of the eleven sixth-grade students (63%), five of the nine seventh-grade students (55%), and five of the eight eighth-grade students (62.5%) who provided suggestions were creative, high-potential students. Different ideas were given by these students; don't burn the plants, turn the flash off if you take pictures, and turn off electronics.

The other pretest and posttest given to the students prompted more open-ended responses to five questions, emphasizing the main topics discussed throughout the lessons. Tables 9 through 13 show the varied responses of the students.

Table 9 shows student responses that tell some of the major life accomplishments of Aldo Leopold. The pretest showed about eight different responses while the posttest contained fourteen different ideas. These results indicate the students increased their knowledge and awareness of Aldo Leopold, but there are still some misconceptions.

Table 9. Student Pretest and Posttest Responses to, "Tell major life accomplishments of Aldo Leopold."

Aldo Leopold's Accomplishment	Pretest Frequency	Posttest Frequency
Conservationist protecting nature, wildlife	18	11
Student said he/she had no knowledge	13	0
Killed a wolf	4	0
Author of Sand County Almanac	3	11
Went to college - Yale	1	1
Prairie restoration / protection/awareness	1	23
Has school buildings named for him	1	4
Forest ranger and environmentalist	1	4
Changed public opinion/awareness of the environment and animals	0	5
After killing a wolf, realized importance of wildlife and started preserving it rather than hunting.	0	5
Scholar and professor	0	2
From Burlington, Iowa	0	1
Built his house	0	1
Associated with Aldo Leopold Foundation	0	1

Lesson one introduced Aldo Leopold and the information was reinforced through the speaker from the Aldo Leopold Foundation, Steve Brower, but this information was not explored as in depth as the other topics. Most of the responses indicated on the posttest, related to information learned in the reading on Aldo Leopold and his life. Students were surprised to learn that he was from their hometown and that was one of the

reasons their school was named for him.

The pretest indicated thirteen students had no knowledge of Aldo Leopold and the posttest showed that all the students were able to give at least one response. Initially, students knew that their school was named Aldo Leopold and some knew he was an individual that had a connection to wolves, their mascot. During lesson one, students read two excerpts from the works of Aldo Leopold, "Killing the Wolf" and "Conservation." The posttest responses indicate that some students increased their understanding of the significance of the wolf by providing an explanation that the death of the wolf inspired him to start helping animals instead of hunting them, as opposed to the pretest response, "killed a wolf." A few students indicated information about him relating to his work as a scholar and forest ranger and more students mentioned he authored Sand County Almanac. Students had an opportunity to browse through the book and utilize it when working on the various prairie-related projects.

Eighteen responses associated Aldo Leopold with conservation of nature and wildlife during the pretest, but this number declined to eleven on the posttest. Students began to associate Aldo Leopold more with prairie restoration given our focus on the prairies and prairie restoration efforts as opposed to his forestry and wildlife conservation roots. The students appeared to make connections to their own lives as most of the students created a symbol incorporating the wolf and prairie grasses/flowers for their lesson one project. The creative, high-potential students drew more in-depth logos, integrating features of the prairie (tall grasses, flowers, insects, animals) and aspects of Aldo Leopold (wolf, conservation, the land).

Table 10 shows the frequency of different student responses in regards to animal,

plant, and soil interactions within the prairie environment.

Table 10. Student Pretest and Posttest Responses to, "List different interactions of animals with animals or plants/soil of the prairie environment."

Prairie Interactions	Pretest Frequency	Posttest Frequency
Animals mate, give birth, reproduce	9	9
Animals eat plants	9	15
Animals build or find shelters in the environment	9	0
Animals eat animals: predator and prey	7	17
Student has no knowledge	6	1
Animal droppings and carcasses enrich the soil	6	11
Specific animal eating specific plant	5	6
Organisms need water to live	4	1
Burrowing animals dig or use tunnels	4	10
Specific predator eating specific prey	3	7
Some animals damage parts of the environment	3	0
Organisms need food	3	0
Plants are pollinated and produce seeds	2	0
Humans hunt animals	2	1
Animals fight and protect their young	2	1
Organisms need air	1	0
Insects pollinate flowers and flowers provide nectar to insects	0	7
Animals make nests or homes in plants and trees	0	7
Plants get nutrients from the soil	0	5
All the organisms interact through a food chain to make the ecosystem	0	4
Animals are camouflaged or hide	0	3
Specific animal symbiotic interaction with another animal	0	2
Plants give off oxygen which animals breathe	0	2
Some animals like worms eat and process the soil	0	1
Balance between predator-prey populations	0	1

