MIDDLE SCHOOL STUDENTS' PERCEPTIONS OF OUTDOOR CLASSROOMS FOR SCIENCE LEARNING

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The undersigned, appointed by the dean of the Graduate School,
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presented by Victoria Burnett, a candidate for the degree of Master of Science,
and hereby certify that, in their opinion, it is worthy of acceptance.

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DEDICATION

To my Heavenly Father, all glory and honor for finishing this thesis and

To my parents, Cary and Tisha Burnett, for their continuous love and support

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

COVER LETTER

This cover letter outlines the work put forth during my graduate program with Columbia Public Schools (CPS) and their innovative science initiatives. My original research, starting Fall 2019, was to explore the impact of the newly implemented place-based science education at Fairview Elementary School through a student questionnaire, teacher interviews and environmental educator interviews. Due to the impact of the COVID-19 pandemic, my original plan and data collection could not be completed. I pivoted my thesis project to analyze previously collected student surveys pertaining to science outdoor classrooms from one CPS middle school; the thesis manuscript outlines the analysis for the middle school student surveys completed Fall 2020- Fall 2021.

Multiple resources were created from Fall 2019- Spring 2020 for the original thesis project that could be valuable for future research to explore the impact of place-based education. Appendix 4 is a student survey created for fifth grade students at the place-based elementary school. This survey can assess student attitudes towards science lessons, attitudes towards components of place-based lessons including learning outdoors, hands-on lessons, learning about local environments and connection to the community, a modified connection to nature index, and student sense of place in the community. This survey was pilot tested with one fifth grade class. Appendix 5 is an interview guide for place-based teachers and science department faculty to better understand the benefits and challenges of transitioning a school to place-based education. This interview guide was pilot tested with two CPS science coordinators. Appendix 6 is an interview guide for environmental educators to better understand community partnerships with schools when implementing place-based lessons.

ABSTRACT

Outdoor classrooms can positively influence students' outdoor experiences and increase awareness of native habitats through experiential learning and small-scale habitat restoration. To better understand student perspectives of outdoor classrooms and native gardens, we surveyed 86 suburban sixth grade students during their science class. Students were asked to (1) draw and explain a picture of their ideal outdoor classroom, (2) choose ideal outdoor classroom elements from photo depictions, and (3) answer quantitative Likert scale and multiple-choice questions to understand their support of the outdoor classroom. The questionnaires were administered immediately before a 2-hour lesson about outdoor classroom design and native prairie plants to get a baseline understanding of student perceptions. Qualitative content analysis was used to interpret and sort student drawings into a typology matrix along with quantitative analysis of the frequency of individual elements drawn.

Results showed suburban middle school students prefer a mixed-natural outdoor classroom with learning interactions such as wildlife observation, gardening and fishing. Students usually preferred three elements in their ideal outdoor classroom: a seating area, a garden, and a water feature. Students demonstrated a high level of support for outdoor classrooms. Findings from my study showed outdoor classrooms can be an instructional tool for implementing experiential science learning.

INTRODUCTION

Background

Time spent in nature is important for youth development, but time spent outdoors is becoming increasingly rare (Louv, 2008). The average time U.S. children spend outdoors has decreased in the past 40 years (Hofferth, 2009; Juster, Ono, & Stafford, 2004; McFarland, Zajicek, & Waliczek, 2014). Estimations of this decrease show children in the 1980s spent on average 6.5 hours/ week outdoors (Juster et al., 2004) and about 4.2 hours/ week outdoors in the late 1990s (Hofferth, 2009) to somewhere between 4 to 2.9 hours/week outdoors in 2003 (Hofferth, 2009; Juster et al., 2004). At the same time, U.S. public schools have seen an increase in curriculum standardization and testing pressure, which can limit the amount of time students spend outdoors during school hours (Chawla, 2007, 2015; Gruenewald, 2003; Smith, 2002). This is particularly challenging for middle and high school students with limited physical activity breaks during a standard school day (Katzmarzyk et al., 2018). Students with access to more green spaces within their schoolyards have shown multifaceted benefits including improved physical health, improved cognitive functioning, improved psychological benefits (Chawla, 2015), as well as a greater connection to nature (Cheng & Monroe, 2012; Ernst & Theimer, 2011). One type of outdoor green space that can be beneficial for getting children outside and be used by schools is an outdoor classroom.

Outdoor classrooms are designated spaces outside used for teaching multidisciplinary curriculum (Goff, 2018; Rios & Brewer, 2014). Outdoor classrooms can be diverse based on the size of the schoolyard and funding limitations; these areas could include elements such as a garden, restored native habitat, a gathering area for

classes or natural play elements (Goff, 2018; Moore, 2014; Rios & Brewer, 2014). These learning areas incorporate the natural surroundings into the lesson through experiential learning or place-based learning (Jose, Patrick, & Moseley, 2017). The science or environmental education lessons taught in the outdoor classroom have been shown to increase environmental knowledge (Largo-Wight et al., 2018; Stevenson, Peterson, Bondell, Mertig, & Moore, 2014). Ecological restoration projects within the outdoor classroom, such as building a garden with native vegetation, can be used within science lessons and help benefit local wildlife (Hall & Bauer-Armstrong, 2010; Hansen & Sandberg, 2020).

Previous research has documented the benefits of outdoor classrooms, but there are numerous challenges in implementing efficacious outdoor classrooms including: synchronization with existing curriculum and standards, time constraints (Carrier, Tugurian, & Thomson, 2013), additional teacher training, adequate funding, parental support, and backing from the school administration (Meighan & Rubenstein, 2018). Although there are challenges, a number of U.S. public schools have successfully built and utilized curriculum within an outdoor classroom (Dennis Jr, Kiewra, & Wells, 2019; Eick, 2012; Guardino, Hall, Largo-Wight, & Hubbuch, 2019); however, research assessment has been limited to focusing on outputs of the outdoor classroom.

The Dimensions Education Research Foundation has calculated that approximately 450 outdoor classrooms have been certified through the Nature Explore program at schools and other childhood centered institutions such as museums and nature centers (Dennis Jr et al., 2019). As the data is limited, it is believed more outdoor classrooms are being used in U.S. public schools that have not been certified. Research

has more widely documented the growth of schoolyard gardens, which have increased in U.S. public elementary schools by 19% from 2006 to 2014 (Turner, Eliason, Sandoval, & Chaloupka, 2016). Organizations such as the Nature Explore Program (Dennis Jr et al., 2019), Earth Partnerships for Schools (Hall & Bauer-Armstrong, 2010), Children and Nature Network (Stevenson et al., 2020) and the National Wildlife Foundation Schoolyard Habitats Program (Derr & Rigolon, 2016) are partnering with schools to build outdoor classrooms. The Schoolyard Habitats Program and Earth Partnerships for Schools specifically encourage the creation of native habitat restoration and native gardens to benefit wildlife and add to science curriculum.

Not only can an outdoor classroom be beneficial for classrooms after adoption, but during the planning and design. Some schools have developed programs where students help design and create their school's outdoor greenspaces, giving them a greater sense of responsibility and respect for the outdoor classroom (Hall & Bauer-Armstrong, 2010; Moore, 2014).

One local middle school located with Columbia Public Schools wanted to build an outdoor classroom with native habitat to incorporate into their science lessons. As science teachers and community environmental education partners began planning this outdoor classroom, they wanted to better understand what students wanted in their outdoor classroom and to have the student participate in the design. What elements and activities did students envision in this space? This study had suburban middle school students design their own outdoor classroom and learn about the benefits of native habitat restoration to incorporate the students in the creation of the outdoor space.

Outdoor Classrooms- Columbia Public Schools

Columbia Public Schools (CPS) located in Missouri, U.S. has increased emphasis on science teaching with a focus on place-based education opportunities and outdoor classroom learning. Students have opportunities for weeklong place-based field trips in the summer to the Teton Science School in Wyoming, U.S. that have been offered for 10 years. The school district has hosted the Teton Science School in 2019 and 2021 to train elementary teachers on interdisciplinary place-based education. Four of the 32 Columbia Public Schools have become specialized in science, technology, engineering, art, and math (STEAM), place-based education or agricultural science. Some of the other sustainable science initiatives seen within the district include: native plant gardens, food audits and composting, energy audits, raising chickens and honeybees. The two CPS science coordinators have a continuing effort to put a place-based playground in all 21 elementary schools that can be used for interdisciplinary lessons incorporating science and math. During 2021, the school district was developing a nature school for use by all district schools designed for week-long immersive field trips. These initiatives demonstrate the high priority the CPS district places on experiential learning and outdoor science opportunities.

LITERATURE REVIEW

Children and Time Spent Outdoors

Youth today are spending increasingly less time outdoors (Chawla, 2015; Hofferth, 2009; Louv, 2008; Soga & Gaston, 2016). During 1997 to 2003, the amount of time children ages 6-12 spent outdoors decreased from 36 minutes/ day to 25 minutes/ day (Hofferth, 2009). In Texas, parents reported children 3-5 years of age spent around

30- 60 minutes a day outside while at home (McFarland et al., 2014). On the higher end of estimating time spent outdoors, it was found about 62% of children between six to 15 years old spent about two hours outside daily in the U.S. from 2007-2009 (Larson, Green, & Cordell, 2011). Louv (2008) famously has called this decrease in time children spend outdoors "nature deficit disorder."

Researchers have found multiple reasons why children are spending less time outdoors. Some reasons why children today are spending less time outdoors include: decreased proximity to natural areas (Soga & Gaston, 2016), interest in other indoor activities such as watching TV or time spent using technology (Juster et al., 2004), increased time studying (Hofferth, 2009), lack of transportation to natural areas and safety concerns (Larson et al., 2011). The amount of time children spend outside has been correlated to the parents' attitudes towards nature (McFarland et al., 2014).

The declining trend of children spending less time outdoors corresponds to decline in benefits of spending time outdoors. Chawla (2015) provides many benefits of children who have access to nature, a few of which include overall cognitive and emotional development, health benefits such as increased vitamin D, physical activity, creative social play and exploration, better motor development. Other benefits that have been researched include increased connection to nature (Ernst & Theimer, 2011) and later increased likelihood for pro-environmental behaviors (Chawla, 2007; Hughes, Richardson, & Lumber, 2018).

Public schools are one place where students could have time built into the day to get outside. A major component of getting outside, physical activity, is currently not being prioritized in schools. In the U.S, 65% of school districts require regularly

scheduled recess as a time for students to get outside (Katzmarzyk et al., 2018); however, middle and high school students do not have recess during the day. Only 8% of U.S. middle schools and 2% of high schools provide regular physical activity breaks during the school day (Katzmarzyk et al., 2018). Most of the school day for public school students in middle and high schools involves sedentary classroom learning excluding physical education classes.

Learning Methods and Environmental Literacy

Standardized curriculum and increased importance of standardized testing limits time students can spend outdoors. Standardization in U.S. schools began in the 1990s and reached a peak with the No Child Left Behind Act of 2001 (Gruenewald, 2003). Since then, U.S. classrooms have felt pressure to focus on standardized test grades with standardized curriculum focusing on reading and math (Carrier et al., 2013; Gruenewald, 2003; Smith, 2002; Stevenson, Carrier, & Peterson, 2014). A lack of time allocated for science instruction, lack of resources and lack of administration support have also been cited as reasons students do not go outdoors for science lessons (Carrier et al., 2013; Hansen & Sandberg, 2020; Jose et al., 2017; Stevenson et al., 2014).

On the other hand, individuals have been pushing to include environmental education and outdoor education into schools. National reforms have promoted the addition of environmental education in curriculum. In 1990, the U.S. Environmental Protection Agency created the National Environmental Education Act which increased environmental education into mandatory school curriculum (Meighan & Rubenstein, 2018). In 2015, Every Student Succeeds Act passed by President Obama included awarding grants to states to create and use environmental education standards to increase

environmental literacy and promote field-based learning (*Every Student Succeeds Act*). As of 2015, there has been a shift to emphasize science, technology, engineering, and math (STEM) education in U.S. public schools (Meighan & Rubenstein, 2018).

Alternative methods of learning, such experiential learning or place-based learning, provide a way to incorporate environmental education and outdoor learning into public schools. This subsequently can impact student environmental literacy. Experiential learning, a learning theory built upon by educators like Dewey, focuses on hands-on, real life experiences that prepares students for life after school (Palmberg & Kuru, 2000; Smith, 2002). Experiential learning theory suggests "learning occurs when students use hands-on, task-oriented activities and relate previous knowledge in a contextual way to real life examples" (Jose et al., 2017, p. 271; Wenger, 2009). Kolb (1984) outlined specific characteristics of experiential learning which include: learning as a continuous process, grounded in experience, involving transactions between the person and the environment which in turn creates knowledge (p. 26- 34, 37). Outdoor lessons that incorporate the schoolyard create an opportunity to fulfill characteristics of experiential learning with transactions between the student and the environment (Jose et al., 2017; Palmberg & Kuru, 2000).

Place-based education, an alternative method of learning, incorporates components of experiential learning. Place-based education is a learning process that connects students to their local community and environment through interdisciplinary lessons that focus on hands-on, relevant projects (Sobel, 2004). The basis of place-based education is place as lessons are formed around local history and local environment. Place-based education can be taught indoors or outdoors, but usually has some

component of education outside of the classroom (Smith, 2002). Students form experiences through real-world problem solving, internships, field trips or through lessons similar to a nature study (Smith, 2002; Sobel, 2004). Place-based education and experiential learning can be implemented in outdoor classrooms as they are interdisciplinary in nature, hands-on and focus on the environment that is present near the school.

Both experiential learning and place-based learning can impact student environmental literacy. Environmental literacy includes "ecological knowledge, environmental attitudes, problem solving and critical thinking skills and pro-environmental behavior" (Hollweg et al., 2011; Stevenson et al., 2014, p. 1). Hands-on education in outdoor schoolyard has been found to increase environmental literacy and environmental learning in students (Largo-Wight et al., 2018; Malone & Tranter, 2003; Stevenson et al., 2013). Time spent outdoors during lessons was one of the most significant predictors of environmental knowledge, affect and behavior in one study looking at middle school students (Stevenson et al., 2013).

Loss of Native Habitat and Schoolyard Habitat Restoration

The Midwest is experiencing a loss of native grassland habitat and native pollinators; however, schools could be one potential location of native habitat restoration through schoolyard restoration projects. Broadly, in North America there has been a steep decline in native grasslands which provides habitat for native pollinating insects and birds. About 99% of tall grass prairie has been removed from the North American Midwest landscape and is being used as agricultural or developed land (Anderson, 2006).

