EFFECTS OF OUTDOOR LEARNING TASKS ON KINDERGARTEN SCIENCE UNDERSTANDING AND ATTITUDE

by

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ABSTRACT

Throughout my experience teaching students aged 5 up to 14, I've noticed a dramatic shift in attitude towards learning when given the opportunity to teach outdoors. There is inherent difficulty in building a schedule that allows for outdoor learning. My study aimed to support whether the additional instruction time needed for outdoor learning benefits learners by looking through quantitative and thematic data. The non-treatment phase of the study recorded students' attitudes towards learning science, scoring on a summative assessment, and observed use of scientific understanding throughout indoor classroom instruction. The treatment phase of the study collected data in the same ways but with the addition of frequent outdoor learning tasks in which students were brought outdoors for a short (10 to 15 minute) activity ahead of or following the classroom science lesson. Qualitative and quantitative data patterns pointed to an immediate preference for indoor learning with a declining positive attitude score as time went on. Inversely, attitudes toward activities with outdoor learning tasks began low but rose over time. Summative scores pointed to slight gains in content understanding after being introduced to outdoor learning tasks. Generally, students showed slight preference towards lessons with outdoor learning tasks and in combination with a slight gain in content understanding following outdoor lessons justifies continued exploration of outdoor learning activities with young students.

CHAPTER ONE

INTRODUCTION AND BACKGROUND

Context of the Study

I've worked at Horace Mann Elementary School, which serves students Kindergarten through Sixth Grade, since 2021. In that time, I've taught Sixth Grade, Second Grade, and Kindergarten, where I am currently placed. Horace Mann is a small school of approximately 200 students located on the periphery of Iowa City's downtown. The demographic range of families we serve is wide with representation from new non-English speaking immigrants, low income and high income households, academics, parents working 60-hour weeks with siblings picking up familial duties, etc. We are one of the only elementary schools in our district surrounded by housing or commercial development. Where the other elementary buildings tend to be built within subdivision neighborhoods or on the edge of town flanked by corn fields, Horace Mann exists in the center of the city.

Throughout my time teaching generalized elementary classes, I've observed some disconnection in the way that my students have approached scientific learning outdoors when compared to their approach in the classroom. Students at all grade levels have approached scientific exploration in the classroom with caution. However, the barriers felt by my students indoors collapse when I have taken them outside. I've noticed remarkable changes out on our playground, in our school garden, and at local parks. Quiet students turn on their voices. Kids that would not have looked at each other previously begin to dissect newfound berries collaboratively. Giggling echoes across the lawn, loud enough that I frequently turn to make sure

I am hearing the voices of my students. Scholars that were afraid to take risks are now laughing, running, and asking big questions about the world.

I have struggled to bundle up these feelings and carry them with us inside. I want my young scientists to feel the same joy in my classroom that they do learning in nature. The interest and questioning that I have observed my students use outdoors are imperative to their scientific learning as they grow, and I want to pinpoint whether little bouts of nature help to bolster the excitement inside my classroom. This led me to the research study focus I explored in my action research.

Support Team

While thinking through the educators around me who might have helpful perspectives on this research, it was important to me to find people that would have experience in a particular part of the project. Additionally, I enlisted educators that were also creative and willing to think outside the box as problems, twists, and turns arrive throughout the research project. Keeping this in mind I have asked three educators to assist with my research that I am confident can help me in their area of expertise as well as help brainstorm revisions for the other parts of the project. These people are Stacey Medd, Dan Lawver, and Teresa Mobley.

Stacey Medd has acted as my Reading Practicum Cooperating Teacher, Student Teaching Cooperating Teacher, and I was lucky enough to be able to call her my colleague for two years ahead of her retirement from K-12 education. She is now an adjunct professor in the College of Education at the University of Iowa. She taught multiple grade levels in her K-12 career but hovered predominantly around the K-2 primary grade levels. Stacey is a wealth of pedagogical information. She seeks to constantly address the needs that her students have and holds highly the strengths that all students bring to our classroom community. I will primarily look for Stacey to help me ensure that my treatment plan and assessment materials are appropriate for kindergarten learners. I have no doubt that Stacey will push my thinking and support the pedagogical needs of my students.

Dan Lawver has taught multiple classes that I have taken in the MSSE Program and most recently led a trip to Makoshika State Park in Eastern Montana for Dinosaur Paleontology I, a course in which I was enrolled. Dan has watched me as a learner in many different contexts and has a research background in many different areas. I am hopeful that Dan can help me to step closer towards developing a professional piece of academic research. He has seen many students complete their capstone project and I know will be a valuable resource for helping develop each part of the Capstone project.

Lastly, I've asked Teresa Mobley to be a member of my support team as a Science and Teaching Advocate as well as my Proofreader. Teresa completed the MSSE Program last June but prior to that she was a friend that I frequently worked with on coursework. Teresa has been a K-12 teacher in California in many different grade levels as well as her district's Elementary Science Coordinator. Teresa will have many important perspectives on the research and writing elements, having just completed her own capstone. Her knowledge of the MSSE formatting requirements is fresh and when coupled with her attention to detail, this combination produces a perfect proofreader. Additionally, her role as a science coordinator has given her expertise on the teaching of science specific to younger students that I know I will benefit from. This insight strengthens my project considerably

Focus Question

My focus question was, To what extent does frequent, short-duration, outdoor learning tasks, in conjunction with an indoor science lesson, increase student science content knowledge?