Specific animals and plants mentioned on the pretest were: buffalo, chipmunks, cows, coyotes, deer, ground hogs, mice, prairie dogs, rabbits, snakes, vultures, wolves, acorns, berries, and wild grass. Specific animals and plants mentioned on the posttest were: bees, buffalo, bugs, butterflies, coyote, deer, honey badger, honey guide bird, insects, mice, moles, rabbits, rat, garter snake, hawk, insect, snakes, spider, voles, grass, and flowers. Students named more specific animals on the posttest.

Students listed general relationships, such as animals eating plants and mating with each other, but the posttest indicated more interactions. Student responses referencing "burrowing animals dig or use tunnels" increased from pretest to posttest by a frequency of six. Small mammals of Iowa, including some burrowing animals, were studied during lessons five and six. The organizational chart enabled the students to sort and discriminate the defining characteristics of each animal as they matched the jointed animals. Lesson six focused on the trapping and management of small mammals and many students selected the mole, an animal noted for its digging. Students were asked to determine a possible compromise for humans and the animals after considering the pluses and minuses of the human-small mammal conflicts. The academically-gifted students were suggesting to have the mammals moved to a specific area where they could not bother humans and still have their home or to find a peaceful way to kill them. The creative, high-potential students didn't have many responses because they felt more time was needed to come up with a viable solution. They did not think it was right to move the animals or to kill them. These experiences exposed students to the concept of burrowing animals that some of them later referenced.

Similar to the objective pretest and posttest, only one student still indicated that he/she still had no knowledge to answer the question from the pretest. Nine responses were new from the pretest providing more descriptive interactions. Instead of "plants are pollinated and produce seeds" as indicated on the pretest, seven students referenced "insects pollinate flowers and flowers provide nectar to insects," showing a more in-depth understanding of the pollination process and its purpose. Additional responses also

showed learning; "plants give off oxygen which animals breathe," "animals are camouflaged or hide," and "plants get nutrients from the soil."

Table 11 shows student responses to why prairie restoration is important in the Midwest. All students had a posttest response and many acknowledged human roles.

Table 11. Student Pretest and Posttest Responses to, "Why is the restoration of the prairie important to the Midwest?"

Reason for Prairie Restoration	Pretest Frequency	Posttest Frequency
Humans ruined the prairie ecosystem and prairie animals/ wildlife need a habitat/place/ home to live	11	10
Student has no knowledge	6	0
It improves the soil.	3	0
Because prairie animals and plants are natural to the Midwest, but many are being lost.	2	6
For the beauty of the land.	1	1
Because of deforestation and urbanization.	1	0
If we do not save it, we will not have it or the animals that live in the prairie.	0	9
It shows Americans that our environment is important and the animals matter.	0	2
If we completely destroy our planet's prairie, our whole ecosystem will be messed up.	0	2

Students explored this topic within their newspaper piece. All of the students either referenced plants or animals and several of them that wrote articles mentioned facts about the loss of prairie over the years and the impact on plants and animals. The creative, high-potential students took their pieces further by either communicating a message or relating the information to their audience. Their comments showed more interest in how people perceive the prairie habitat and how the outdoor classroom would benefit the community. Student 09 commented; "There's a sidewalk for kids to get up close and personal with nature and bugs, but if you're scared, or don't like bugs, there's a wide sidewalk that's trimmed off but still close enough to view the nature." Student 23's

words; "Animals of all shapes and sizes can be harmed by the destruction of prairies and if they have nowhere else to go, they may go into people's lawns." This last quote was a great introduction into lesson six discussing human management of small mammals.