Creation of small native gardens can help native pollinators and aid in science lessons. It has been found that even small native pollinator gardens located in urban areas can positively benefit the abundance and diversity of native pollinators (Ahrne, Bengtsson, & Elmqvist, 2009). Within communities, multiple patches of diverse native gardens can positively impact invertebrates and pollinators (Goddard, Dougill, & Benton, 2010). Native gardens at public schools have the potential to aid in the connectivity of established wildlife gardens in the community. There is a need to redesign schoolyards to increase greenspaces as most schools yards have become a "monoculture of mowed grasses" and asphalt for students (Moore, 2014, p. 41). Students with a standard schoolyard of asphalt, monoculture lawn and a few trees have shown desire for more green space (Christidou, Tsevreni, Epitropou, & Kittas, 2013).

There are initiatives in the United States to create more green spaces in public schoolyards. The Children and Nature Network located in the U.S. have a goal of creating a green schoolyard in public schools in every community by 2050 (Stevenson et al., 2020). Other programs that help bring native green spaces to schoolyards include the Schoolyard Habitats program from the National Wildlife Foundation (Derr & Rigolon, 2016). In Missouri, the Missouri Environmental Education Association gives mini grants to schools for environmental education projects, including the creation of native plant gardens (Missouri Environmental Education Association, 2021). The redesign of schoolyards to include natural elements such as native trees and plants has the potential to help native wildlife and create an opportunity for students to experience nature at their schools.

There is a potential for students to be involved in the restoration of native habitats within their schoolyard through ecological restoration education. The concept of ecological restoration education is to involve students in hands-on native habitat restoration projects as part of curriculum; students gain increasing environmental literacy by learning about the role of humans in affecting the environment positively and negatively (Hansen & Sandberg, 2020). In the U.S., Earth Partnership for Schools collaborates with schools to create native habitat restoration projects in the schoolyard. As of 2010, Earth Partnership for Schools had completed native planting projects in 400 schools (Hall & Bauer-Armstrong, 2010). This organization has students and schools help to design the restoration as a part of the curriculum.

There are benefits to increasing green space in schoolyards. Studies have shown that green spaces in schools aid in student social development (Dennis Jr et al., 2019), encourage on-task behavior with less redirections, enhance reading comprehension and increase environmental ethic and knowledge (Largo-Wight et al., 2018). A majority of studies within a systematic review of schoolyard greening showed increased physical activity, better attention restoration and increased mental well-being in students (Bikomeye, Balza, & Beyer, 2021). Schoolyard greening in public schools can improve equitable access to nature not only for the students, but the community (Stevenson et al., 2020).

Outdoor Classrooms

Outdoor classrooms combine a way for children to spend more time outside, experience hands-on science lessons and increase native habitat and green space in the schoolyard. Outdoor classrooms are a type of dedicated green space in the schoolyard, or

neighboring area, used for multidisciplinary learning (Goff, 2018; Rios & Brewer, 2014). It is important to distinguish an outdoor classroom from a green schoolyard as the purpose of the space is to integrate school lessons with outdoor experiences (Guardino et al., 2019). Programs such as the Nature Explore Program in the U.S. educate teachers, provide outdoor classroom creation consultations and certify outdoor classrooms based in schools, libraries, museums and nature centers (Dennis Jr et al., 2019).

Some teachers have experienced success in teaching science through experiential learning and use of outdoor classrooms. Eick (2012) researched one third grade classroom that successfully incorporated hands-on science and literacy learning in an outdoor classroom. Results showed that 15 out of 16 students who used the outdoor classroom met the annual yearly progress needed in science and literacy testing.

Guardino et al. (2019) spent six weeks observing students and teachers who learned in both an indoor classroom and newly constructed outdoor classroom. When surveyed, the two teachers reported they enjoyed teaching in the outdoor classroom and found it usually worthwhile and beneficial. When teachers were comparing student interactions in the indoor and outdoor classroom, they reported that student interaction between peers and student learning was “somewhat better” to “no different.” When students were interviewed about their perceptions of the outdoor classroom, eight out of 12 students preferred to learn in the outdoor classroom (Guardino et al., 2019).

Research has shown the support and benefits of utilizing outdoor classrooms, but there are challenges. The main challenges with maintaining or creating outdoor classrooms include: limited time, transportation if the outdoor classroom is not in the schoolyard, teacher ability and comfort teaching outdoors, limited funding, unpredictable

weather and safety concerns (Ernst, 2014; Meighan & Rubenstein, 2018) changes in district budgets, priority of standardized state testing and no support from the district (Goff, 2018). A review of outdoor classroom literature found that the most successful outdoor classrooms were: financially self-sufficient and supported from a broad range of partnerships and stakeholders (Dennis Jr, Wells, & Bishop, 2014; Meighan & Rubenstein, 2018; Sharpe & Breunig, 2009). Goff (2018) found that outdoor classrooms that had continual use were maintained by teachers who had a passion for teaching environmental literacy. These classrooms are designed to serve the purposes of the school, teachers and students and are maintainable by the school and partners (Largo-Wight et al., 2018).

These diverse spaces could include outdoor gardens, native plants and trees, vegetable gardens, nature inspired play equipment, animal feeding stations, seating areas, walkways, natural structures, meadows, woodlands, ponds, exploratory natural environments, gathering areas and signs (Goff, 2018; Moore, 2014; Rios & Brewer, 2014). The best designs of outdoor classrooms include: multiple choices, children-sized spaces, pathways and boarders and flexible spaces (Dennis Jr et al., 2014). In some cases, having less rigid design for an outdoor classroom can be beneficial. Tranter and Malone (2004) found that more unstructured areas, such as a forest edge or garden bed, was the best for environmental learning as the environment was more flexible for children to explore.

Children Participatory Design and Evaluating Drawings

Researchers can better understand what students want in an outdoor classroom and include them in the placemaking process through evaluating student drawings.

Researchers Kevin Lynch and Roger Hart were at the forefront of child participatory design in the 1970s as they wanted to better understand how children use spaces (Derr, Chawla & Mintzer, 2018, p.7). Placemaking is defined as the "participatory act of imaging and creating places with other people" (Derr et al., 2018, p. 2). Students can partner with adult planners in this placemaking process to design inventive, sustainable, and inclusive spaces whether it be a small-scale outdoor classroom or large-scale urban planning projects. Children have a unique perspective that should be contributed to the design process (Moore, 2014). Young adults have been incorporated in city planning through the organization Growing Up Boulder located in Colorado, U.S. where students have participated in city planning meetings. Once skeptical City of Boulder staff now advocate for students to be a part of the design process due to the young adults' thoughtful input regarding city design, policies, and education (Derr et al., 2018, p. 9-10).

Students who participate in placemaking have shown greater respect for the space and feel a sense of responsibility over the space (Moore, 2014). Participatory design aids in student overall development, critical thinking, communication skills and practical reasoning (Chawla, 2015; Christidou et al., 2013). Children helping with space design can also create a stronger sense of community and strengthen place attachment (Derr & Rigolon, 2016).

Multiple methods can be used to allow for children participatory design including observations, mapping, drawing, photography, interviews, questionnaires, focus groups and the use of GIS design (Derr et al., 2018, p. 7). Moore (2014) suggested using student drawings or 3-D models for students to help communicate design ideas. Previous research has used drawing tasks with children to better understand their perceptions of

nature (Aaron, 2009; Li, 2015) the environment (Alerby, 2000; Shepardson, Wee, Priddy, & Harbor, 2007), perceptions on climate change (Hestness, McGinnis, & Breslyn, 2019), and perceptions of schoolyards (Cronin-Jones, 2005; Tranter & Malone, 2004). Drawings allow students a symbolic language (Alerby, 2000) to communicate their thinking when words alone cannot explain their thoughts. However, a drawing with written or verbal explanation has been emphasized in research as the best method to help in drawing interpretation and analysis as it allows the child to clarify their conceptions in the drawing (Li, 2015; Rennie & Jarvis, 1995; Shepardson et al., 2007).

Literature shows both quantitative and qualitative methods for analyzing student drawings. Cronin-Jones (2005) deductively analyzed student drawings of outdoor classrooms by creating a quantitative scoring rubric with seven criteria. The scoring focused on the accuracy and completeness of the drawing compared to the actual outdoor habitat. The drawings were rated by three researchers and inferential statistics were done to look at the reliability of the ratings. The quantitative rubric was found successful, and it was noted that drawings with the rubric could be used to evaluate changes in student environmental knowledge before and after exposure to a schoolyard habitat.

Christidou et al. (2013) analyzed the frequency of items children drew of their schoolyard to explore what elements were considered most important or prevalent by students; these drawings were analyzed along with student interviews and observational mapping. The degree of elements in each drawing differed and some elements were deemed more dominant by the increased frequency and relative size the element took up in the drawing. For example, in this study the basketball court and football field appeared

the most frequently and were sometimes drawn in a larger in proportion to other elements (Christidou et al., 2013).

Shepardson et al. (2007) inductively analyzed student drawings of their mental models of the environment. Students were asked to draw a picture of the environment and explain their drawing followed by a photo depiction task that asked students to indicate which photos depict the environment and to explain their responses (Shepardson et al., 2007). Researchers then reviewed and coded drawings and pictures into four mental models of the environment that emerged from the data. Researchers looked at which mental model was most prevalent and compared the mental models across grade levels and community setting.

Significance of Study

This study assesses suburban middle school student perceptions of an ideal outdoor classroom and native gardens through use of drawings, photo depictions and quantitative Likert questions. This study was designed to evaluate the needs for an outdoor classroom at one local middle school. Results can help inform the design and implementation of not only this outdoor classroom, but future outdoor classrooms within the CPS district. The results may be of interest to school districts, school faculty and community environmental educators who are in the beginning stages of outdoor classroom planning. The themes emerged through the student designs provide insight into the types of science activities and science learning preferred by middle school students in the space.

The research adds to growing literature studying the importance of including students in participatory design of their own outdoor spaces (Chawla, 2015; Derr et al.,

2018). The methods of this study can be used by other public-school teachers or community environmental educators who desire student input on outdoor classroom creation through student drawings and questionnaires. The methods for student drawing analysis are unique to this study with the creation of a typology table to analyze student outdoor classrooms and participatory design; this method for analysis of student drawings could be of interest in future research studies.

This study specifically looks at middle school student participation in designing outdoor classrooms, as many studies have focused on early-childhood and elementary school students and teachers (Eick, 2012; Goff, 2018; Guardino et al., 2019). The potential positive implications from this study would support and inform outdoor classroom creation, schoolyard habitat restoration and integrating outdoor learning into public school science lessons.

Research Objectives

This study assessed the needs and perceptions of suburban middle school students before the creation of an outdoor classroom. Based on this opportunity, the three driving research questions for this study include:

1. What themes emerge from suburban middle school students' drawings of ideal outdoor classroom?
2. What elements make up the ideal outdoor classroom for suburban middle school students?
3. To what extent do students support the creation of an outdoor classroom?

METHODS

Location and Participants

This study occurred at Gentry Middle School located within CPS in Columbia, Missouri, USA. Students at this school are mostly white (73%) with 21% of students eligible for free or reduced lunches (U.S. Department of Education, 2021). Gentry Middle School was not a designated science specialized school by CPS district but did have teacher and administration support for an outdoor classroom. During 2018-2019, science teachers at Gentry Middle School began planning an outdoor classroom by collaborating with environmental educators in the community from organizations such as the University of Missouri- School of Natural Resources and the City of Columbia Office of Sustainability. To enhance the outdoor learning experience, students were asked to participate in the design by contributing drawings of their ideal outdoor classroom. A purposive sample of 86 sixth graders voluntarily completed the questionnaire in the Spring of 2019 during their science class (Table 1). These students were chosen to participate as their science teacher, the main proponent for the outdoor classroom, desired to incorporate the learning exercise lesson in their science class and receive student feedback for the outdoor classroom. This sample made up about 33% of the total population of sixth grade students at the school.

Learning Exercise

As a part of the learning exercise, the 86 participating students received a two-hour lesson from their science teacher on the decline of native Missouri prairies and pollinator habitats. Material for the lesson was developed by the Community Conservationist at the City of Columbia who is experienced with designing outdoor

classrooms and native gardens. Instructional materials included a PowerPoint presentation about decline in pollinators, importance of native Missouri wildlife and plants for ecosystem health and how to design an outdoor classroom (Appendix 1). The learning exercise included a classroom discussion about choosing native plants and sketching different sections of the outdoor classroom. The final product of the lesson included a classroom-designed outdoor classroom.

We used a questionnaire to better understand student perspectives of outdoor classrooms and use of native prairie plants in the classroom before the learning exercise. Administering the questionnaire immediately before the lesson allowed researchers to better understand the baseline knowledge and support students had for outdoor classrooms and native gardens. The questionnaire was reviewed by Gentry Middle School science teachers to help ensure it was age appropriate. Approval was obtained from the University of Missouri Institutional Review Board; the project was deemed exempt as it was a needs assessment evaluation. Verbal consent was requested before administering the surveys and students were informed participation was voluntary. The questionnaires were administered immediately before the learning exercise lesson and responses were recorded on student iPads. Collected questionnaires were safely secured on password protected computers.

Survey Instrument

A survey questionnaire was developed by the community environmental educator partners on this project to best understand student perceptions of outdoor classrooms. This questionnaire consisted of four sections: the outdoor classroom design, attitude toward outdoor classrooms and use of native plants, knowledge about native plants and

prairie ecosystems and demographic information (Appendix 2). Only the outdoor classroom design and attitude towards the outdoor classroom will be addressed in this paper. Questionnaire section 1 helped answer Research Question 1: what themes emerge from suburban middle school students' drawings of ideal outdoor classrooms and Research Question 2: what elements make up the ideal outdoor classroom for suburban middle school students? This exercise involved three tasks: drawing a picture of an ideal outdoor classroom with explanation of important components, photo depiction demonstrating three elements of successful outdoor classrooms (Figure 1) and five Likert scale questions rating the importance of five outdoor classroom benefits (e.g "habitat for wildlife and biological diversity"; Appendix 2, Section 1).