My sub-questions include the following:

1. Will the inclusion of frequent short-duration outdoor learning tasks, in conjunction with an indoor science lesson, increase positive attitudes while learning within the classroom?
2. Will the inclusion of frequent short duration outdoor learning tasks, in conjunction with an indoor science lesson, increase the students' application of scientific content knowledge and behaviors outside of structured learning times?
3. To what extent does implementing frequent short-duration outdoor learning tasks impact the experience of the teacher leading the science instruction?

CHAPTER TWO

CONCEPTUAL FRAMEWORK

Personal Connection

My initial interest in this research topic stems from my own educational background that was rich with natural learning opportunities outdoors. The elementary school I attended, Bohumil Shimek Elementary, managed a native Iowan prairie on our school grounds. Being the namesake of a naturalist and champion for conservation in the State of Iowa, my school prioritized engagement with nature as an educational tool. My informal anecdotal experience tells me that students are happier, more engaged, and retain more scientific content knowledge when learning is done, at least in-part, in the outdoors. I felt it as a young student and strive to have formal data that supports the added time it takes to infuse nature into learning tasks in my role as a young educator.

Literature Review

My experience learning and teaching outdoors has been shared by the Department of Education Carrier (2009). In a study of preservice teachers' interest in science, and perceived efficacy teaching science, both categories increased after educators were taught a series of science lessons in natural environments (Carrier, 2009). There was less intimidation to teach science felt amongst the teachers when learning outdoors. Science lessons taught outdoors are primed for immediate student application of their learning and without the spotlight and silence of a walled classroom. Preservice teachers connected to their learning environment and felt comfortable applying what they understood about the learning task. In this case the application was teaching, but I feel there could be a strong correlation to the content learning that my students are attempting to grasp. This effect can also be seen when revisiting the same outdoor locations repeatedly (Vascellaro, 2011). Preservice teachers note in their journaling that revisiting the same field trip locations over time opens their eyes to new and interesting phenomena that was not noticed in prior visits (Vascellaro, 2011). The use of interview notation to record preservice teachers' responses was pivotal in summarizing these effects. The effectiveness of revisiting field trip locations as well as recording interview responses will be important to consider. My students were frequently exposed to different activities at the same locations on our outdoor campus.

Historically, field trips have been adult-led activities – exercises in walking students through information. For example, the instructors may take their class to the zoo, see the tigers at noon, the gorillas at 1:00, and the flamingos at 2:00 before packing up the bus to head back to school. A different picture is painted when teachers first ask how the field trip experience will make their classroom learning deeper, more magical, and more engaging, rather than seeing it as something to complete. Instead of scheduling a tour of the local weather station to open a unit on meteorology, for instance, you may opt to take your students outside as a storm approaches. Rather than handing out a worksheet of weather terms to define throughout the trip, the students could come back to the classroom with new phenomena they noticed in the natural environment that will lead directly into investigation and discussion (Krishnaswami, 2002). Using a phenomenon-and-environment-based philosophy for field trip planning will ensure that students are led into meaningful discussion and investigation following the outdoor learning task rather than being pulled into too many trivial directions.

The check-off, scheduled field trip model for outdoor learning is common in the United States. Much of the educational theory behind exploration-based outdoor learning in compulsory schools, outside of the United States, has come from cultures around the world that deeply value and integrate nature into their lives. Communities that deeply honor nature tend to reject the four walled classroom as the only place to educate children. Deeply honoring humans, honoring children, requires that we honor and learn from the natural world (Rosseau, 1762). The Nordic nations are a few of many examples of cultures that place significant emphasis on bringing nature into their everyday lives. In Danish contemporary culture, there is an event, sometimes described as a philosophy, called Udeskole. In direct application, Udeskole is a weekend school that takes place outdoors. Kids are tasked with building, playing, and learning in and about the natural world. In pedagogical circles, though, Udeskole represents a movement to increase the amount of time that students are exiting the classroom and entering natural environments (Barford & Mygind, 2022). Udeskole, and the core benefits of outdoor learning, are felt by students and teachers alike. Teachers noted increased positive relationships and interactions between students as well as between themselves and their students. I think that these reported experiences of thought provide very strong examples of the social emotional benefits that I am deeply interested in providing for my students.

Methodology for data collection and analysis with five and six year old students is unique. Typical assessment formats like multiple choice written assessments or essay-style written answers are not an appropriate option. Young students may not be able to reliably communicate their true understanding, so an innovative, invigorating assessment design is imperative (Kakuk, 2021). A checklist filled out by the observing teacher while students were on scientific nature walks captures the actions of students that display scientific understanding. The checklist is a template for noting when the young students apply the scientific knowledge that had been previously taught or for when students were actively investigating their own scientific questions (Kakuk, 2021). Additionally, notating verbal explanations from students can capture similar data to written assessments. These authentic forms of data taking are much more informative than only using more standard paper and pencil forms of assessment with young students. We are then able to compare patterns in student behaviors and find the correlation between the outdoor learning tasks and the students' application of their understanding. I think that this model is extremely close to meeting the needs of my research goals. It is one of my primary structural guides for the methodology of my action research.

Assessing student attitudes is innately challenging just as assessing knowledge can be. Using one form of assessment may not be enough to deeply assess the many values that may impact a student's attitude in the classroom (Lovelace & Brickman, 2013). With older students, asking a variety of questions surrounding past experiences, priorities, and values can help to read patterns in student thinking. With young students, this poses a unique challenge. A combination of response methods including interviews and pictorial notes can add to the variety of observational notes bolstering the understanding we have of student's attitudes while learning in different environments (Lovelace & Brickman, 2013).