Student responses for outdoor classroom rules indicated their awareness of the importance of protecting the plants and animals within the prairie environment. A few of the rules related to classroom behaviors and littering, but the remaining rules focused on the plants and animals: don't pick the plants, respect the animals and plants, no running over plants, don't disturb area of animals, don't hurt animals, and respect animals' habitat. These same thoughts were reflected in their responses to the importance of the prairie to the Midwest, since four of the six responses on the posttest referenced animals. About 60 to 70 percent of the responses were suggested by creative, high-potential students.

The four students who created the play, incorporated student action by having the three young girl characters go home to research more about the animals and plants within the prairie environment to share with others why it was important that they make sure the prairie was not torn down to build a new Mini-Mart. This concept showed how the audience could take action themselves and why this topic was important. This same message was conveyed to the elementary students during the game show presentations. Students were asked to later explain what they learned about why the prairie was important to earn points for their team. The game show motivated the students to listen and learn more of the information.

Table 12. Student Pretest and Posttest Responses to, "Name prairie plants and tell a way each is adapted to living in the prairie."

Prairie Plant and Adaptation	Pretest Frequency	Posttest Frequency
Grass/prairie grass/ long grass	13	9
Flowers	10	1
Student has no knowledge	10	2
Weeds	4	0
Bushes/shrubs/brush/hedges	3	7
Trees	3	2
Long grasses – due to rain	1	0
Wheat	1	0
Prairie grass – grows fast and is hard to kill	1	0
cattails	1	1
Purple cone flowers	0	5
Big/little blue stem	0	4
Sunflower – grows tall to get a lot of sunlight	0	3
Sunflower – provides food for birds and animals	0	2
Sunflower	0	2
Indian grass – has a hard covering for protection	0	2
Black-eyed Susan	0	2
Royal catchfly	0	2
Bluebells and blue wildflowers	0	2
Black-eyed Susan are tall to keep seeds away from small animals	0	1
Flowering plants grow around the grasses and attract insects	0	1
Hedges – provide shelter for animals	0	1
Lily pads – provide resting places for frogs	0	1
Grasses – grow long to get more sun	0	1
Milkweed – attracts insects for animals to eat	0	1
Grasses – are eaten by animals	0	1
Grasses – have longer roots	0	1
Butterfly milkweed	0	1
Cardinal flower	0	1
Dandelions	0	1
Purple Prairie clover	0	1
Sideoats grama	0	1

The Aldo Leopold Foundation speaker, Steve Brower, discussed during lesson two, how children have a natural connection to nature and like to build tents and forts because they like the feeling of being enclosed within the environment. This information

reflected the work of Kirkby (1989) and Sobel (1999, in which they noted children build nest-like structures and Louv (2006) who worried children would develop Nature-Deficit Disorder if not exposed to nature (Wilson, n.d., p. 2-4). The tall grasses help create an enclosed location for animals and insects to hide, as some students noted on the posttest. Brower also referenced the relationship between insects and the flowers. Bees, for example cannot see the beautiful colors of the flowers and rely on the unique patterns and textures for identification. This specific idea was referenced in reflection of the speaker by two of the students and somewhat noted in the posttest, "flowering plants grow around the grasses and attract insects."

Similar to Aldo Leopold, we did not have an in-depth study of plants, but the posttest showed that fewer students felt they had no knowledge of the plants and there were twenty-two new responses given from the pretest. Lesson three engaged the students in photography of the flowers and plants around the outdoor prairie classroom, exposing them to the insects among the grasses and flowers and the unique features of these plants. The slideshow they evaluated and later shared with the guest photographer, Ed Minard, captured the various colors and textures of the plants in the prairie classroom environment. We also discussed how there are few trees within the prairie. The student who created the prairie model noted how he put too many trees within his model, acknowledging his error. Recently, the students played a writing game and one of the students drew a picture of a grassy area with the forest in the background. The students corrected each other on whether it was a prairie or forest, indicating some of them had transferred the knowledge and referencing what they had learned.