Questionnaire section 2 helped to answer Research Question 3: do students support the creation of an outdoor classroom? This section used three five-point Likert Scale questions look at student attitudes towards the creation of the outdoor classroom (Appendix 2, Section 2 Statements A, B and C). Students were asked from one (strongly disagree) to five (strongly agree) how much they agreed with statements (e.g. "In general, I am motivated to build an outdoor classroom with my science class"). When looking at internal reliability of three statements for the attitude towards outdoor classroom the Cronbach alpha score was low ($\alpha = 0.54$).

Data Analysis – Outdoor Classroom Design

Data analysis was done in two sections: analysis of the drawings with explanation and quantitative analysis of the Likert scale questions. Content analysis was used to qualitatively analyze student drawings and explanations. Analysis was inductive to allow themes to emerge from the drawings (Shepardson et al., 2007) instead of having a pre-

determined list of themes for deductive analysis (Cronin-Jones, 2005; Li, 2015; Moseley, Desjean-Perrotta, & Utley, 2010). A similar procedure outlined in Creswell and Poth (2018, p. 264-266) was used ensure intercoder reliability. Three researchers, the main researcher and two undergraduate mentees, reviewed student drawings and explanations together to get familiar with that data. Three researchers were used to increase consistency with drawing interpretation and increase reliability through investigator triangulation (Shepardson et al., 2007). Two major themes that emerged from the drawings were highlighted, this created categories for a typology table to better classify the data. The researchers developed and shared initial definitions for the table and sorted the first third of drawings with the initial typology matrix. Definitions for each of the categories were agreed upon by the researchers. The typology matrix was adjusted to include another category after review of the data and assessing intercoder agreement with sorting to better encompass the data. The researchers independently sorted all drawings into the finalized typology matrix; a final meeting compared the individual tables and conferred any drawings that were sorted differently. A total of five meetings were held to discuss sorting decisions, assess intercoder agreement and discuss themes that emerged from the drawings for each researcher.

The two overarching themes that emerged from the data were the amount of nature depicted and the differing learning interactions depicted. The researchers were curious about the overlap of the amount of nature drawn in the outdoor classroom and the amount of science interaction the students wanted to do in the environment. Although other themes did emerge from the drawings, it was decided to focus on how much nature

was incorporated in the drawing and type of learning interaction with the environment as the two variables for a typology matrix to better categorize the data.

For nature depicted in the outdoor classroom, drawings were sorted based on whether the drawing and description depicted mostly (over 50%) human/built environment, a mixed environment with roughly 50% built and 50% nature or mostly (over 50%) natural elements to the outdoor classroom (Table 2). Examples of a human/built feature would include: shelter houses, tables, benches, amphitheaters and birdhouses. Examples of natural features would include: plants, grass, animals and ponds. This helped the researchers sort which types of items were most desired in the outdoor classroom and why.

For the type of learning interaction with the environment, the researchers focused more on the descriptions of the drawings to better understand specific tasks the students wanted to do in the outdoor classroom. Drawings were sorted into specific learning interaction category if a specific activity incorporating the environment was listed, examples included nature observations, fishing, gardening, or eating snacks from the garden (Table 2). Drawings were sorted into general learning interactions if a general activity was described but did not include a specific activity incorporating the outdoor classroom environment, examples included general reading or writing. Drawings were sorted into no learning interaction if the description did not describe any learning activity or interaction with the environment. This sorting helped the researchers better understand how much the students thought of the outdoor classroom as an extension of their science classroom learning, the type of science learning they pictured doing in the outdoor classroom and discover alternative purposes for outdoor classrooms.

The frequency of items in each drawing and written description was analyzed by doing a presence count for items drawn in student drawings (Aaron, 2009; Christidou et al., 2013). After reviewing the data and results, some items were grouped together that served a similar purpose. For example, all streams, ponds and other water bodies were sorted under the same "water features" category. Some items found in one drawing do have multiple counts, such as a drawing that included both a garden with flowers and a garden with produce were both counted under "gardens." This helped the researcher to understand what elements of the outdoor classroom design were thought of as the most ideal for students.

Questionnaire section 1 included the photo depictions task. To analyze the photo depictions task, the frequency of photos chosen was calculated and recorded using Microsoft Excel. Results from the photo depiction task were compared to results from the draw and explain task to provide data triangulation to increase credibility (Creswell & Poth, 2018, p. 256).

Data Analysis – Attitudes Towards the Outdoor Classroom

Likert Scale quantitative questionnaire results were coded using a coding manual created by the researcher. These data were coded with help from an undergraduate researcher. Student names were removed from data and given a lettered pseudonym to protect child identities. Results were analyzed using IBM SPSS, Version 27. Descriptive analysis was completed to look at the mean and standard deviation to better understand student support of the outdoor classroom.

RESULTS

I obtained 78 questionnaires before the learning exercise from participating students. From those, only 73 of questionnaires could be analyzed as some students did not complete the questionnaire or files received could not be opened with the saved formatting.

The Outdoor Classroom Design

My final analysis of the 73 outdoor classroom drawings resulted in a 3x3 typology matrix bounded by the amount of nature depicted and the type of learning depicted (Table 3). It is important to disclaim that the sorting typology matrix is only "an attempt to characterize different conceptualizations students hold" about outdoor classrooms and to summarize general themes seen in the drawings by the researchers (Shepardson, 2007, p. 342); there is not one typology that is superior to another. The most common typology drawn was the mixed classroom with a specific learning interaction (20 out of 73 drawings or 27% of all typologies). The two most frequently drawn outdoor classrooms depicted a mixture nature classroom (57%) or a specific learning interaction (41%). The least frequently drawn outdoor classroom categories included general learning (21%) and human/built (20%).

Figure 2 depicts the differences in the amount of nature emphasized in the outdoor classroom. Drawing 2A shows the human/built emphasized outdoor classroom; more than half of the classroom was a built structure with the concrete shelter house, tables and chairs. The only natural element referenced would be the aquatic animals used for observation. Drawing 2B depicts both built structures through the stage, seats and path; some natural items depicted include the trees and pond with fish as well as a garden

with was seen by researchers as both a human built and natural item. As both human/built and natural items represent about half of the area, the drawing was sored as a mixed outdoor classroom. Drawing 2C depicts a tree and a pond with no human built items, over half of the outdoor classroom depicted shows nature and was sorted into the nature category. It is important to note within a real habitat restoration, the pond and trees would most likely be manipulated by humans; but for the sake of sorting items features such as a pond or tree emphasized a natural outdoor classroom.

Figure 3 shows the three different types of learning interactions seen in student drawings. When sorting the learning interactions, the researchers focused on the drawing as the explanation allowed the students to explain the purpose of items drawn in relationship to the type of science learning they wanted to pursue in the outdoor classroom. Drawing 3A was sorted as a specific learning interaction with the drawing explanation:

> We can plant fruits, vegetables, flowers and watch them grow. Then off to the left we can have an observing table… if we are learning about wild life we could put maybe like a frog or something in the observing table and we can learn about that…Just hands on learning. (Figure 3A)

The specific learning includes the action of planting, observing the growth of the plants and observing wildlife found in the outdoor classroom. The student stated specific activities related to science that can be done interacting with the outdoor classroom habitat.

Drawing 3B depicted a general learning interaction as the students talks about having tables as a place to “write and read” but does not state a specific science topic being learned or does not connect the writing and reading to a part of the outdoor classroom habitat. It is unclear what type of learning is being done in this outdoor classroom, but the student does state intent to use the outdoor classroom for learning through writing and reading. The most common types of general learning stated among students included writing or reading without a subject listed.

Drawing 3C depicted no learning interaction. The explanation of the drawing described what the elements were in the drawing but did not include how the students would interact with the outdoor classroom. The researchers tried to limit assumption of the drawings by relying on the direct text. Even though a garden is mentioned, it does not say if the teacher or a maintenance person is the one gardening or if the students are gardening. In Drawing 3A, the student says “we” will garden collectively as a class; this gives specific ownership of care of the garden to the class.

A drawing of each of the nine typologies found in Table 3 along with an explanation for how the drawing was sorted is detailed below. Figure 2A shows one example of a human/built outdoor classroom with a written specific learning interaction. Built structures are strongly emphasized and make up over half of the drawing including the shelter house, tables, benches and bowls. This was coded as a specific learning interaction as the student talked about using aquatic animals for biology lessons in the drawing description. Out of the nine typologies, this typology was rarely drawn by students at 4% in the study.

Figure 2B shows a student drawing that was sorted as mixed natural environment and specific learning interaction. This drawing was coded as mixed as there were built structures such as the stage, benches and steppingstones but natural elements such as the trees and pond and the garden which is thought of as a combination of a natural and built structure. The description talked about both the built structures and natural elements. This drawing was coded as a specific learning interaction as the student talked about caring for the garden and observing wildlife in the pond and forest area. Out of the nine typologies, mixed nature and specific learning interaction had the greatest frequency of drawings making up 27% of drawings.

Figure 2C shows an example of a drawing coded as a nature and specific learning interaction. The drawing was sorted as a nature emphasized outdoor classroom as a nature setting of a tree with a pond with no man-made objects was depicted. For the specific learning interaction, the student talked about fishing from the pond and using those fish for an "ecologically" [ecology] lab. The action of fishing and the intent to incorporate wildlife from the outdoor classroom into a science lesson shows a specific interaction with the schoolyard habitat. An outdoor classroom emphasizing nature and a specific learning interaction was drawn 10% of the time.

Figure 4 shows an example of a drawing sorted into the human/built and general learning interaction typology. This drawing was sorted as human/built as the built structures of the swing, learning area and slide were emphasized in the picture and description with little natural elements besides the green ground. The drawing was sorted under general learning as the student described the learning area being a place with "tables for students to work" but did not specify the type of work being done or any

specific interaction with the outside environment while working. This drawing also has a larger emphasis on the outdoor classroom being an area for "fun" play with the swing and slide after school. Only 3% of students depicted the human/built and general learning typology.

Figure 3B was sorted into mixed outdoor classroom and general learning interaction with the outdoor habitat. The bridge and picnic tables represent built items, the gardens and campfire both represent elements that are a combination of natural and human-built and the water runoff represents a natural element. The researchers agreed that water represents a natural element even if it has been manipulated by humans. Because both human built and natural items were present, the drawing was sorted as mixed. This drawing was sorted into general learning as the picnic tables are used for "places to write and read" but the type of learning is not specified as science learning, nor is there a specific interaction with the environment described. The mixed and general learning interaction was depicted 14% of the time in this study.

Figure 5 illustrates a student drawing sorted into a nature outdoor classroom and general learning interaction. The drawing was coded as nature as over half of the drawing space depicts natural elements such as the prairie, green ground, and blue feature on the righthand side which could possibly be a water feature. The built shelter house takes up about a third of the drawing whereas the natural items take up over half of the space. The drawing was coded as a general learning interaction as the explanation describes using the space for "learning" but does not specify the type of learning or activities to be done in the space. Only 4% of drawings were sorted into nature and general learning interaction.

Figure 6 shows a student drawing sorted into Human/Built outdoor classroom and no learning interaction. This was sorted as human/built as the building with roof, tables and chairs and the “black board” were the most emphasized items in the drawing and the only nature items found are the single flowers. Within the drawing description the built items are emphasized as well with the roof for keeping students “dry and warm” and tables for sitting. This drawing was sorted as no learning interaction as the student does not describe any learning activities with the outdoor environment. Student drawings were sorted into the human/built and no learning interaction category 12% of the time for this study.

Figure 3C represents a student drawing coded as mixed and no learning interaction with the outdoor classroom. This drawing was coded as mixed as it contained a built structure with the ruff and tables underneath, a natural item with the pond and rocks and one mixed item being the garden. Neither built items nor the natural items were emphasized more in the space taken up in the drawing or the drawing description. The drawing was coded as no learning interaction as the explanation did not include any specific or general learning interaction with the environment, it only stated each part of the drawing. It is important to note that many drawings sorted in the mixed outdoor classroom category did include three elements seen in this drawing: a seating area, a water feature, and a garden. Student drawings were sorted into this typology 16% of the time.

Figure 7 shows a student drawing sorted in nature outdoor classroom and no learning interaction. Over half of the drawing emphasized natural elements such as the grass area and stream. The written description did emphasize the natural elements of the

birds, plants and stream. Built structures included the birdhouses and the bridge. The written description did not include a learning interaction with the environment. This student did note there was a desire for the outdoor classroom to be "peaceful" due to the natural elements of the birds, plants and stream. Student drawings were sorted into this typology 10% of the time.

To answer Research Question 2, presence counts for items drawn in student outdoor classroom designs to see what elements were frequently incorporated (Table 4). The most frequently drawn items included seating areas either on the ground, with benches or with chairs. Gardens were the next most frequently drawn items including edible food gardens, flower or pollinator gardens or unspecified gardens. Water features were the third most popular element which included all ponds, streams or unspecified bodies of water. The researcher noted that students or other humans were only incorporated into drawings six times which is further discussed in the discussion section. Other items counted less than five times were not included in Table 4, but 46 different items were counted in student drawings and explanations (Appendix 3).

To answer Research Question 2, the frequency of photos chosen in questionnaire Section 1.3 was calculated along with the percentage out of the total number of photos chosen (Table 5). Some students did not choose three photos as instructed, but all choices were included in the calculation. The photos were grouped into the same three categories as the drawing typology matrix: human/built, mixed and nature. The seating area for outdoor learning and a managed pool for wildlife observation were both chosen 26% of the time by students. A garden with edible vegetables and fruits was chosen 20% of the time. A restored prairie for birds and pollinators was chosen 12% of the time and area for

nature play 11%. A schoolyard garden with landscaping was the least preferred element of the outdoor classroom chosen only 5% of the time.

To better understand why certain elements were desired by students in the outdoor classroom, questionnaire Section 1.4 asked students to rank the benefits of having an outdoor classroom from a scale of one (not at all important) to four (very important). The mean and standard deviations were calculated (Table 6). Out of the five statements, space to learn science outside was the most important benefit of the outdoor classroom (M= 3.71, SD= .568) followed by habitat for wildlife and biological diversity (M= 3.42, SD= .768). The two benefits with the perceived lowest benefits on average were aesthetic view (M= 2.88, SD= .814) and space for unstructured play (M= 2.51, SD= .974).