Sourcing compilations of outdoor learning activities can be difficult. Although most outdoor learning tasks given to my students were inquiry-based, it is also important to have collections of structured outdoor activities that accomplish specific learning goals. Bug, plant, and animal identification are structured tasks that can be accomplished as easily in metropolitan centers as in rural areas (Russell, 2001). The spectrum of outdoor learning tasks ranges from Teacher-centered and highly structured to student-led and inquiry-based. In a study of 71 teaching events, categorized from high-inquiry learning with expansion guidance from the teacher to no inquiry taking place, 51% were inquiry-based (Barford & Daugbjerg, 2018). My study utilized outdoor learning tasks in supplement to the classroom lesson, but did not entirely move the curricular lesson outdoors. Noting that Udeskole does not entirely move learning outdoors adds further validity to the combination model I put in place. Udeskole educators are utilizing inquiry-based activities, but there is significant need for teacher-led activities as well. Student motivation and excitement was higher throughout inquiry-based Udeskole lessons, however there was a practical need for teachers to involve more scaffolded lessons as well. This is an important balance to consider as I aim to increase student learning as well as engagement.

Friluftsliv, a Norwegian word which translated directly to English would mean ‘free air life’, is a concept similar to Udeskole but with important distinctions that reflect the unique cultural priorities of the communities who developed it. This philosophy has origins in the local Norwegian cultural priorities but is solidified within the Norwegian Educational Standards that ask that their students be environmentally aware and able to incorporate the needs of the natural environment with their own lives (Gomboc, 2016). Students will spend days, or extended lessons, out of the classroom and outdoors to grow an appreciation for nature, to understand how the systems of nature work together, and to understand how human intervention affects the natural world. This ideal sounds very similar to the Danish Udeskole but differs slightly in the focus while outdoors. My research focus utilizes nature as a modality for my instructional goals. Udeskole flips the other direction and modifies instructional goals as a modality for appreciating and understanding nature. Friluftsliv more prominently values that there are learning goals but that simultaneously we live as a part of a natural world. It also asks how we make those things work together. Investigating this philosophy in more depth has greatly benefited the direction of my questioning and instructional routines to adopt for my own outdoor teaching. Rather than reworking the natural world to accomplish my goal, I wonder if it is not more important to first adjust my goals to reflect the environment my students and I live within.

The outlined historical, cultural, and personal importance placed on outdoor learning provided a sturdy framework on which my research goals were built. Connecting students of all ages to the natural world has shown to be an effective and positive component of strong academic and social emotional learning. I had been in search of a compelling and logistically reasonable way to build outdoor learning into my teaching routine. The researched results presented above provided a framework for effective outdoor instruction.

CHAPTER THREE

METHODOLOGY

Demographics

My classroom, the group that participated in my action research, is built of 17 Kindergarten students that I teach in a generalized learning setting. They do not rotate to other teachers other than for Music, Physical Education, Library, Art, and Guidance (social emotional learning). The core academic subjects I teach to them include Math, Science, Reading, Writing, Social Studies, and Behavioral Skills.

The income and racial demographics of my classroom closely mirror the population of our school building. There is a wide range of diverse families that live near our building. We are lucky, both building wide as well as specifically within my classroom, to have this diversity. The racial majority of the group is white, 64.7%. Black students make up 23.5% of our class and Hispanic students make up 11.8%. Economic status is also varied with multiple families enrolled in our Free and Reduced Lunch program as well as many families who have one or more adults in the home employed as tenured professors at the University of Iowa.

Treatment

I sought out to discover if taking my students outdoors before or after a classroom science lesson increased their knowledge of science content. Finding an answer could help myself and my colleagues to prioritize outdoor learning in our unit planning. I wanted to explore the types of attitudes that my students report towards our lesson when learning in different environments. I was also curious if increasing the frequency of unstructured outdoor learning times would in tandem increase the curiosity-based behaviors displayed when we were back in the classroom. Additionally, making notes of the effect that the scheduling change had on my experience as the teacher could sway my recommendation to colleagues.

To effectively involve my students in outdoor learning opportunities, while attempting to affect our learning schedule as minutely as possible, I implemented frequent, short duration, outdoor learning tasks that either preceded or followed an indoor curricular science lesson. These opportunities took place in a variety of natural areas including our community garden on campus, our playground area, and a collection of local parks. Three days of the week (Monday, Wednesday, and Friday) my students and I took part in a learning activity outdoors for approximately 10 to 15 minutes. These lessons engaged students with the content knowledge that we would (pre-lesson knowledge), or had just (post-lesson knowledge), practiced in the classroom. Examples of these activities included “notice and wonder” thought activities, natural discovery and exploration time, teacher-led problem solving, etc. The act of noticing and wondering was intuitive to my young students even though it is often difficult for adults. This activity was as simple as displaying a leaf and asking students to respond with things they noticed or wondered about it. Responses could include its color, shape, possible species, purpose for spots or tears, etc. My hope was that this bout of outdoor learning would prompt background knowledge and excitement for a learning topic that carried into the classroom or acted as a summative cap on learning that had taken place. Rather than asking students to simply talk about weather, experiencing the colors of the sky, or noticing the heavy smell ahead of a storm, we would ideally have given the students many more layers of understanding to explore when back in the classroom. An exemption from the Internal Review Board at Montana State University was granted for this research (Appendix A).