Students' authentic projects helped expose them to the plants in the prairie. Two

students' computer game project invited the player to earn points and money by destroying human-made items that destroy the prairie and then use the points/money to purchase new plants and grasses to plant in a prairie restoration area. The students included the plants found in the outdoor school prairie and looked up images to make them accurate for the game. Four other students worked together to create a display case for the outdoor prairie classroom. The students created boards documenting the plants with names and facts so the students will know what they may see while out in the prairie classroom. One of the students commented, "I wish that I would have drawn the pictures of the flowers instead of printing them out." She felt she could have been more engaged with their features if she would have drawn them herself.

Table 13 shows the results for the final task; "Name five small animals that live in the prairie ecosystem and for each explain two unique body adaptations for survival." Part 1 shows the frequency of animals mentioned without including body adaptations. Part 2 shows the animals and their descriptions given. Overall, more body adaptations and descriptions were given on the posttest from pretest, especially for the small mammals that were discussed within the unit.

Table 13. Student Pretest and Posttest Responses to, "Name five small animals that live

in the prairie ecosystem and for each explain two unique body adaptations for survival"
Part 1: Animals mentioned without body part or adaptation

Small Animals	Pretest Frequency	Posttest Frequency
Prairie dog	10	2
Birds	7	1
Field mice	4	1
Don't know/blank	4	2
Snake	4	3
Gopher	4	7
Moles	3	1
Deer	3	0
Insects	2	0
Vole/meadow vole	2	2
Bat-sonar/hearing	2	0
Ground squirrel/13-lined	2	4
Squirrel	1	2
Chipmunk	1	4
Owl	1	0
Woodchuck	1	0
Buffalo	1	0
Rabbit	1	5
Shrew	1	4
Ground hog	1	0
Total animals noted without body part adaptation	55	38

Table 13. Student Pretest and Posttest Responses to, "Name five small animals that live in the prairie ecosystem and for each explain two unique body adaptations for survival" Part 2: Animals mentioned with body part or adaptation

Small Animals	Pretest Frequency	Posttest Frequency
Prairie dog-digs tunnels underground to survive and escape, good ears, make noises, paws, nose	8	1
Moles-claws/shovel-like feet for digging underground to hide from enemies, good ears, make noises, paws, nose	5	7
Snakes-poisonous, venom, slither fast, no hands, camouflaged, different colors, sharp teeth, eat small mammals, low in grass, part of food chain, makes self look bigger, protective	3	12
Mice-hard to find/hide in tall grasses, teeth, nose, colors, short legs, small, fast	3	7
Rabbit-long, strong legs for jumping and running, big ears, paws to dig, big teeth, small	3	6
Bat-nocturnal, flying mammal, die if awaken during sleep	3	0
Chipmunk-cheek pouches/holds food in cheeks, climbs trees, claws, striped, big teeth, eats berries, nuts, fast runner, very small	2	13
Foxes-legs, senses, long tail to help be a fast runner, colored to hide	2	4
Garter snake-hard to catch, fangs, small, hides, or sneaks up on prey	2	3
Hawk-perch in trees, eat mice, flies, top of food chain	2	2
Wolves-legs, ears	2	0
Squirrels-hibernation, cheeks to store food, claws for climbing, big teeth, long tail for balance, hide in dark places	1	6
Gophers-underground resources, fast, digger to build safe home	1	2
Owl-nocturnal	1	0
Skunk-sprays scent/scent glands for protection and to warn predators, stripes, does whatever it wants	0	10
Grasshopper mouse-longer tail than body, runs away fast, small, greenish a to hide, strong legs for jumping	0	7
Deer-use horns for protection, fast, bigger than others	0	4
Bog lemming	0	3
Thirteen-lined-Ground Squirrel-stores food, pouches, body fat	0	3
Birds-fly, find resources from plants	0	2
Butterfly-small, flying	0	2
Vole-digs to live underground	0	1
Spiders-build webs for homes to catch animals	0	1
Badger-take trees and make dens in rivers	0	1
Total Statements	38	97

Students listed a variety of animals that do live within the prairie environment. Some of the students did not read the directions carefully and wrote down larger animals and just gave descriptions without focusing specifically on body features. There is insight into what the students think they know about some of the animals and it appears that there are still some misconceptions, such as grasshopper mice do not jump and their tail is shorter than their body. Students may have confused what they know about grasshoppers with grasshopper mice. Badgers were never discussed, but students have been very curious about them given a recent Youtube video about a honey badger. However, there were more descriptions of animals present on the posttest showing the students had learned more information from the pretest.