Outdoor Classroom Support

Results answer Research Question 3 to explore student support of the outdoor classroom creation using three statements to measure student attitude and support for the outdoor classroom (Table 7). On a scale from one (strongly disagree) to five (strongly agree), students on average strongly agreed (M= 4.58, SD= .622) they were motivated to build an outdoor classroom. Students strongly agreed (M= 4.41, SD= .767) they were excited to apply scientific knowledge in the outdoor classroom. Students strongly agreed (M= 4.62, SD= .594) that the outdoor classroom would benefit local wildlife with food, water, cover and places. Overall, students' perception of the outdoor classroom was positive and showed a motivation to build an outdoor classroom in their schoolyard, even before the learning exercise lesson.

DISCUSSION

The Outdoor Classroom Design

My results showed students preferred elements of both a mixed-natural setting combined with specific outdoor learning activities. Looking at the student drawing typology matrix, the largest category of 27% of student drawings were sorted into the mixed nature and specific learning interaction category. When looking at the mixed nature setting, a large group of drawings included a variation of three elements: a seating area, a water feature, and a garden (e.g. Figures 2B, 3B and 3C). This was also confirmed looking at the frequency individual items appeared in student drawings as the three most frequently drawn items were a seating area, gardens and a water feature (Table 4). This was confirmed again by the photo depiction activity as both a "seating area for outdoor learning" and "a managed pool for wildlife observation" were chosen as elements desired by students the most frequently, followed by "a garden with edible vegetables and fruits" (Table 5). Students perceived the benefits of "habitat for wildlife and biological diversity," a "space to grow local food" and "a space to learn science outside" as important to very important in the outdoor classroom (Table 6). This might help us understand why natural areas such as a water feature, gardens and seating areas for science lessons were desired by students in their outdoor classroom design.

When looking at specific learning interactions with the outdoor classroom, students generally talked about the similar interactions of observation, gardening or fishing. Of the students sorted into specific learning interactions, 16 out of 30 described an observation activity with something found in the outdoor classroom. Students talked about observing wildlife in different habitats such as in the water, prairie, or forest areas.

One student described their outdoor classroom as “a good learning environment [where] we care for garden, observe wildlife in the pond and forest area and have lectures on the stage all while watching the wildlife around us” (Figure 3A).

Of the students sorted into specific learning interactions, 17 out of 30 students described specific learning with a garden. The purposes of having a garden included observing animal interactions with the garden, observing how plant roots grow, working together to maintain and grow the garden, generally learning about plants and being able to eat produce. Three students talked about interacting with the garden by eating the produce. One student saw the garden as an opportunity to better the community and described how produce could be donated “like the urban garden does” which is believed to be a reference to the Columbia Center for Urban Agriculture that donates food from a community garden. This student drew upon previous knowledge of other gardens to incorporate into their design and purpose of the outdoor classroom garden. When looking at specific learning interactions with the outdoor classroom, a handful of students described the actions of fishing or using aquatic animals for lessons in their outdoor classroom. Three students talked about fishing in a water body in the outdoor classroom; students talked about fishing as a part of an “ecology” lab (e.g. Figure 2C).

Some of the students described a desire for the outdoor classroom to be a space for more hands-on learning with less technology or without textbooks. One student described the outdoor classroom as a place to “interact with nature and observe… [which] also helps kids learn more hands on then just reading out of a textbook.” Another student also mentioned that observation in the outdoor classroom is helpful instead of just looking at pictures of plants and animals. The student drawing in Figure 3A describes using the

outdoor classroom to “explore things without textbooks or IPads.” Some students did voice a desire for the outdoor classroom to be a space to learn through experiencing the schoolyard habitat. These student desires support the implementation of more experiential or place-based learning in the outdoor classroom. This interaction with wildlife and habitat is what helps build a connection to nature and supports environmental learning (Cheng & Monroe, 2012; Largo-Wight et al., 2018; Malone & Tranter, 2003; Stevenson et al., 2013).

An additional theme noted by the researchers was the outdoor classroom being an area for playing and relaxation (e.g. Figures 3B and 4). Some of the students wanted a “play area for decompressing” or a “swing and the slide be[cause] you know the kids need to have fun after a long day or school from working their brain all day.” Five students depicted swings or hammocks for a play or relaxation element (e.g. Figure 4 and 9). Four students labeled a “play area” in their drawings. When looking at the Photo Depiction section, the photo of an “area for nature play” was chosen 11% of the time by students. Many students did not view the outdoor classroom as an area for unstructured play (Table 6). However, outdoor classrooms can be multifaceted. Some students also desired the outdoor classroom to have areas or elements for relaxation. One example in Figure 6, the drawing included a campfire for the purpose of “relaxing” in the outdoor classroom. The middle school students in this study no longer had access to a playground for recess that is provided to all elementary schools in CPS. Perhaps these students associated going outside with recess instead of formal learning if they had little prior experience with outdoor education. Guardino et al. (2019) noted in their study elementary school students used their outdoor classroom as a play area or reading area during recess

time. Having an area for play should be considered as an alternative purpose for outdoor classrooms.

Some students incorporated native plants or restored prairies into their outdoor classroom before the learning exercise. A total of 15 students drew a butterfly or native flower garden or prairie in their ideal outdoor classroom; seven students drew a restored prairie and eight drew a butterfly or native flower garden. When providing the explanation, some students talked about the prairie being a place for learning (e.g. Figure 5). Three students talked about the ability of native plants or "wild flowers" to attract pollinators and allow for observation. One student stated they would add pollinator plants to their outdoor classroom because "because there isn't enough that helps the butterflies, bees and pollinators" (e.g. Figure 9). Looking at the photo depiction responses, 12% of students thought that a "restored prairie for birds and pollinators" was an important element to an outdoor classroom. This might indicate that some students already had awareness of the benefits of restored prairies and planting native forbs before the classroom lesson on native plants.

Very few students included in their outdoor classroom design description the purpose of having areas for conserving wildlife. One student when referring to a water feature in their drawing said the class "could make sure the water by the bridge is good for wildlife to live there." Figure 9 describes having pollinator plants because it helps butterflies, bees and pollinators. However, when looking at the Likert responses on average students agreed to strongly agreed with the statement "I believe an outdoor classroom provides benefits for local wildlife with food, water, cover and places" (M = 4.62, SD= .594; Table 7). Students responded that "habitat for wildlife and biological

diversity" was a moderately to very important (*M*= 3.42, *SD*= .768) benefit of the outdoor classroom (Table 6). Students appear to have the knowledge that the outdoor classroom could benefit wildlife, but either could not or chose to not explain that in their drawings.

Another interesting observation made by the researchers of student drawings was the lack of people drawn. When asked to draw their ideal outdoor classroom, only six students included a human in their classroom design. Some of the students drew the teacher in the outdoor classroom (e.g. Figure 10) or one student. Only one drawing featured multiple people that could be interpreted as a class (e.g. Figure 8). Christidou et al. (2013) noted that students when asked to draw their own schoolyard rarely included children, concluding that students did not consider themselves an important element of the schoolyard. One potential reason for the lack of children in the drawings of the schoolyard could have been a lacking sense of place or connection to the schoolyard (Christidou et al., 2013; Tranter & Malone, 2004). Similarly, as these students were drawing a hypothetical outdoor classroom, they might have had trouble visualizing themselves in the space as there is no connection or sense of place. For future classes taught in the outdoor classroom, the lesson should try to incorporate that the students themselves are an important element of the outdoor classroom.

Overall, these students were able to aid in participatory research design by contributing to the outdoor classroom planning through the use of drawings and classroom discussion during the learning exercise (Derr et al., 2018; Derr & Rigolon, 2016; Moore, 2014). The elements that were most desired by the students outlined in the results and discussion should be strongly considered as elements for their future outdoor

classroom, or further education should go into why those elements might not be best suited for that space. Through this placemaking process the students can learn to think critically about the elements best suited for the space (Chawla, 2015).

This study utilized a typology matrix successfully to sort and inductively analyze student drawings. Shepardson et al. (2007) has a similar method for inductively analyzing student drawings of the environment, however; the typology matrix as a tool used to analyze outdoor classroom drawings or participatory design research has not been located in the literature. This tool should be considered when aiding in student participatory design to better understand the varying elements of the drawing.

Outdoor Classroom Support

To answer Research Question 3 student support for building the outdoor classroom, students appeared to support building the outdoor classroom and native gardens. Students agreed to strongly agreed that they were "motivated to build an outdoor classroom with their science class" (Table 7). Students were likely to very likely to "support building a prairie restoration" in the outdoor classroom (Table 9). Overall, students showed support for building an outdoor classroom even before the learning exercise.

LIMITATIONS AND FUTURE RESEARCH

The study was limited by the size and scope of data collection. For the quantitative portions of the survey, the smaller sample size could have impacted the validity of the results. The scope of data collection was limited in that only one school was able to be sampled, which could have impacted the generalizability of the

quantitative results. The demographic data of the children was uniform as most students identified themselves as non-Hispanic/ Latino (94%), white (73%) and suburban (71%). The smaller scope of this research could have impacted the qualitative drawings by having a limited diversity of students to sample. For example, Shepardson et al. (2007) was able to survey students from multiple grade levels, schools and multiple U.S. states which allowed for better analysis comparing the similarities and differences of drawings from diverse students. Future research should increase the sample size and scope of the research by surveying students from different grade levels, schools in the district, and geographic areas of the country interested in building an outdoor classroom.

Another limitation of the study was the potential impact of implicit researcher bias from inductive qualitative analysis of student drawings. The impact of bias was controlled as best as possible regarding the outdoor classroom design through researcher triangulation, data triangulation and relying on student descriptions of the drawings. However, the personal background of the researchers does impact interpretation of the drawings (Dentzau, 2011). Future research could incorporate a deductive formal grading rubric to limit researcher bias with interpretation.

Future research is needed to know the frequency and duration of learning exercises needed to impact student views on environmental literacy and knowledge concerning native habitat restoration. This study implemented one 2-hour lesson about outdoor classrooms and native habitat restoration, which is relatively short. When measuring change in environmental literacy, Stevenson et al. (2013) measured the difference between students after a semester of environmental education and lessons spent outdoors. Guardino et al. (2019) interviewed students after six weeks of use in their

new outdoor classroom to get their perspective compared to the traditional classroom. This could support the idea that multiple interventions in the outdoor classroom and habitat restoration would be needed to best understand student perceptions of the outdoor classroom and to measure a change in environmental knowledge. Future longitudinal research could have the students participate in multiple lessons in the outdoor classroom and measure the difference in environmental knowledge and attitudes towards the outdoor classroom.

Additional research for established outdoor classrooms could look at the type of curriculum used, the professional development needed for teachers and the types of partnerships needed to maintain the outdoor classroom. Challenges to creating and maintaining an outdoor classroom include having curriculum align with teaching standards (Carrier et al., 2013), teacher training (Meighan & Rubenstein, 2018) and support from administration (Goff, 2018; Meighan & Rubenstein, 2018). More environmental education curriculum is being created to align with Next Generation Science Standards, such as Project Learning Tree and Project Wet. Future research could assess the types of curricula that are best used in an outdoor classroom setting. As seen in this study, outdoor classroom curriculum should emphasize that the students are an important element in the outdoor classroom and emphasize classroom efforts can aid in habitat and wildlife conservation.

Further research could look at the types of teacher training, or professional development, used to help educate teachers about teaching in the outdoor classroom. Ernst (2014) found that early childhood teachers understood the importance of outdoor education, but certain barriers made the setting seem less feasible to use. Professional

development is one way to educate teachers about solutions to those perceived barriers. As stated, CPS has used the Teton Science School for professional development of place-based practices for science teachers. These professional development courses could educate on nature-based curriculum available and navigate perceived barriers with teaching outdoors, such as inclement weather.

Finally, future research could look at the types of partnerships needed to maintain an outdoor classroom. Research indicates that one barrier is lack of administrative support (Goff, 2018; Meighan & Rubenstein, 2018) or parental support (Meighan & Rubenstein, 2018). Guardino et al. (2019) cited parents of students helped in the creation of the school's outdoor classroom. Parent Teacher Association (PTA) support can be influential in the creation and maintenance of outdoor classrooms as well (Goff, 2018). Partners outside of the school are important to outdoor classrooms. In this study, both the University of Missouri School of Natural Resources and the City of Columbia supported the creation and design of the Gentry Middle School outdoor classroom. More research should be done on how these important partners are located and how the relationships are maintained.

CONCLUSION

There is a recent push in the U.S. for greening of schoolyards, as research has shown the benefits of time outdoors for students and classrooms. Schoolyards can be an important part of field-based formal learning (Malone & Tranter, 2003; Tranter & Malone, 2004). Schools, public and private, should be encouraged to build outdoor classrooms and implement them into their formal curriculum. Malone and Tranter (2003) found that regardless of the size of the schoolyard or financial resources of the school, "a

place for flower boxes, a small vegetable garden, a tree, or patch of grass" can all be incorporated into education (p. 124).

Based on this study, it is encouraged to have students aid in the design of their own outdoor classroom. Student participation in the design gives them a sense of responsibility over the area and stronger sense of classroom community (Derr & Rigolon, 2016; Moore, 2014). This participation can provide new insight into designing the space and incorporate students as an equal partner in the process. It would be recommended that students help in the building of the outdoor classroom and any habitat restoration projects (Hansen & Sandberg, 2020). It is suggested that outdoor classroom design implements native habitat, such as native prairie plant gardens, to benefit wildlife and science education. The construction of the native garden and the native garden itself can be incorporated into science curriculum (Hall & Bauer-Armstrong, 2010). Learning methods such as experiential learning can be utilized to help teach science and environmental education concepts while in the outdoor classroom. As in the case of this study and other research studies, community partners are beneficial in the design, construction, and maintenance of the outdoor classroom (Dennis Jr et al., 2014; Meighan & Rubenstein, 2018; Sharpe & Breunig, 2009). The creation of the outdoor classroom can be an experience to bring together community partners, parents, teachers and faculty.