Although there are not a significant number of unique terms within the treatment plan I constructed, there are some more common terms that would feel ambiguous without some strict definitions. Throughout the course of the research project there are several terms displayed that will be consistently used with their following definitions (Table 1).

Table 1. Treatment plan vocabulary definitions.

Outdoor Learning Task (OLT)	An activity given to students that takes place outside of our school building and within a natural setting. These tasks will ask students to explore, notice, or wonder about a phenomena or object that naturally occurs in the natural space we inhabit.
Short Duration	10 to 15 minutes
Frequent (in reference to the OLTs)	3 to 4 times weekly
Science Content Knowledge	The information given throughout the science curricular lessons and measured on curricular assessment
Positive Attitude States	Attitudes and reasonings that increase the likelihood of students engaging in the activity again

Instrumentation

I collected the non-treatment data throughout January and February over the course of 5 weeks. The weather in Iowa throughout these months required that we do our learning indoors and thus could act as non-treatment benchmark data. Outdoor Learning Tasks (OLTs) could begin in March and continued into April for a 5-week section of treatment.

The outdoor learning tasks were based in observation and curiosity. OLTs ahead of a lesson acted as steppingstones into the curricular content, allowing students to spark interest and develop background knowledge ahead of the move into the classroom. In the circumstances where the OLT occurred following a lesson, the focus was on rounding out the classroom learning and giving students the opportunity to apply their learning in a natural setting.

Assessment of student progress and the effectiveness of the OLT were measured with a variety of strategies. Primarily, treatment and non-treatment summative assessment scores were compared. This was a paper-and-pencil assessment that asked students to explain phenomena they'd studied as a part of the curricular unit (Appendix B). This also included teacher observation of skill application within the classroom (Appendix C). I was able to record the behaviors and content knowledge I observed students utilizing inside of the lesson as well as outside of the lesson structure. The collection of observation data helped to supplement the written assessment data collected. Working with young students required that I utilize multiple forms of data in case they were not developmentally ready to display their thinking verbally or through writing/drawings.

I also employed interviews (Appendix D) with my students to gather information about their content understanding and emotional state. The responses to interview questions regarding understanding of curricular content knowledge were explored through questioning, and scribed responses are recorded by the teacher. This is a third data method to gather a well-rounded idea of student understanding.

Data collection for Sub Question 1 utilized an Attitude Exit Ticket (Appendix E) comprised of emoticons that the students colored in to reflect their attitude towards the learning activities completed during that learning period. The Attitude Notes form (Appendix item F) ensured that I could denote any moments or reasonings from students for the attitudes they marked on their exit ticket.

Table 2 displays the instrumentation methods alongside the research questions that the collected data supports. Each research question was supported by more than one source of data. I felt confident that the collection of data triangulated from two to three sources would create a robust data set that could be reliably complied into conclusions. Stacey Medd and Teresa Mobley reviewed the sources for development appropriacy and content focus respectively. Their conclusions confirmed the purpose of each component's design.

Table 2. Data Triangulation Matrix.

	Summative Assessment	Observation of Student Application	Individual Interview	Attitude Exit Ticket	Attitude Notes Form
Research Question To what extent do frequent, short-duration, outdoor learning tasks, in conjunction with an indoor science lesson, increase student science content knowledge?	X	X	X		
Sub-question 1 Will the inclusion of frequent short-duration outdoor learning tasks, in conjunction with an indoor science lesson, increase positive attitudes while learning within the classroom?			X	X	X
Sub-Question 2 Will the inclusion of frequent short duration outdoor learning tasks, in conjunction with an indoor science lesson, increase the students' application of scientific content knowledge and behaviors outside of structured learning times?		X	X		

Data Collection and Analysis Strategies

The collection of the raw data was completed with the five instruments described above. Compiling, organizing, and analyzing the data, however, required a few more tools.

Observational Data collected using the Observational Data Form (Appendix C) could be taken most reliably when it was done immediately. Young students move quickly, and their thoughts are fleeting. To record observations of their application I had to write quickly, and this didn't allow time in the moment to organize the observations into like-categories for analysis. To aid with this I created the Observational Data Analysis Sheet (Appendix G) to be able to secondarily re-organize the observations of students into patterns. Grouping similar observations of students over time allowed me to focus on the common effects that I was seeing the treatment have on students. Similarly, the Interview Patterns Recording Sheet (Appendix H) allowed for secondary organization of thought patterns displayed throughout interviews. Particularly within interviews following the Attitude Exit Tickets, reasonings for student responses showed common themes. Analyzing the frequency of responses or thought patterns using the Interview Patterns Recording Sheet shed a brighter light on the ways that my students were interacting with the lesson modalities, for better or worse.

Lastly, to visually see the patterns of student attitude responses I converted the response options to numerical representations that could be averaged, graphed, and compared over time. The Attitude Exit Ticket lists five potential responses; "love it", "like it", "it's fine", "don't like it", and "hated it". These responses were coded from 5 to 1, with 1 representing hating the activity. The quantitative data was recorded in the Attitude Recording Calendar (Appendix I). The collection of the numerical responses in line with the calendar date they were collected allowed for comparisons of responses over time. This data set was directly compared to the summative assessment scores over time to determine if there was a correlation.