Most of the students did not know what a bog lemming was at the start of the unit but three students acknowledged it as a prairie animal on the posttest. The prairie dog was not referenced as much on the posttest. Initially, students wrote down the animal that had the word prairie within its name, but the prairie dog was not discussed as much this unit, so they opted to focus on other animals.

The ending activity for lesson five was an animal guide for animals that might be viewed out in the outdoor prairie classroom. We discussed a variety of animals, large and small, including deer and coyotes because they already roam the forests behind the school and have been seen crossing the street in front of the school. Skunks were mentioned on the posttest, probably because the students have seen them around the grounds outside school and they could possibly visit our outdoor prairie classroom. All the students typed their animal guide, but some of the creative, high-potential students chose to incorporate more images that might evoke different emotions. They wanted to let the viewer know

that if threatened, the animals may respond in a certain way. One of the creative, high-potential students used personality and voice within her writing to discuss skunks; "This beautiful creature is actually feared for the stench that its scent glands can let out to protect it. But following this guide will help you know all there is to know about skunks and how to keep them from spraying you!" The academically-gifted students produced animal guides with pictures and straight-forward facts as opposed to incorporating emotional interaction with the reader.

The variety in animals that may be present within our outdoor prairie classroom will vary from the actual prairie, which probably explains the responses on the posttest.

Changes in Student Attitudes toward Animals

Table 14 shows students' rating of 17 animals from pretest to posttest. When considering pretest to posttest results for both groups of students combined, there were statistically significant differences for only three animals. Paired t-test results indicated that students liked the already popular dog even more from pretest to posttest with a medium effect size (Cohen's d = 0.41); improved their appreciation for moles with a small effect size (Cohen's d = 0.32); but decreased their liking of chipmunks with a small effect size (Cohen's d = 0.33).

Table 14. Pretest-Posttest Animal Ratings Made by Student Groups

Animal	Pretest Mean Rating			Posttest Mean Rating		
	Identified Gifted Students	Non-Identified High Potential Students	Both Groups Combined	Identified Gifted Students	Non-Identified High Potential Students	Both Groups Combined
Dog	8.69 (1.8)	8.91 (1.8)	8.78 (1.8)	9.25 (1.4)	9.64 (0.9)	9.41 (1.2)
Chipmunk	8.06 (3.0)	6.36 (1.4)	7.63 (2.5)	7.19 (2.6)	7.00 (1.7)	6.85 (2.2)
Rabbit	8.00 (2.1)	6.73 (1.6)	7.48 (2.0)	7.63 (1.8)	7.00 (1.6)	7.37 (1.7)
Hamster	7.19 (2.9)	6.45 (2.5)	6.89 (2.7)	7.19 (2.6)	6.64 (2.9)	6.96 (2.7)
Thirteen-lined ground squirrel	7.06 (2.8)	5.45 (2.7)	6.41 (2.8)	6.88 (2.4)	5.91 (2.9)	6.48 (2.6)
Woodchuck	6.69 (2.1)	4.64 (3.3)	5.85 (2.8)	6.25 (1.5)	3.91 (3.1)	5.30 (2.5)
Bog Lemming	6.19 (3.4)	3.91 (1.9)	5.26 (3.1)	4.07 (2.5)	4.18 (2.9)	4.12 (2.6)
Cat	6.06 (2.5)	6.64 (2.5)	6.30 (2.4)	6.81 (2.9)	6.82 (2.8)	6.81 (2.8)
Gopher	5.75 (2.9)	5.55 (2.3)	5.67 (2.6)	5.75 (2.3)	4.36 (1.9)	5.19 (2.2)
Garter snake	5.63 (2.5)	5.18 (3.4)	5.44 (2.8)	5.19 (2.6)	5.27 (2.8)	5.22 (2.7)
Deer mouse	5.44 (3.2)	4.64 (2.0)	5.11 (2.7)	5.25 (2.0)	4.45 (2.7)	4.93 (2.3)
Bat	5.06 (2.8)	3.91 (1.6)	4.59 (2.4)	4.25 (2.7)	4.36 (1.9)	4.30 (2.4)
Grasshopper mouse	4.94 (2.5)	3.27 (1.9)	4.26 (2.4)	5.00 (2.6)	3.82 (2.8)	4.52 (2.7)
Shrew	4.44 (2.3)	3.09 (2.1)	3.89 (2.3)	4.38 (2.6)	3.55 (2.2)	4.04 (2.4)
Meadow vole	4.06 (2.5)	3.27 (1.5)	3.74 (2.2)	4.06 (2.1)	3.36 (2.2)	3.78 (2.1)
Mole	3.63 (1.9)	2.73 (1.6)	3.26 (1.8)	3.94 (1.9)	3.73 (1.8)	3.85 (1.9)
Skunk	3.31 (2.7)	1.64 (1.2)	2.63 (2.3)	4.06 (2.7)	2.36 (2.0)	3.37 (2.6)
Mean Rating for All Animals	5.89 (1.5)	4.88 (1.0)	5.48 (1.4)	5.70 (1.0)	5.04 (1.4)	5/43 (1.2)