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TABLES

Table 1

Self-reported Sociodemographic Characteristics of Participants

Baseline Characteristics	*N*	%
Gender		
Male	33	49
Female	31	46
Prefer to Not Say	3	5
Race		
American Indian or Alaskan Native	3	4
Asian or Pacific Islander	1	1
African American or Black	5	8
White	48	73
Two or More Races	7	11
Other	2	3
Ethnicity		
Hispanic/ Latino	4	6
Not Hispanic/Latino	60	94
Background		
Urban	11	18
Suburban	45	71
Rural	7	11

Note: n= 67 to 63 who completed the demographic section of the survey

Table 2

Definitions of Drawing Coding Typology Matrix

Outdoor Classroom Descriptions	Definitions
Amount of Nature	
Human/Built Environment	Drawing is mostly (over 50%) built structure, writing emphasizes built structure
Mixed Environment	Drawing is about half built structure and half nature, writing does not have obvious emphasis on human or nature
Nature Environment	Drawing is mostly (over 50%) nature with little human manipulation of the landscape, writing emphasizes nature
Type of Learning Interaction	
Specific Learning Interaction	Student uses written verbs or descriptions of drawing that talk about **specific** learning in the outdoor classroom about nature or science (ie. Gardening, specific nature observation, fishing)
General Learning Interaction	Student uses written verbs or descriptions of drawing that talk about **general** learning in the outdoor classroom (ie: reading in general, writing in general)
No Learning Interaction	Student has no written verbs or descriptions of drawing that talks about learning or interacting with the natural environment in outdoor classroom

Table 3

Drawing Coding Typology Matrix for Outdoor Classrooms (n=73)

Amount of Nature	Type of Learning Interaction			Total
	Specific Learning	General Learning	No Learning	
Human/Built	3	2	9	14 (19%)
Mixed	20	10	12	42 (57%)
Nature	7	3	7	17 (24%)
Total	30 (41%)	15 (21%)	28 (38%)	

Table 4

Frequency of Top 15 Drawn Items in Outdoor Classrooms (n=73)

Items in Free Drawings	Frequency
Seating Area (Benches/ Chairs)	49
Gardens (Unspecified, Produce and Flower)	47
Water Features (Pond/ Stream/ Water)	40
Shelter house (Pavilion/ Shed/ Ruff)	28
Trees/ Fruit Trees	23
Tables	23
Unspecified grass area	18
Stage/ Teaching area	17
Flowers- stray flowers, not grouped in a garden	16
Animals (Space for animals/ Wildlife/ Pollinators)	12
Bridge	12
Prairie	7
Path	7
Human	6
Birdfeeder/ Birdhouse	5

Table 5

Percentage of Responses to Photo Depictions

Category	Photo Depiction	*n*	%
Human/Built	Seating Area for Outdoor Learning	58	26
	A Schoolyard Garden with Landscaping	12	5
Mixed	Area for Nature Play	25	11
	A Garden with Edible Vegetables and Fruits	44	20
Nature	A Restored Prairie for Birds and Pollinators	27	12
	A Managed Pool for Wildlife Observation	58	26

Table 6

Descriptive Analysis Perceived Benefits of the Outdoor Classroom

Statement	*M*	*SD*	*n*
A. Habitat for wildlife and biological diversity	3.42	.768	71
B. Space to grow local food	3.08	.890	71
C. Space to learn science outside	3.71	.568	72
D. Aesthetic view	2.88	.814	69
E. Space for unstructured play	2.51	.974	70

Note: measured on 4-point Likert scale from 1 (not important at all) to 4 (very important)

Table 7

Descriptive Analysis Attitudes Toward the Outdoor Classroom

Statement	*M*	*SD*	*n*
A. In general, I am motivated to build an outdoor classroom with my science class	4.58	.622	72
B. I believe an outdoor classroom provides benefits for local wildlife with food, water, cover and places	4.62	.594	71
C. Building an outdoor classroom excites me because it allows me to apply scientific knowledge for a better place	4.41	.767	71

Note: measured on 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree)

FIGURES

Figure 1

Pictures of Elements in Ideal Outdoor Classroom

3. Select 3 elements from the following pictures that you think are the most important for an outdoor classroom.

☐ A seating area for outdoor learning

☐ A restored prairie for birds and pollinators

☐ A managed pond for wildlife observation

☐ An area for nature play

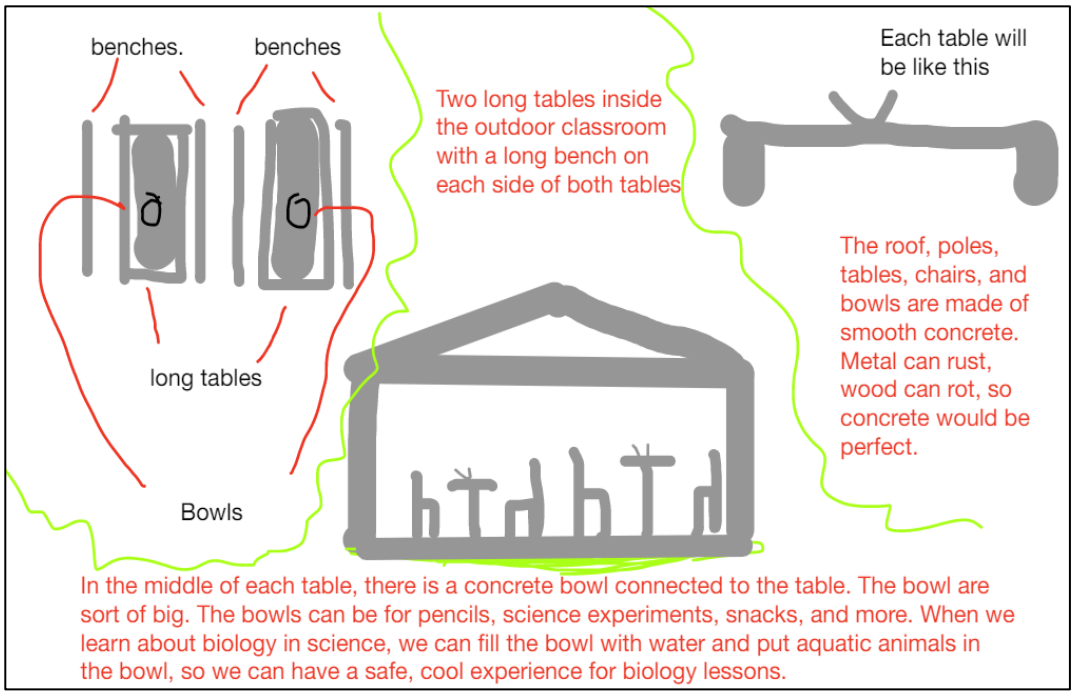
☐ A schoolyard garden with landscaping

☐ A garden with edible vegetables and fruits

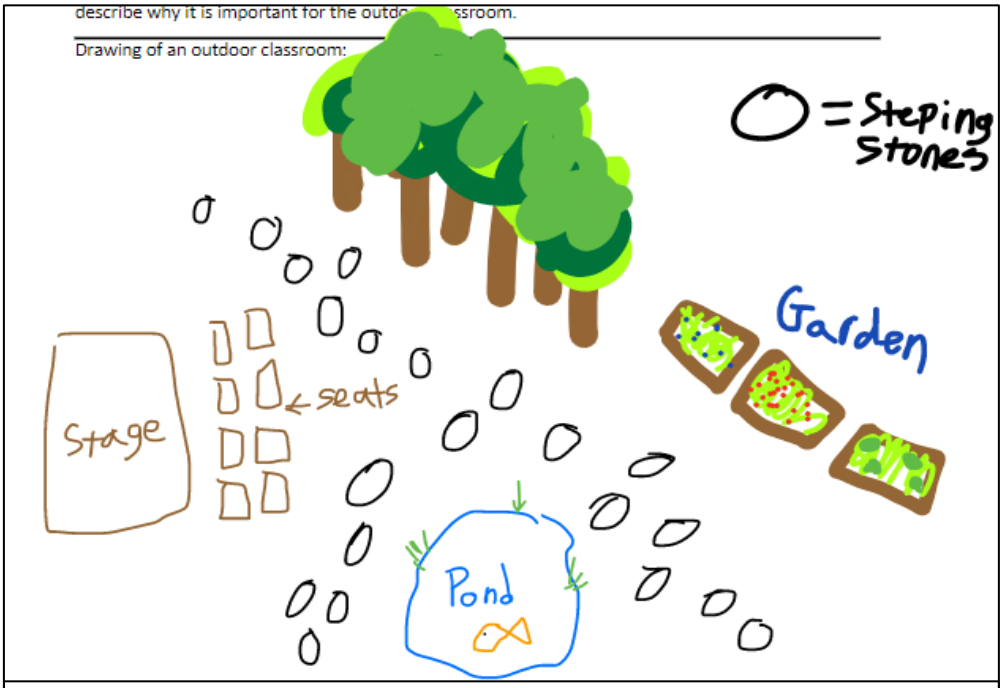
Figure 2

Student Drawings Comparing Amount of Nature Emphasized in Outdoor Classrooms

A



B



"I think the majority of this outdoor classroom would make a good learning environment. We could care for the garden, observe wildlife in the pond and forest area and have lectures on the stage, all while watching wildlife around us."

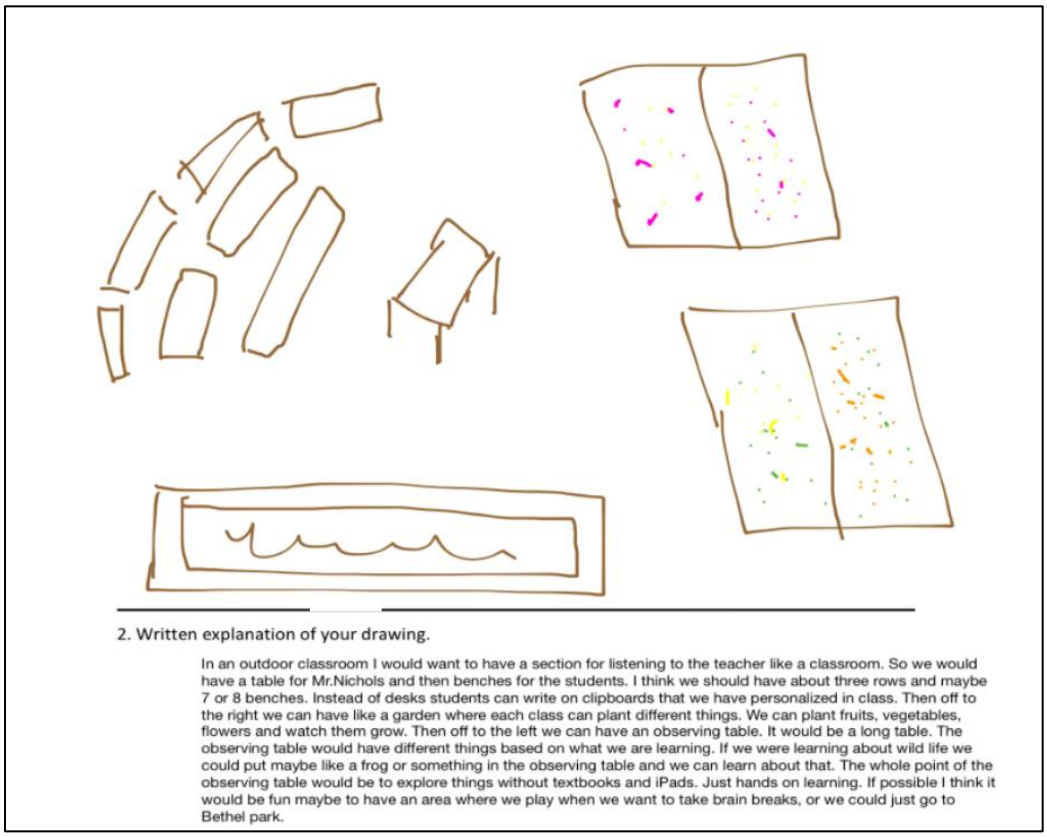
C

Note: Drawing A sorted into Human/Built; Drawing B sorted Mixed; Drawing C sorted Nature

Figure 3

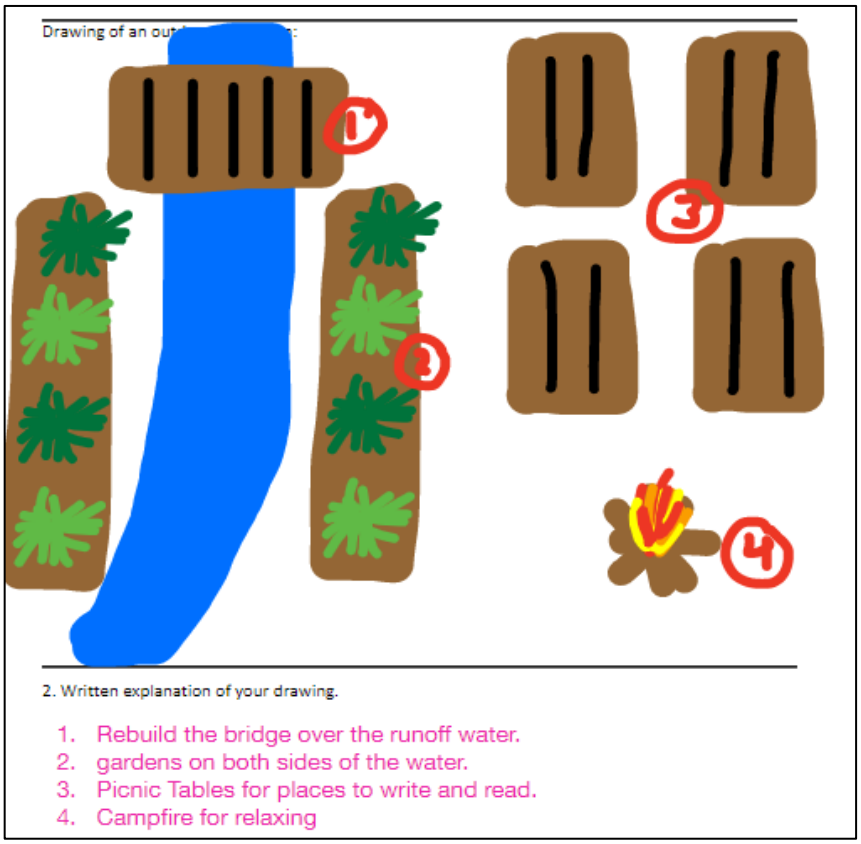
Student Drawings Comparing Learning Interactions