CHAPTER FOUR

DATA ANALYSIS

Results

The results were gathered through three primary data collection methods. Conflicts such as running out of time or changes in weather conditions affected the ability to collect data as frequently as was hoped. Quantitative data sets such as attitude surveys and summative rubric scores and qualitative sources including interviews are used to gain a wider perspective of the factors influencing the students' learning indoors and outdoors.

Attitude and Emotional Surveys

The Attitude Exit Tickets offered both qualitative and quantitative data sets to analyze. Students were asked at the end of the science lesson to color in an emoji that indicated whether they loved, liked, felt fine about, disliked, or hated the lesson. Student responses for their attitude towards the lesson were coded 1 to 5, and the quantified score can be analyzed for frequency of response over time as well as mean response over time. Base percentiles comparing non-treatment and treatment responses show a larger portion of positive responses for non-treatment lessons and activities. Data was compiled by response and fitted to a pie chart in treatment and non-treatment groups to alleviate the difference in response opportunities between the two groups. Comparing frequency directly would have given inaccurate benefit to the non-treatment set due to the difference in data set sizes. Within the non-treatment lesson group, positive attitude ratings accounted for 69 of 77 responses (Figure 1). The remaining responses accounted for just 8 of the 77, a large minority of the responses (Figure 1). In contrast, student responses in the treatment lesson group had greater variety. Positive attitude ratings accounted for 29 of 40 responses (Figure 2). This is still a majority but is notably less dominant than was seen in the non-treatment group.

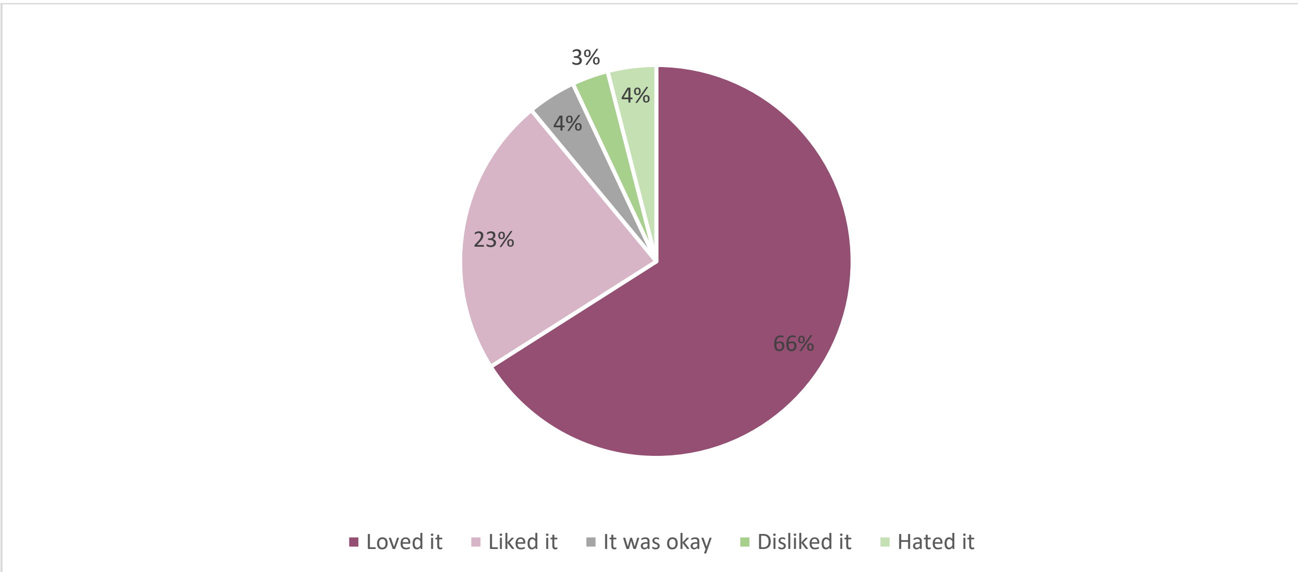

Figure 1. Response Type Percentage for Non-Treatment Lessons, (*N*=77).