Several students were unaware of some of the prairie animals listed on the animal rating pretest. "What is a shrew?" "I've never heard of a meadow vole before." Others had heard of some of the animals but were making judgments based on cuteness or opinions of others. "Aw, chipmunks are so cute. Isn't there a new Alvin and the Chipmunks movie coming out soon?" "Yes, Alvin is so cute." "Moles are so bad - they tear up our yard and my mom tries to get rid of them."

Lesson five enabled the students to observe and learn more about small mammals native to Iowa and the prairie through the matching of jointed animals. Three students labeled the Eastern Chipmunk as "cute, chubby cheeks" on their chart but the other students listed specific details such as rodent, small ground squirrel, internal cheek pouches, and up to eleven inches long. These descriptors are realistic and explain the reason for the chubby cheeks, perhaps dismissing the "cute" preference. The same students who thought chipmunks were cute listed the Eastern Mole as "gross." However in comparison with the Eastern Chipmunk, the other students listed more specific attributes, such as large, shovel-shaped front feet, saliva paralyzes worms, and eyes hidden by skin flaps.

Posttest results show that students were more aware of the mole and chipmunks on the rating scale and could make more informed judgments. Many students selected to read about the trapping and management of moles during lesson six and started to change their opinions of moles. "I just thought moles were a nuisance, I hadn't realized they helped the ground." Analysis of the objective content posttest showed that all but three of the students were able to identify at least one positive aspect and negative aspect of a mole, indicating a broader perspective from the pretest in which only three students could answer the question. On the posttest, all but six of the students were able to identify features of the Eastern Chipmunk. The students indicated it was a rodent, perhaps associating it with other rodents, like mice, impacting their favorability for the animal.

Changes in Student Attitudes toward Prairies

Table 15 shows student responses about prairies and the animals that inhabit them.

Table 15. Pretest- Posttest Results of All Students' General Attitudes toward Prairie Ecosystems