A

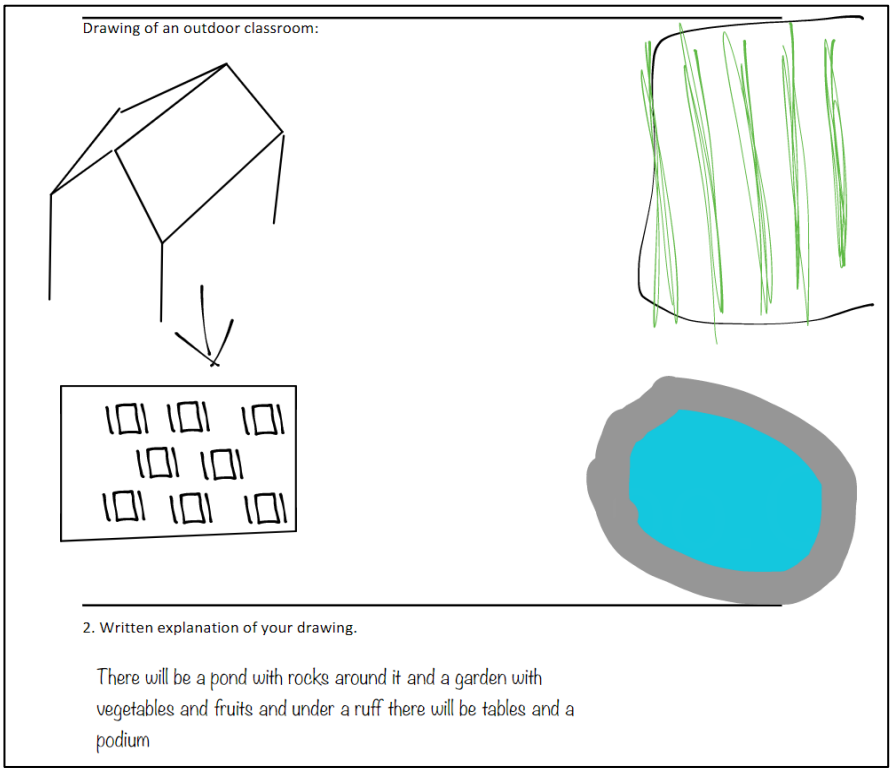


"In an outdoor classroom I would want to have a section for listening to the teacher like a classroom. So we would have a table for [the teacher] and then benches for the students. I think we should have about three rows and maybe 7 or 8 benches. Instead of desks students can write on clipboards that we have personalized in class. **Then off to the right we can have like a garden where each class can plant different things. We can plant fruits, vegetables, flowers and watch them grow.** Then off to the left we can have an observing table. It would be a long table. **The observing table would have different things based on what we are learning. If we were learning about wild life we could put maybe like a frog or something in the observing table and we can learn about that.** The whole point of the observing table would be to explore things without textbooks and iPads. Just hands on learning. If possible I think it would be fun maybe to have an area where we play when we want to take brain breaks or we could just go to Bethel park."

B



C



"There will be a pond with rocks around it and a garden with vegetables and fruits and under a ruff there will be tables and a podium"

Note: Drawing A depicts a specific learning interaction in bolded text; Drawing B depicts general learning interaction in bolded text; Drawing C depicts no learning interaction within text. Emphasis added.

Figure 4

Student Drawing Sorted Human/Built and General Learning

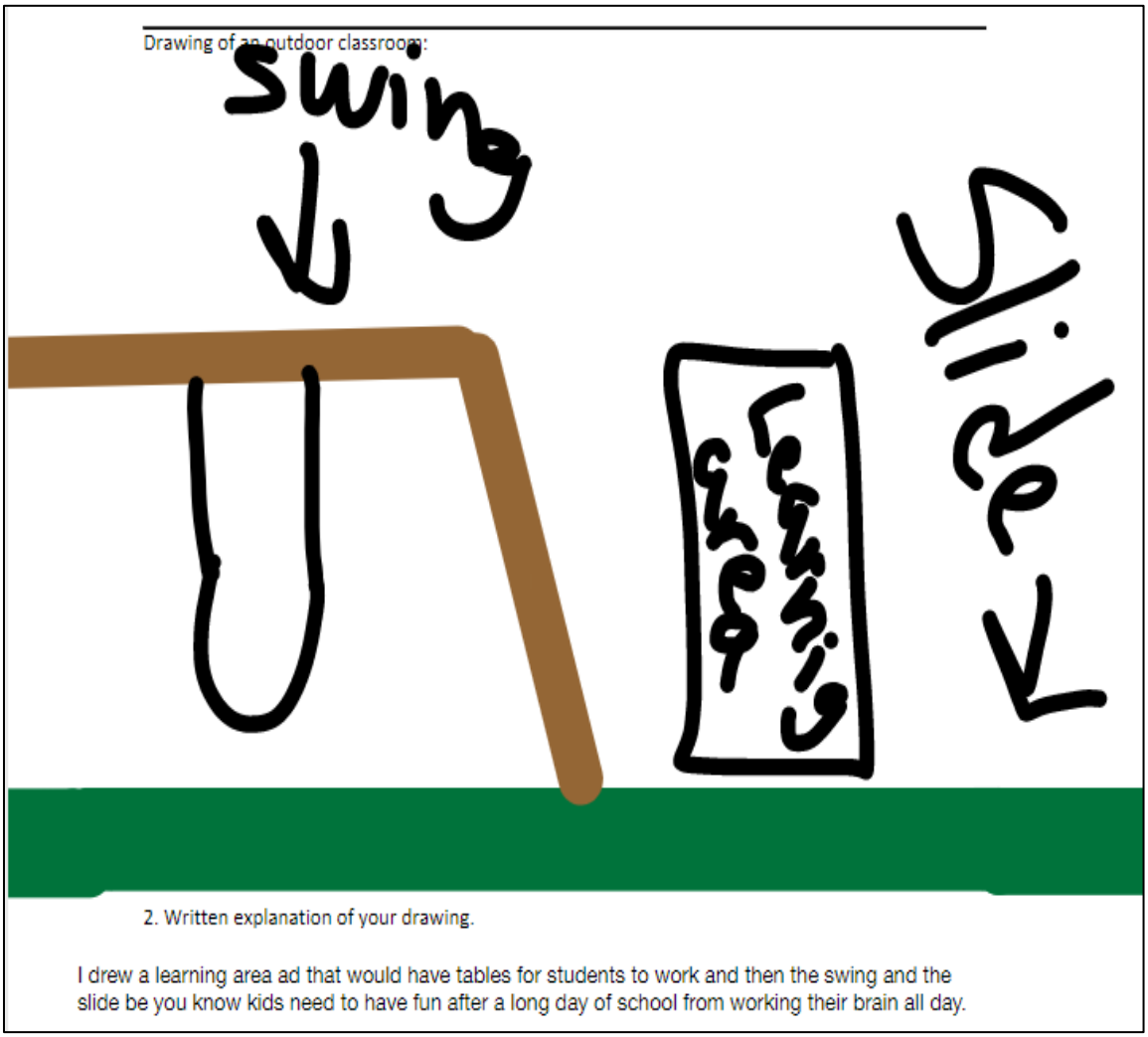


Figure 5

Student Drawing Sorted Nature and General Learning

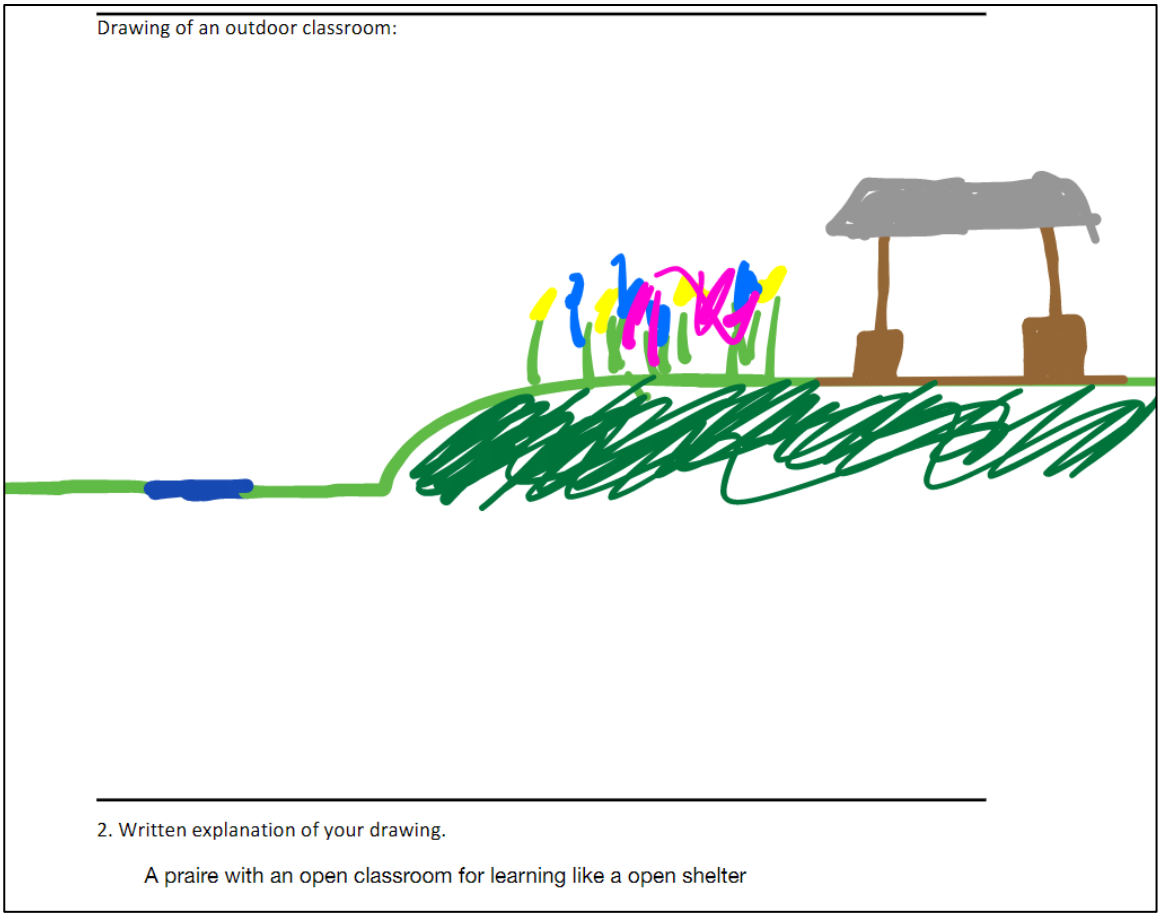
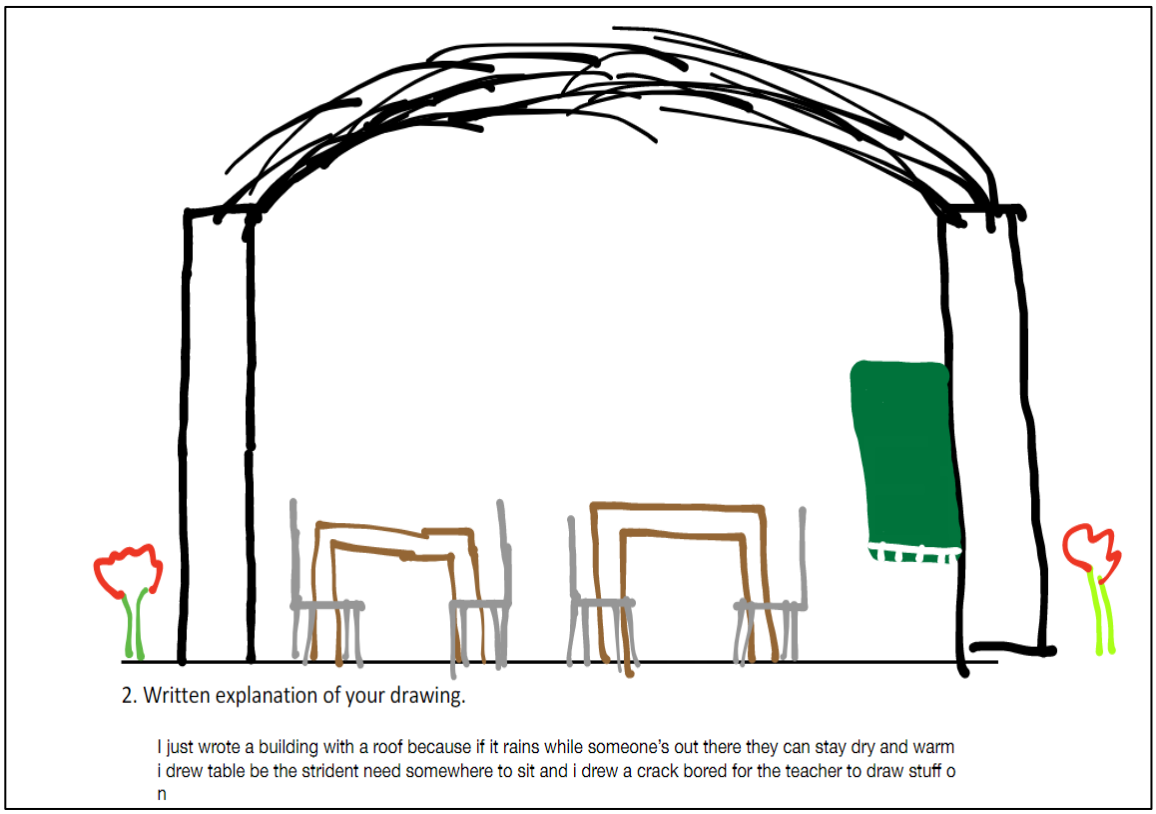


Figure 6

Student Drawing Sorted Human/Built and No Learning



"I just wrote a building with a rood because if it rains while someone's out there they can stay dry and warm I drew table be the strident [student] need somewhere to sit and I drew a crack bored [black board] for the teacher to draw stuff on"