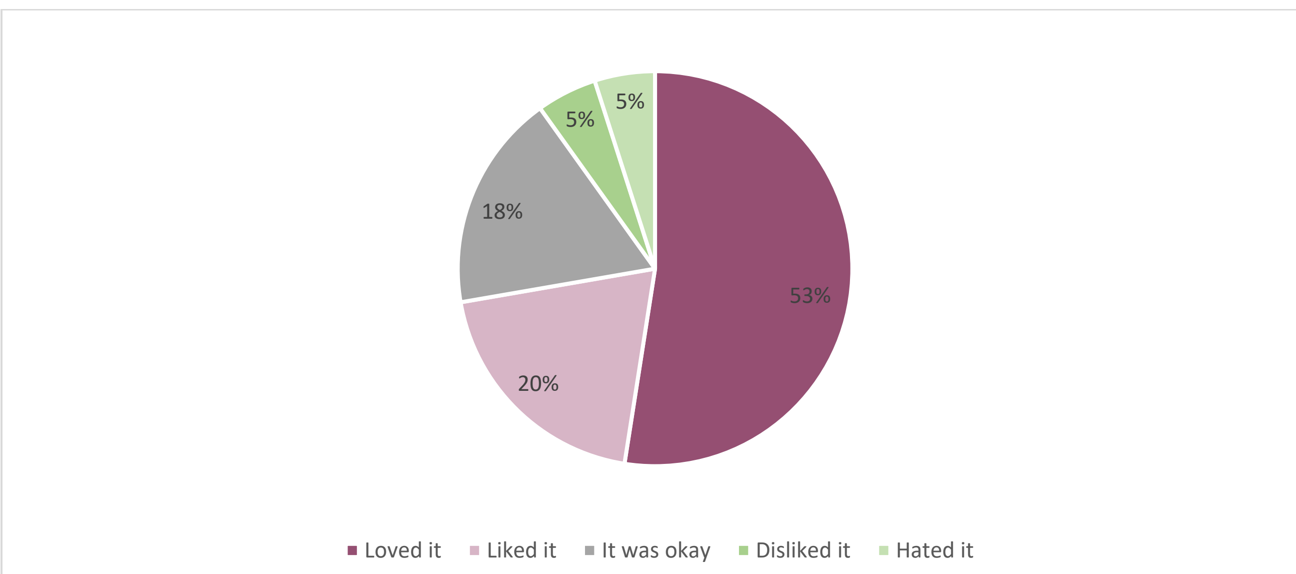

Figure 2. Response type percentage for treatment lessons, (*N*=46).

It is beneficial to see how these data points elaborate over time as well as in percentage of the whole data set. To visualize change in student response over time the response data can be disaggregated by response by the day of assessment (Figure 3). The design of Figure 3 attempted to place like-responses side by side to best be able to see patterns in responses change over time. Non-treatment responses (blue gradients) show the strength in positive response categories that we observed in Figure 1, although there is a slight negative slope in “Loved it” responses over time. Excluding the data entry for 2/29, there is a notable decline in students rating “loved it” to the classroom-only non-treatment lessons as time goes on. Inversely, there is a much lower response frequency for “loved it” at the beginning of the treatment section (yellow gradients) but quickly there is a very positive slope to the final treatment lesson response. Responses in the remaining four categories remain generally stable.

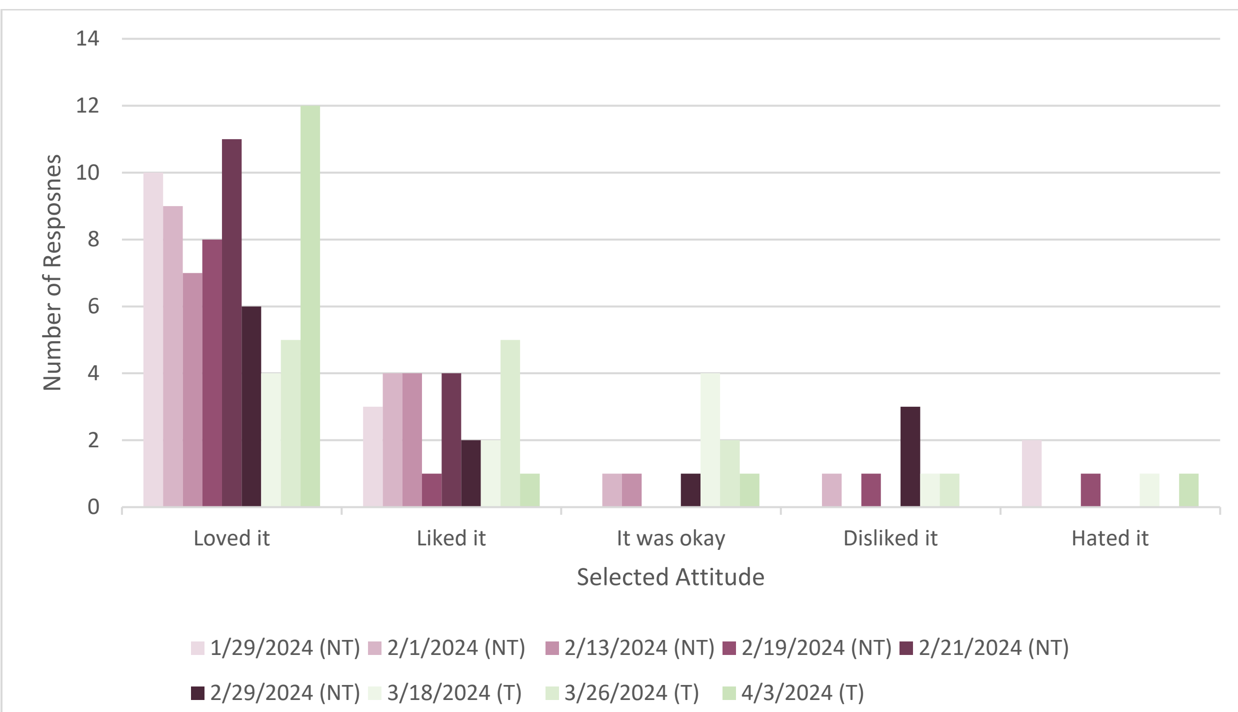

Figure 3. Attitude survey student responses, (N=123).

Interview responses at the time of exit ticket collection shine some additional light on the reasonings the students had for their responses. There are four general categories of interviewed students' reasonings. These were that the activity sparked interest, the activity did not go as planned, the student was unsure of the cause, and outlying responses that did not fit within the previous three categories. There were significantly less interviews conducted in the non-treatment section. Two out of three responses (66%) displayed that the activity sparked interest. One student said "the plants were cute" and the other "I really like taking care of the plants". There was one response indicating that the activity did not go as hoped; they said, "I never got my toy back". A tool, identified by the student as "toy", was taken away due to misuse during the activity.