Statement	Pretest	Posttest	Pretest to Posttest Trend	p from T-Test	Cohen's d Effect Size
1. People should set traps, poison, or shoot to kill ground squirrels, voles, shrews, gophers, moles, and other creatures that are digging holes or tunnels on their property.	2.04 (1.1)	2.11 (1.15)	No change	Not a significant difference	-
2. Prairies are basically overgrown weed fields that are not much use to anyone. It would be better to do something else with the land.	2.00 (1.0)	1.67 (0.7)	Stronger disagreement	0.03	0.39 Medium
3. Prairies do not support the rich level of animal life that a forest supports.	2.33 (0.8)	2.00 (0.8)	Stronger disagreement	0.05	0.40 Medium
4. Squirrels are a nuisance trying to get into bird feeders, so it's okay to shoot them with a BB gun or run them over with a vehicle if they are in the street.	2.15 (1.4)	1.81 (1.0)	Stronger disagreement	0.05	0.28 Small
5. It would be better to have landscaped bushes, trees, and mowed grass in front of our school than prairie plants.	3.00 (1.0)	2.33 (0.7)	From Neutral to Disagreement	0.002	0.77 Large
7. Prairies should only be restored out in the open country and not within a town or city.	3.37 (1.1)	2.78 (1.0)	From Agreement to Disagreement	0.01	0.56 Medium
8. Little animals like mice, moles, voles, shrews, gophers and ground squirrels are not as important as larger wild animals; we don't really need them and would be much better off without them.	1.81 (0.8)	1.83 (0.6)	No change	Not a significant difference	-
6. It is important to keep/restore a variety of habitats/ natural environments for various animals and plants in Iowa, even when we don't use, enjoy, or regularly see the plants or animals.	4.19 (0.7)	4.30 (0.5)	No change	Not a significant difference	-
9. Prairie restoration at a school can inspire leadership and create a sense of community.	3.56 (0.9)	3.74 (1.0)	No change	Not a significant difference	-
10. Prairie grasses are better than mowed lawn grasses for the environment.	3.15 (0.9)	3.28 (0.7)	No change	Not a significant difference	-

Note: Standard deviations are shown in parentheses

The significant differences in responses for numbers three, five, and seven relate to specific issues the students addressed at the onset of the unit. The outdoor prairie classroom project began two months before the unit started. Students' initial comments

reflected opinions of parents and other adults. "My parents think this prairie project is a disaster and is going to make our new school look so ugly with all of those tall grasses." "My mom thinks this is a bad idea since we have a new building and the landscaping already looks nice." Others had opinions of their own; "I think we are going to ruin the look of our new school." "Why don't they put a prairie out in the country?"

The authentic projects the students completed reflected the prairie as an ecosystem and the importance of preservation. Lesson one introduced the students to Aldo Leopold. Many students, especially the incoming sixth graders did not realize he was a person. In lesson two, the creator of the outdoor prairie classroom and member of the local Aldo Leopold Foundation visited the classroom to share his experiences with nature and the purpose for the outdoor prairie classroom. Some students staggered into the classroom not excited for the speaker but upon leaving there were more positive responses. "I learned that we have a natural preference to be enclosed and connected to nature but we are often not given experiences to be in nature and continue to respect it as we get older." "I like how he discussed his experiences with nature and what got him motivated to help children reconnect with nature." "I respect that he has a lot of passion for his job and nature."

Students demonstrated their understanding of the importance and impact on plants and animals when prairies are saved and restored as opposed to destroyed through their choice of newspaper piece creations. Students who struggle to express their ideas in paragraphs of text combined their drawing skills with text to create cartoons. One high-potential, creative student, Peter, drew six scenes depicting the conversation of two boys, where one is bothered by insects and animals in the prairie and the other corrects him for

using the wrong names and getting so upset. The final box shows a prairie dog named Perry, reminiscent of Smokey the Bear, saying, "Only you can affect the prairie life which brings animals to help in our ecosystem; so save don't pave!"..."Oh, talking squirrel." "Prairie dog!" Peter's explanation for his cartoon, "Remember when that guy came and spoke to us about people not being around nature enough and being scared? I wanted to show that idea and let people know that the animals help the prairie ecosystem." (interview, 2011) Other students wrote informational pieces or editorials commenting on the loss of the prairie and the impact on the animals and plants native to this ecosystem.

Photography and sketching of the outdoor prairie classroom enabled the students to observe the varied plant and insect life present in this ecosystem. A local nature photographer spoke to the students about photographic techniques and modeled with his own photographs. Students went out to the prairie and began to take pictures from different angles and viewpoints. What does the New England aster flower look like looking upward from the ground as an ant? Jeffrey, an eighth-grade student with strength in mathematics, was engaged for 40 minutes moving around the prairie taking pictures of the flowers. His photographs of a close-up of a grasshopper sitting in a group of Heather aster flowers and a ladybug in flight from a blade of grass were evaluated positively for content. Five students sat down and sketched individual flowers, capturing the detail of each petal, seed, and stem feature. Students saw the interaction of these insects with the plants through the photographs and their sketches.