Figure 7

Student Drawing Sorted Nature and No Learning

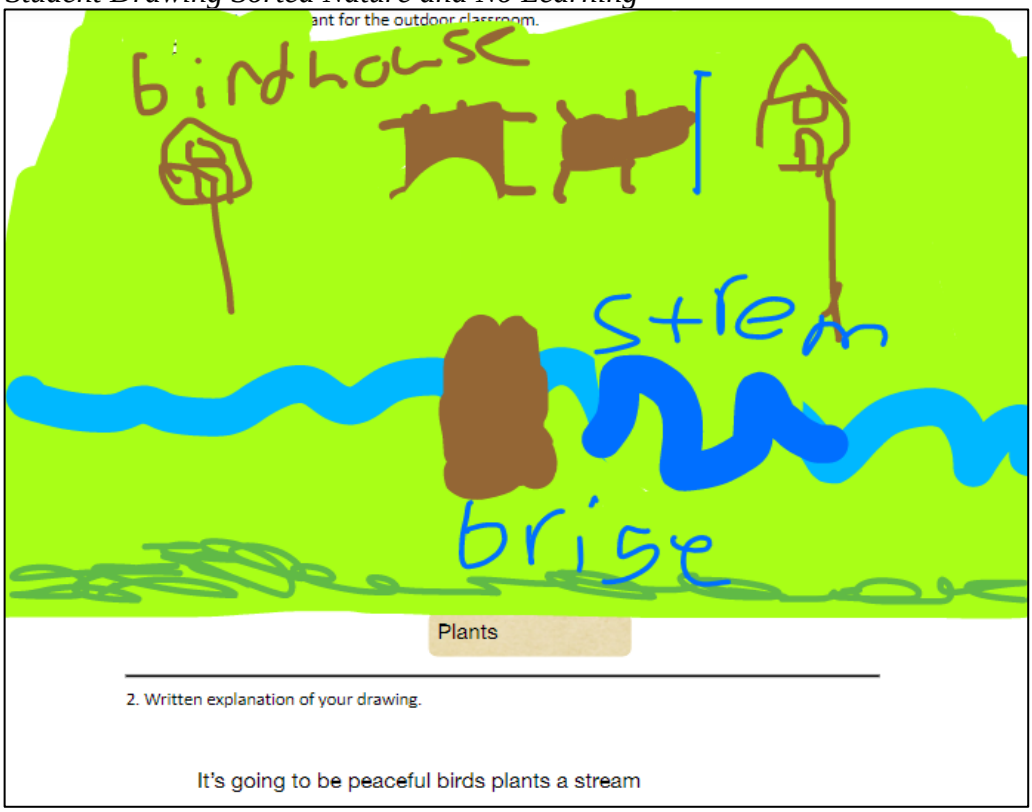


Figure 8

Student Drawing Emphasizing Play

Figure 9

Student Drawing Emphasizing Conservation of Pollinators

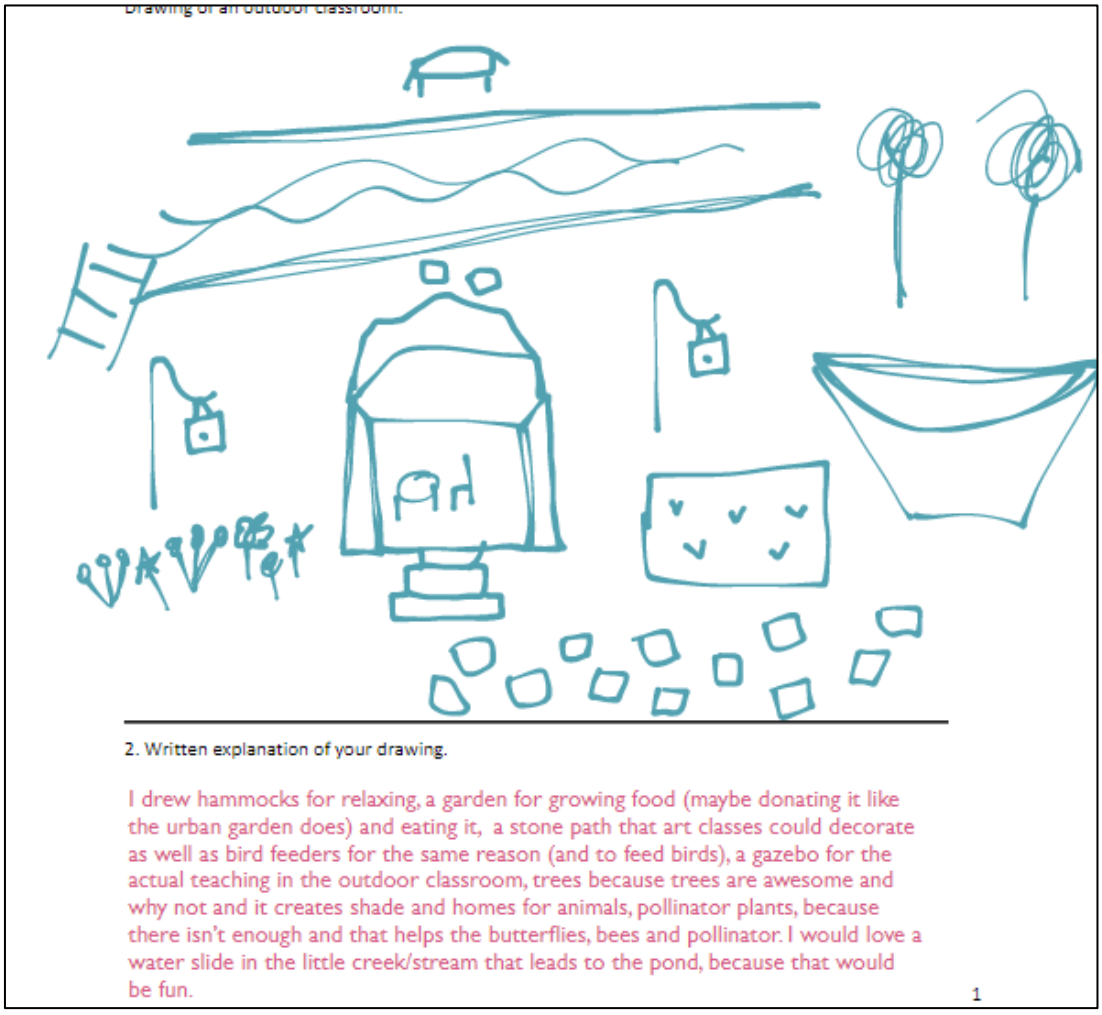
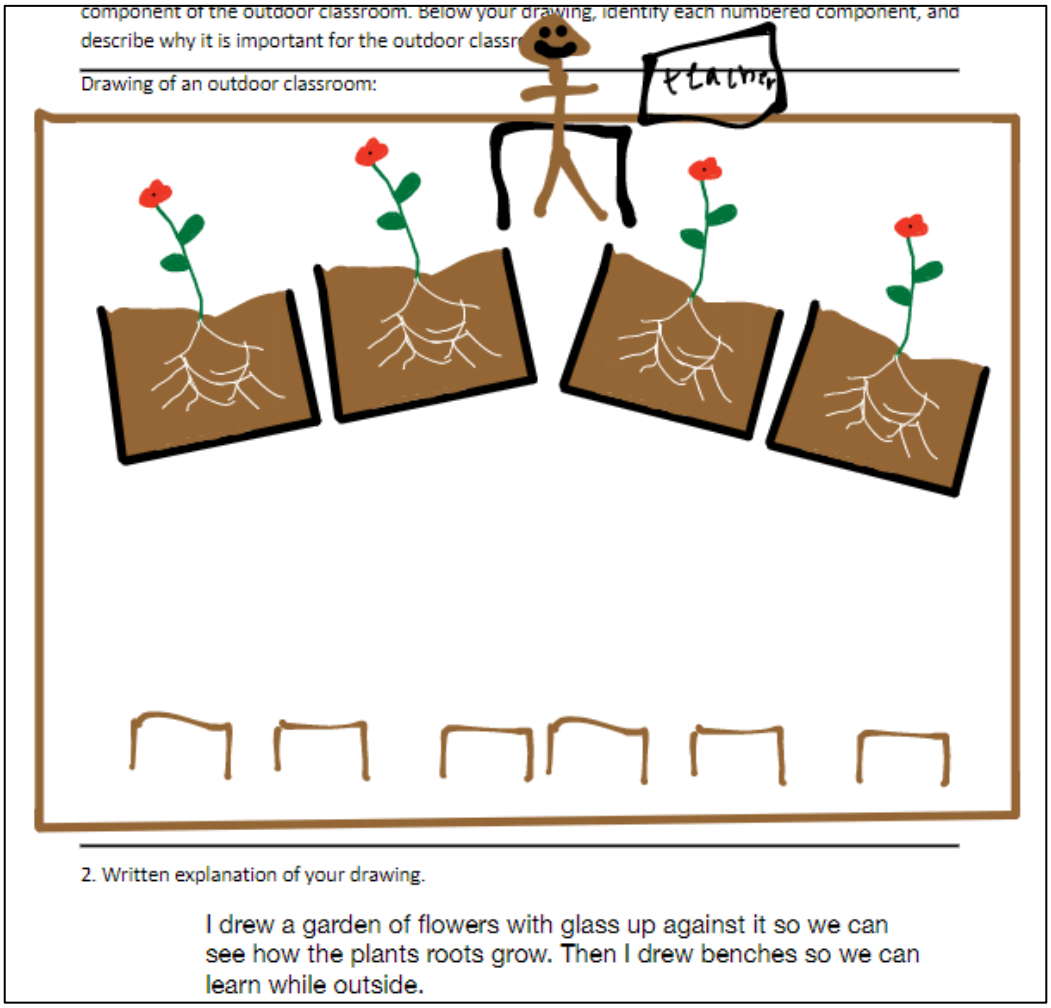


Figure 10

Student Drawing with Teacher



Appendix 1. Learning Exercise PowerPoint

What is an outdoor classroom?

- An outdoor classroom is an outdoor educational space that can be developed into a natural study grounds for educators, students and anyone interested in the natural environment.
- All subjects can be presented in an outdoor classroom.

Why do we need an outdoor classroom?

- A lot of benefits for People and Wildlife
- Provide space for outdoor learning
- Space for wildlife habitat
- Aesthetic view
- Ecosystem services for food, water, and shelter for native species such as pollinators
- Space to learn from authentic experience

Bring Back Native Plants

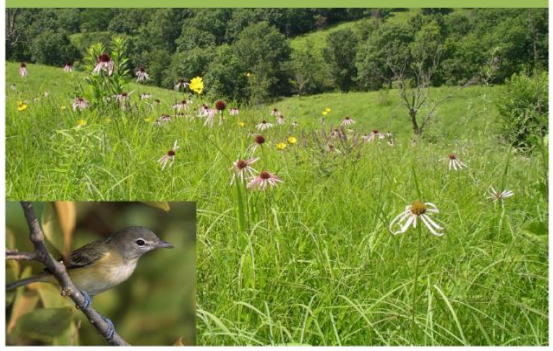
Native Plants

- originate from Missouri
- adapted to our environment
- support native wildlife

Host Plants

Some insects only eat a certain species of plant.
Example: Monarch butterfly, Milkweed bug

Plants are food and shelter for animals.



Native vs. Non-native

Native Plants

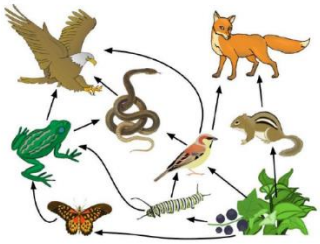
- originate from Missouri
- adapted to our environment
- support native wildlife

Non-native Plants

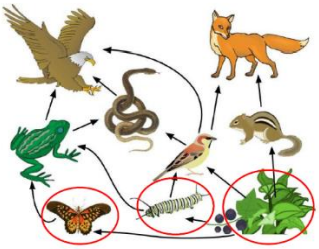
- do not originate from Missouri
- many ornamental species
- invasive by naturalization
- disrupt native ecosystems

Non-native plants disrupt the ecosystem by:

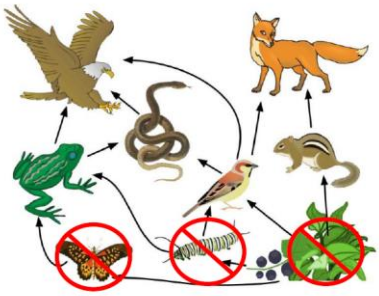
- Outcompeting native plants that provide food and breeding habitat to insects



Why are plants and insects so important to the ecosystem?



If the plants and insects disappear: What will happen to the other animals?



Ecosystem Collapse

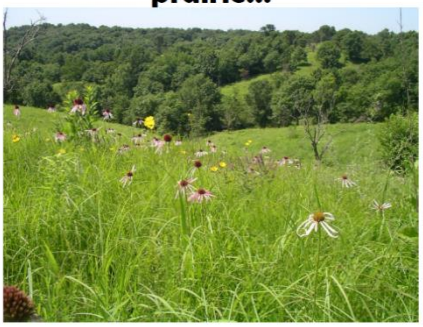
How can we help?

Plant a Habitat Garden

– Provides food, shelter, and water to wildlife

Transform a vacant lot to a prairie…

Transform a vacant lot to a prairie…



Enhance a previously planted garden could

1) eliminate invasive species and
2) add other native plants that support wildlife

Plant Selection

Garden A (under fire escape)

1. Marsh Milkweed/S/UT
2. Blue aster/F/T
3. Bluebells/Sp/M
4. Sand phlox/Sp/G
5. Wild pink/Sp/S
6. Bush poppy Mallow/Spks/M
7. Wild quinine/S/T
8. Blue lobelia/F/M
9. Joe Pye Weed/UT/S
10. Little Flower Alumroot/F/

Garden B (by Eco-classroom)

1. Purple Beardtongue/SpS/M
2. Threadleaf Blue Star/Sp/M-spread wide
3. Purple Poppy Mallow/S/S
4. Texas green eyes/T/ST
5. Cardinal Flower/T/F
6. Soapweed Yucca/SpS/M-T
7. Rigid Goldenrod/F/T
8. Heart-leaved Alexanders/S/M
9. Glade Coneflower/T/S
10. Butterfly Milkweed/M/S
11. Prairie Blazingstar/T/S
    Little Bluestem

Many Habitat Patches = Habitat Connectivity

"A conservationist is one who is humbly aware that with each stroke of the axe they are writing their signature on the face of the land."

- Aldo Leopold

Other Elements of an Outdoor Classroom






Appendix 2. Outdoor Classroom Student Questionnaire

Outdoor Classroom Task Survey

Your Name:_____ Teacher's Name: _____

Section I. The Outdoor Classroom Design

In the space below, draw a picture of an ideal outdoor classroom. Write a number next to each component of the outdoor classroom. Below your drawing, identify each numbered component, and describe why it is important for the outdoor classroom.