Within the treatment section there were substantially more responses, and they were more varied. Interview responses of students noting that the activity sparked interest included "I love looking at the plants", "It was fun to run around and see the different [tree] colors, why are they different colors?". And "because I got to make flower boats out of pedals". Common responses of students who did not have the activity go as planned included "It was cold", "Because it was cold", "Fun but cold", "It was cold and my shoes were cold", and "It was okay but kind of boring". The remaining responses of students either unsure of the cause or who had given an outlier response included, "I don't have a reason", "Felt good", "I really liked running from the babies (a group game)", and "Got to run away from babies (group game) and look at trees". Students largely shifted from a positive response (loved / liked) throughout the non-treatment to a more neutral position with a higher percentage responding that it was okay.

<u>Behavioral Observation</u>

Attempting to observe students applying content information or science questioning skills outside of the structured lesson proved much more difficult than I previously had anticipated. There were no occurrences where I was able to notice these behaviors while in the non-treatment section of data collection. This is likely due to a combination of factors. I believe the presence of student application in the non-treatment phase was present but with much less frequency. I found it difficult to manage the kindergarten classroom while closely noticing student comments and behavior. This likely influenced the lack of data as well.

Within the treatment section, there were seven recorded applications of content and science questioning skills. Six of these applications were discussion based with a peer or an adult. A few of these included discussing with peers why the garden plants should be happy (we had a warm stretch of weather) and a following debate from a peer that they would be sad (the weather was turning cold in the forecast). This also included an energetic discussion between friends about a spiderweb and moss all living in a hole they found in an oak tree. The only observed behavior that was not discussion based involved a student running around a local park and noting for themselves the different colored tree barks they could observe. I believe that the environmental features outdoors prompted students to apply their learning much more tangibly and frequently than I was able to do through indoor lessons. Spiders, leaves, and bark of difficult colors much more quickly drew students to process their surroundings.

Summative Assessments

Students were given the same picture-based assessment with one at the end of the non-treatment section and again at the end of the treatment section. The assessment was looking for changes in student understanding of trees and basic ecosystem principles. These were explicitly taught at the beginning of the non-treatment section (chronologically first) and were frequently revisited in both treatment and non-treatment sections. The rubric (Appendix J) displays how students were scored from 1 to 3 in three separate categories to build a composite score out of nine (Table 3). Students were asked to draw a picture of a tree, then to add to the picture things that the tree needs, and lastly to add anything that they know lives with the tree.

Table 3. Summative assessment scores.

	Non-Treatment				Treatment			
Score Area	Tree Anatomy	Needs	Ecosystem Elements	Composite	Tree Anatomy	Needs	Ecosystem Elements	Composite
Mean	2.1 / 3	1.8 / 3	2.9 / 3	6.2 / 9	2.4 / 3	1.9 / 3	2.4 / 3	6.8 / 9

From non-treatment to treatment, students averaged an increase in composite score. The mean composite for non-treatment group assessments was 6.2 out of 9. The mean composite for treatment group assessments was 6.8. Using a normalized gain assessment of the composite scores, the effect size is .21. This relatively small effect size does not provide substantial confidence in the treatment as an educational strategy to affect content knowledge. Scores can be broken down by individual category as well. The mean non-treatment score for anatomy category was 2.1, mean for needs category was 1.8, and mean for ecosystem was 2.9. The mean scores after the treatment section were slightly higher in the first two categories; the mean for anatomy was 2.4 and for needs was 1.9. The mean score for ecosystem in the treatment group went down, though, to 2.4. There are advantages to the treatment when looking at assessed content knowledge although there are drawbacks as well. Both positive effects and negative effects are small in effect size. Additionally, a paired samples t-test of composite scores reveals a p-value of .1643, signifying that these results are not statistically significant. Content knowledge was not affected in very noticeable ways through the treatment and assessment strategies.

CHAPTER FIVE

CLAIM, EVIDENCE, AND REASONING

Claims From the Study

The primary research question was seeking to understand if the inclusion of short-duration outdoor learning tasks to the curricular science lesson increased the content knowledge retained and displayed by the students. Based on the summative assessment data and behavioral observation notes, I see that the treatment did have a positive effect on the students' application of content knowledge, albeit smaller than expected. Three out of four summative assessment scoring categories saw growth. In particular, the detail in student drawings grew substantially after the treatment phase. Students were not given any explicit instruction on drawing with detail. They did receive much more frequent exposure to real trees living in real ecosystems throughout the treatment phase, however, which could have given more opportunity to notice details that were not previously included in their pictures. Within the curricular lesson students are exposed to a few examples of basic tree needs, ecosystem elements, and anatomy, but when brought into natural environments, students had the opportunity to explore many more. Looking at the cartoon tree pictures included with the curriculum materials and online resources effectively display the canopy, trunk, and roots but seeing many real trees the students were able to see the odd mid trunk branches, crooks and bends, and above ground roots. The presence of bugs in the assessment pictures grew, displaying that our time outdoors had given them additional examples of tangible ecosystem elements that they have interacted with. One student in particular ran from tree to tree shouting the names of the various bark colors as they discovered them. "Red! Yellow!