Poetry can capture meaning and emotions of nature and the students' poems mirrored these characteristics. Initially, many of the students were not receptive to

reading nature poems and exploring with their own expressive language. We looked at haikus and free verse. One student remarked, "Poetry is hard and boring." However, a few creative, high-potential students moved to an isolated section of the room and began to write. As some of the other students observed them, they were inspired to begin writing. Presley, a high-potential, creative sixth grader wrote the following poem to convey her understanding of a prairie:

I am a prairie

And I'm full of flowers and grasses

But I'm not concrete

Or buildings

I like the deer that visit my tasteful grasses

And all the busy bees that visit my beautiful colors

But I don't like the bulldozers that destroy me

Or the cities that bury my remains

I feel like I'm all alone

But I don't feel like I'm going to be here much longer

Her words show the concept of the loss of prairie and rich diversity of the prairie ecosystem without paragraphs of text.

The significant difference for number four on the animal rating scale relates to the bulletin board the students created in the classroom to have students share their opinions and ideas on the trapping and killing of small mammals. The students posted the question: "Do you think it is ok to kill small animals that are considered a nuisance in our yards and neighborhoods?" Students wrote responses and attached them to the board.

Some students even began pinning pictures and articles related to the question on the board. The students realized that they needed to have a justification for their answers and discussion often ensued. By the end of the unit, there were only two slips of paper left out of the twenty that were in favor of killing the animals.

Chapter 5: Conclusions and Recommendation

Summary of Results

The assessments and student products indicate student learning of the prairie ecosystem and the purpose of prairie preservation. The content knowledge test showed the creative, high-potential students outperformed their academically-gifted classmates.

- Student choice within a balance of content and creative learning activities engaged the students in completing projects that interested and motivated them.

- Overall, more content knowledge was evident on the posttests, especially concerning plants and animals, topics covered throughout the unit.

- Posttest responses indicated students gained an understanding of the importance of the prairie habitat to the animals and plants and conveyed these ideas through other products, such as the news pieces and their authentic projects.

- Speakers modeled authentic presentation skills while sharing information and skills related to content and creative topics that students were able to utilize when creating their authentic projects.

- The creative, high-potential students contributed more, varied responses during the CoRT Thinking Skill activities.

- The creative, high-potential students incorporated more creative strengths and connections to their personal lives within their products.

- The Type III projects prompted leadership and responsible behaviors to plan and implement contact with an authentic audience.

- Student comments and teacher observation further supported the level of engagement with the topic for creative, high-potential students.

Conclusion and Recommendation

The findings of this study supported previous research that justifies the inclusion of creative, high-potential students in gifted and talented programming. Traditionally, gifted programs have served academically advanced students, but today we realize that students with creativity and high-potential sometimes outperform intellectual peers and show more achievement in future accomplishments. Their talents can enable them to move beyond the facts to process the information and express their learning with more creative details and personal associations.

Future research should explore this topic within a longer time period and have students engaged in Type III projects of greater depth. It would be interesting to see differences in student projects and work if they were each able to study a topic of interest to them. I noted how students were engaged when they had choice, so it would be interesting to expand this topic to have students complete a project of their choice and compare the students' results. Renzulli (2011) noted that task-commitment and creativity is a part of identification for gifted behavior, so it would be interesting to further explore the academically-gifted for additional traits beyond academic strengths (p. 61).

Results showed the creative, high-potential students outperformed their academically-gifted peers, but there were fewer participants than originally intended and timing was difficult to follow. More subjects within each group could help emphasize the comparisons between these students, so next time I would make sure to incorporate more subjects from both groups to provide a broader perspective. Schedule changes prompted changes in lesson delivery and time was drawn out further than expected, perhaps contributing to misconceptions and information forgotten from the beginning lessons. If I

were to redo this study, I would make sure that the students met with me more often in order to complete the lessons in a timelier manner and have more time for the students to engage in more in-depth Type III projects. I was also surprised to learn that students weren't invited to participate in the creation of the outdoor classroom as I had originally interpreted, so next time I would make sure the foundation knew that students were interested in getting more involved.

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