1. Drawing of an outdoor classroom:

2. Written explanation of your drawing.

3. Select 3 elements from the following pictures that you think are the most important for an outdoor classroom.

☐ A seating area for outdoor learning

☐ A restored prairie for birds and pollinators

☐ A managed pond for wildlife observation

☐ An area for nature play

☐ A schoolyard garden with landscaping

☐ A garden with edible vegetables and fruits

4. Please rate the importance of the following benefits of your outdoor classroom:

1 = not at all important; 2 = slightly important; 3 moderately important; 4 = very important

A	Habitat for wildlife and biological diversity	1	2	3	4
B	Space to grow local food	1	2	3	4
C	Space to learn science outside	1	2	3	4
D	Aesthetic view	1	2	3	4
E	Space for unstructured play	1	2	3	4

Section II. Attitude toward Outdoor Classrooms and Use of Native Plants

1. To what extend do you agree or disagree with the following statements? For each of the following items below, CIRCLE the ONE number that best describes how you feel (1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree)

A	In general, I am motivated to build an outdoor classroom with my science class.	1	2	3	4	5
B	I believe an outdoor classroom provides benefits for local wildlife with food, water, cover, and places.	1	2	3	4	5
C	Building an outdoor classroom excites me because it allows me to apply scientific knowledge for a better place.	1	2	3	4	5
D	I value using native plants in the outdoor classroom landscaping for the benefits of wildlife and diversity.	1	2	3	4	5
E	Native plants help preserve soil and water quality.	1	2	3	4	5
F	Use of native plants for the outdoor classroom help reduce carbon emissions from mowing lawn.	1	2	3	4	5
G	Many wildlife species prefer native plants for habitat and depend on them for survival.	1	2	3	4	5

Section III. Knowledge about Native Plants and Prairie Ecosystem

1. Have you visited a prairie ecosystem? ☐ Yes ☐ No ☐ I am not sure

2. How familiar are you with a prairie ecosystem?

☐ Not at all familiar ☐ Not very familiar ☐ Somewhat familiar ☐ Familiar ☐ Very familiar

3. Name any native species that you can find in Missouri's prairie ecosystem.

4. List any management techniques or tools that conservation professionals use to manage a prairie ecosystem.

5. Are you aware of any threats that the prairie ecosystem is facing? If yes, what are some of these threats?

6. How likely are you to support and build a prairie restoration at your outdoor classroom?

☐ Very likely
☐ Likely
☐ Unlikely
☐ Very unlikely

Section IV Demographic Information Now, please tell me a little bit about yourself.

1. Gender: ☐ Male ☐ Female ☐ Prefer not to say

2. I am: ☐ Hispanic/Latino ☐ Not Hispanic/Latino

3. What is your race?

☐ American Indian or Alaskan native
☐ Asian or Pacific Islander
☐ African American or Black
☐ White
☐ Two or more races
☐ Other (Please specify) _____

4. Which of the following best describes the area you live in?

☐ Urban ☐ Suburban ☐ Rural

Appendix 3. Full List of Items in Student Drawings

Item Drawn	Frequency
Seating Area/ Benches/ Chairs	49
Gardens	47
Pond/ Stream, Water	40
Ruff/ Shelterhouse/ Pavillion/ Shed	28
Trees/ Fruit Trees	23
Tables	23
Unspecified grass area	18
Stage/ Teaching area	17
Flowers- stray flowers, not grouped in a garden	16
Animal Space/ Animals/ Pollinators	12
Bridge	12
Prairie	7
Path	7
Human	6
Birdfeeder/ Birdhouse	5
Rocks	4
Sun	4
Campfire	4
Podium	4
Play Area	4
Bush/Hedge	3
Experiment Area	3
Chalk Board/ White Board	3
Swings	3
Greenhouse	2
Hammocks	2
Dam	2
Classroom with Windows/ Glass Classroom	2
Compost	2
Slide/ Water Slide	2
Well	1
Water Power with Irrigation	1
Observation Deck	1
Bird Bath	1
Microscope	1
Statue	1
Glass Containers for Plants	1
Clipboards	1
Bowls- for holding tools and for experiments	1
Art Wall	1
Trash/ Recycling Cans	1
Shed	1
Animal Feed	1
Cabinet with Supplies	1

Appendix 4. Place-Based Education Student Questionnaire

Name of School:_____

Grade Level: _____

Understanding Place-Based Lessons in Columbia Public Schools

Students, please circle the **<u>one</u> answer** that best describes how much you agree or disagree about the statements below. Please only circle one answer per statement. 1=strongly disagree, 2= disagree, 3= neither disagree or agree, 4= agree and 5= strongly agree. **If you do not want to answer a question, please skip the question.**

Section 1. Attitudes Toward Science Lessons

Statement	Strongly Disagree	Disagree	Neither disagree or agree	Agree	Strongly Agree
I usually understand what we are talking about in science class	1	2	3	4	5
Science is easy for me	1	2	3	4	5
Studying science is something I enjoy very much	1	2	3	4	5
Science is one of my favorite subjects	1	2	3	4	5

Section 2. Evaluation and Attitudes towards Fall 2019- Spring 2020 Lessons

Statement	Strongly Disagree	Disagree	Neither disagree or agree	Agree	Strongly Agree
I enjoy when the class goes outside to learn	1	2	3	4	5
I feel nervous going outside the classroom for lessons	1	2	3	4	5
Going outdoors for lessons has helped me learn more during lessons	1	2	3	4	5
The only time I go outside during school is for recess	1	2	3	4	5
Doing hands-on activities helps me better understand the lesson	1	2	3	4	5
The best part about my lessons are doing hands-on experiments	1	2	3	4	5
When we go outside for class, I get to do hands-on activities	1	2	3	4	5
I have learned a lot about the nature right outside of my classroom	1	2	3	4	5

Statement	Strongly Disagree	Disagree	Neither disagree or agree	Agree	Strongly Agree
I understand the subject better when I am learning about nature that can be found near my school	1	2	3	4	5
The nature I learn about in my classes can be found in my own backyard	1	2	3	4	5
I feel more connected to my school this school year	1	2	3	4	5
I want to be more involved in my community because of what I have learned in my class this school year	1	2	3	4	5
I learn better when guests from the community come to speak to my class	1	2	3	4	5

Section 3. Modified Connection to Nature Index

Statement	Strongly Disagree	Disagree	Neither disagree or agree	Agree	Strongly Agree
I like to hear different sounds in nature	1	2	3	4	5
I like to see wild flowers in nature	1	2	3	4	5
When I feel sad, I like to go outside and enjoy nature	1	2	3	4	5
Being in the natural environment makes me feel peaceful	1	2	3	4	5
I like to garden	1	2	3	4	5
Collecting rocks is fun	1	2	3	4	5
Being outdoors makes me happy	1	2	3	4	5
Humans are part of the natural world	1	2	3	4	5
People cannot live without plants and animals	1	2	3	4	5
My actions will make the natural world different	1	2	3	4	5
Picking up trash on the ground can help the environment	1	2	3	4	5
People do not have the right to change the natural environment	1	2	3	4	5

Section 4. Sense of Place

Statement	Strongly Disagree	Disagree	Neither disagree or agree	Agree	Strongly Agree
I miss my community when I am away from it	1	2	3	4	5
I am happier in my community than in other places	1	2	3	4	5
My community is the best place for what I liked to do	1	2	3	4	5
I wish I could move to a different community	1	2	3	4	5
I identify myself strongly with my community	1	2	3	4	5
My community reflects the type of person I am	1	2	3	4	5
I feel like I can be myself in my community	1	2	3	4	5
I feel like my community is a part of me	1	2	3	4	5

Section 5. Short Answer Reflection on Lessons

Answer the short answers question below:

1. Think back to this year's science lessons. What science lesson was your favorite this year? Describe what you did for the lesson.

_____

_____

_____

2. Think back to this year's math lessons. What math lesson was your favorite this year? Describe what you did for the lesson.

_____

_____

_____

3. Think back to this year's social studies lessons. What social studies lesson was your favorite this year? Describe what you did for the lesson.

_____

_____

_____

Section 6. Demographic Questions

Please tell me something about yourself… circle or check **one** answer per question.

1. I am: ☐ Male ☐ Female ☐ Prefer not to say

2. What race are you?
   - ☐ White
   - ☐ African American or Black
   - ☐ Hispanic
   - ☐ Asian
   - ☐ Two or more races
   - ☐ Other (Please specify) _____
   - ☐ Prefer not to say

3. What best describes the area that you live in?

   ☐ Inner city ☐ Neighborhood or suburb outside of the city ☐ Country

4. Is this the first year you have attended this school?

   ☐ Yes ☐ No ☐ I am not sure

5. How many hours do you usually spend outside in nature when you are <u>not</u> in school during the week?

   ☐ 0 hours ☐ 1-2 hours ☐ 3-4 hours ☐ over 5 hours

6. Do your parents/guardians like to be outside in nature?

   ☐ Yes ☐ No ☐ Sometimes ☐ I am not sure

Thank you for completing the questionnaire! Please turn it in to your teacher!

Appendix 5. Public School Science Department and Teacher Interview Guide

Introduction Paragraph

Hello, my name is Victoria Burnett and I am a graduate student at the University of Missouri- Columbia. I am working on a project to better understand the perceptions of teachers who are teaching the place-based lessons at Fairview Elementary. Thank you for agreeing to participate in the study.

Your name will be kept confidential and this audio recording will be kept on a password protected computer and will later be encrypted. No names or identifiable information will be used in any reports. Your participation is voluntary, you can choose which questions you want to answer and you can choose to stop participating at any time. There are no perceivable risks for you participating in this study. This interview should take around 30 minutes. Would you be comfortable with this interview being recorded? This would ensure we have an accurate record of all your answers.

Briefly about me, I grew up in Columbia going to Columbia Public Schools and graduated from Hickman. I was able to participate in the Grand Teton Science Trip during my time at Hickman. That trip exposed me to how beneficial place-based education can be. Having been able to experience that program, it gives me an appreciation for what is happening at Fairview Elementary!

Do you have any questions for me before we begin?

Questions

Introduction Questions: I wanted to start off with some easy questions.

1. How many years have you been a teacher?
    a. In Columbia public schools?
    b. In an elementary school?
2. What grade do you currently teach?
3. How many students do you have in your class this year?

Middle Questions:

1. Place-based education has become a buzz word of sorts, how would you define place-based education?
2. Can you tell me how CPS first became interested in place-based education?
    a. Could you provide a timeline of events?
    b. How did you chose Fairview Elementary school as the first place-based school?
3. I have seen from the powerpoint lessons that it appears the lessons are interdisciplinary in regards to using multiple subjects. How does this lesson format differ from previous years teaching?

    a. Have you seen any benefits or downfalls in teaching multiple subjects in the same lesson?
4. Place-based education puts an emphasis on teaching about local environments and communities. What benefits and challenges have you seen from teaching lessons from a local perspective?
    a. Do you think these types of lessons would help create a better attachment of students to the community? How so?
    b. Can you provide an example from your class?
5. Another emphasis of place-based education is being going outside for lessons. What benefits and challenges have you seen teaching outside?
    a. How often have you taught outside of the classroom this year as compared to previous years?
    b. Can your provide an example from your class?
6. What differences have you noticed in the community of teachers in the school since transitioning to these new lessons?
    a. What advice would you give to other teachers curious about implementing place-based lessons?
    b. What advice would you give teachers in the grades below you in the school?
7. How can teachers be supported in teaching place-based lessons?
    a. What outside organizations can help?
    b. How can the administration help?
8. What connections do you have in the community to help with place-based education?
    a. In what ways are these partnerships beneficial? Can you provide an example?
    b. In what ways are these partnerships difficult? Can you provide an example?
    c. How have these partnerships been maintained?
9. What are Columbia Public Schools goals moving forward concerning these lessons?
    a. Will more schools be using this format?

Conclusion question

1. One final question. Thinking long-term, **how do you think these place-based lessons will impact students in the future?** Will there be any impact at all compared to teaching a more "traditional" curriculum?

Conclusion Paragraph

Those are all of the questions I have at this time for you. Do you have any questions for me at this time? For any clarification of answers or to review our final interpretation of your answers, would you be willing to let us contact you? What is the best way to contact you? Thank you so much for your participation.

Appendix 6. Community Environmental Educator Interview Guide

Introduction Paragraph

Hello, my name is Victoria Burnett and I am a graduate student at the University of Missouri- Columbia. I am working on a project to better understand the perceptions of teachers who are teaching the place-based lessons at Fairview Elementary. Thank you for agreeing to participate in the study.

Your name will be kept confidential and this audio recording will be kept on a password protected computer and will later be encrypted. No names or identifiable information will be used in any reports. Your participation is voluntary, you can choose which questions you want to answer and you can choose to stop participating at any time. There are no perceivable risks for you participating in this study. This interview should take around 30 minutes. Would you be comfortable with this interview being recorded? This would ensure we have an accurate record of all your answers.

Briefly about me, I grew up in Columbia going to Columbia Public Schools and graduated from Hickman. I was able to participate in the Grand Teton Science Trip during my time at Hickman. That trip exposed me to how beneficial place-based education can be. Having been able to experience that program, it gives me an appreciation for what is happening at Fairview Elementary!

Do you have any questions for me before we begin?

Questions:

Introduction Questions:

1. What is your job title and organization you work with?
2. How long have you been in this position? How long have you been an environmental educator?
3. How did you get started doing environmental education?

Middle Questions:

4. From your experiences, how would you define place-based education?
    a. What is the connection to environmental education?
5. How do you use place-based education in your lessons with CPS students?
    a. Can you provide an example?
6. What are your expected outcomes from using place-based education?
    a. Regarding: students, learning outcomes.
    b. Describe an example of seeing these expected outcomes in the class.
7. Thinking back when you first partnered with CPS, how did that partnership begin?
    a. What did that partnership first look like?
    b. What does the partnership look like now?

    c. In what ways is this partnership beneficial? Can you provide an example?
    d. In what ways is this partnership difficult? Can you provide an example?
8. What makes a community partnership long-lasting for subsequent school years?
9. Thinking back to when you first heard about Fairview switching to place-based education, can you describe your initial reaction?
    a. In what ways has your view changed?
10. As a partner in this transition, what actions made switching to place-based education more successful?
    a. What actions has Fairview done to make switching to place-based education more successful?
11. As a partner in this transition, what challenging issue did you face when Fairview was switching to place-based education?
    a. What challenges have you seen as Fairview switched to place-based education?
    b. How can those issues be mitigated?

Conclusion Question:

12. One final question. Thinking long-term, **how do you think these place-based lessons will impact students in the future?** Will there be any impact at all compared to teaching a more "traditional" curriculum?

Conclusion Paragraph:

Those are all of the questions I have at this time for you. Do you have any questions for me at this time? For any clarification of answers or to review our final interpretation of your answers, would you be willing to let us contact you? What is the best way to contact you? Thank you so much for your participation.