Brown! Gray!". The second sub-question asks if the inclusion of frequent short duration outdoor learning tasks, in conjunction with an indoor science lesson, increases the students' application of scientific content knowledge and behaviors outside of structured learning times. This has been somewhat absorbed into the results of the primary research question. Given the slim increases seen in the summative assessment scores, I see it as critical to view the students observed application outside of the lesson as indicatory of their content knowledge understanding. There were substantially more observed applications of understanding in discussions with peers throughout the treatment section. The unstructured environment and real-life phenomena at their fingertips seemed to prime the students for discussion that was not taking place within the classroom. Multiple observed discussions involved claims with evidence, an advanced scientific practice. These observations make me feel much more strongly that over time the inclusion of outdoor learning time would benefit the acquisition and application of science content knowledge further.

Sub-question 1, investigating student attitudes towards learning with outdoor learning tasks, became the most interesting question for me to examine. Student responses, at face value, trended in an unexpected direction. My idea was that students would enjoy being outside, and regardless of the academic benefit, would rate themselves as liking the treatment group lessons at a high rate. The reality was much more nuanced, and I suspect is influenced by a few additional factors. Primarily, weather and appropriate clothing were the biggest noted concern from students. In the exit ticket collection interviews, over 80% of negative responses referenced the cold temperatures outside. The constrictions of my own due dates necessitated that the outdoor learning take place in March and early April, a cold and wet time to be learning outdoors in

Iowa. Secondly, on closer inspection, the trendlines of student responses seem to start to point in the direction of my initial prediction. The positive ratings for the non-treatment lessons start very strong but show a generally negative trend line as data collection goes on. In reverse, the positive rating for the treatment data started relatively low but quickly grew as the section continued. This pattern speaks to a wider concern that I believe had an impact on these results, routine. Kindergarteners are particularly fond of structured routine. They can predict and settle into a schedule, and that routine supports their learning. Non-treatment lessons existed within the established routine, and the treatment group lessons were not only unfamiliar, but outside of the procedures we had practiced all year. It could also be that the students are much more impacted by the content of the activity than they are affected by the location of the lesson. Anecdotally from the teacher's perspective, though, students were equally as engaged in the activities outdoors as they were indoors.

Value of the Study and Consideration for Future Research

I think that the results from this research project provide many more interesting questions than answers. There was an indication from the summative assessment results that students were learning at least as well outdoors as they did indoors if not slightly better, but there were variations in how much they seemed to enjoy going outdoors. They also applied their learning much more readily outdoors despite not liking the weather. I am curious, if the study were to be recreated in May or August, what kinds of results we would see. I am also curious what the results would look like in a classroom that had outdoor exploration time as a learned part of the daily routine. If students were used to going outdoors, and guardians were used to sending them in weather appropriate clothing for going outdoors, I wonder if the noise in the data surrounding weather would quiet down. These results should give educators reasons to try outdoor science education with flexible parameters. There are clues that students benefited from the treatment, but I feel that with changes to the scheduling of the outdoor learning there could be much larger gains. Hopefully, there will be an opportunity in the future to play with these guidelines and try to implement outdoor learning daily or for longer chunks of time to alleviate the rushed transition needed to manage outdoor learning and an indoor lesson.

Impact of Action Research on the Author

The change in routine that came with the treatment section was much harder to manage than I had anticipated. There was already a stretch for the time to get everything done daily in an elementary classroom and the need to find more time to have students put on coats, line up, and walk outside exacerbated that challenge. Often students did not have coats that were adequate for the cold weather we experienced, and that required either more time to locate and borrow attire or adjustments to a shorter outdoor learning experience. This could have been avoided by possibly planning science right after recess time when students were already dressed and outdoors. Additionally, there were multiple days in which we completed the treatment or non-treatment activity but ran out of time to complete an exit ticket. This study felt often like I was fighting against the clock to get everything done while still teaching each required lesson fully. Moving forward with this knowledge, I believe that there are ways to schedule outdoor learning opportunities differently to cut down on transitions and include more activities in sequence once we are already outdoors. When we had finally made it outdoors and were immersed in an activity, the opportunities available to the scholars became much more visible. There was a tangible benefit to outdoor learning, but I needed to fine tune the scheduling to better reflect the students' needs as well as my own. As the educator, I did really enjoy the time that we got outside. Particularly in nicer weather, the kids had the chance to run around, shout, grab things, etc. Ways to interact with science that are not feasible indoors felt freeing and fun outside. The different perspective on studying science with young students enlightened my philosophy. I have continued to incorporate outdoor lessons into our science units but with less frequency throughout the week. The times that we have been outdoors incorporate longer, complete lessons and outdoor opportunities to learn without the additional transitions. Additionally, we have been able to select days with weather that lends itself to the activity we would like to complete.

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APPENDICES

APPENDIX A

IRB EXEMPTION

Protocol Information

Version # 2

Reference Number:	1138
Protocol Number:	2024-1138-EXEMPT
Title:	Inclusion of Outdoor Learning Activities on Elementary Science Learning Outcomes
Protocol Type:	Amendment
Principal Investigator:	Smith, Benjamin
Submit Date:	1/31/2024 7:09 PM
Protocol State:	Approved

APPENDIX B

SUMMATIVE ASSESSMENT SCORING PAGE

SUMMATIVE ASSESSMENTS Scores should be recorded as decimal percentages (ex. 3/5 = .6)														

APPENDIX C

OBSERVATION FORM

Possible Behaviors:

- Applying science standard information to a noticed phenomenon
- Applying science standard information to a peer's question
- Noticing patterns from science standard lessons in a natural setting
- Asking questions about a natural setting that link to science standard topics

	Date	Observed Behavior	Standard Area
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			

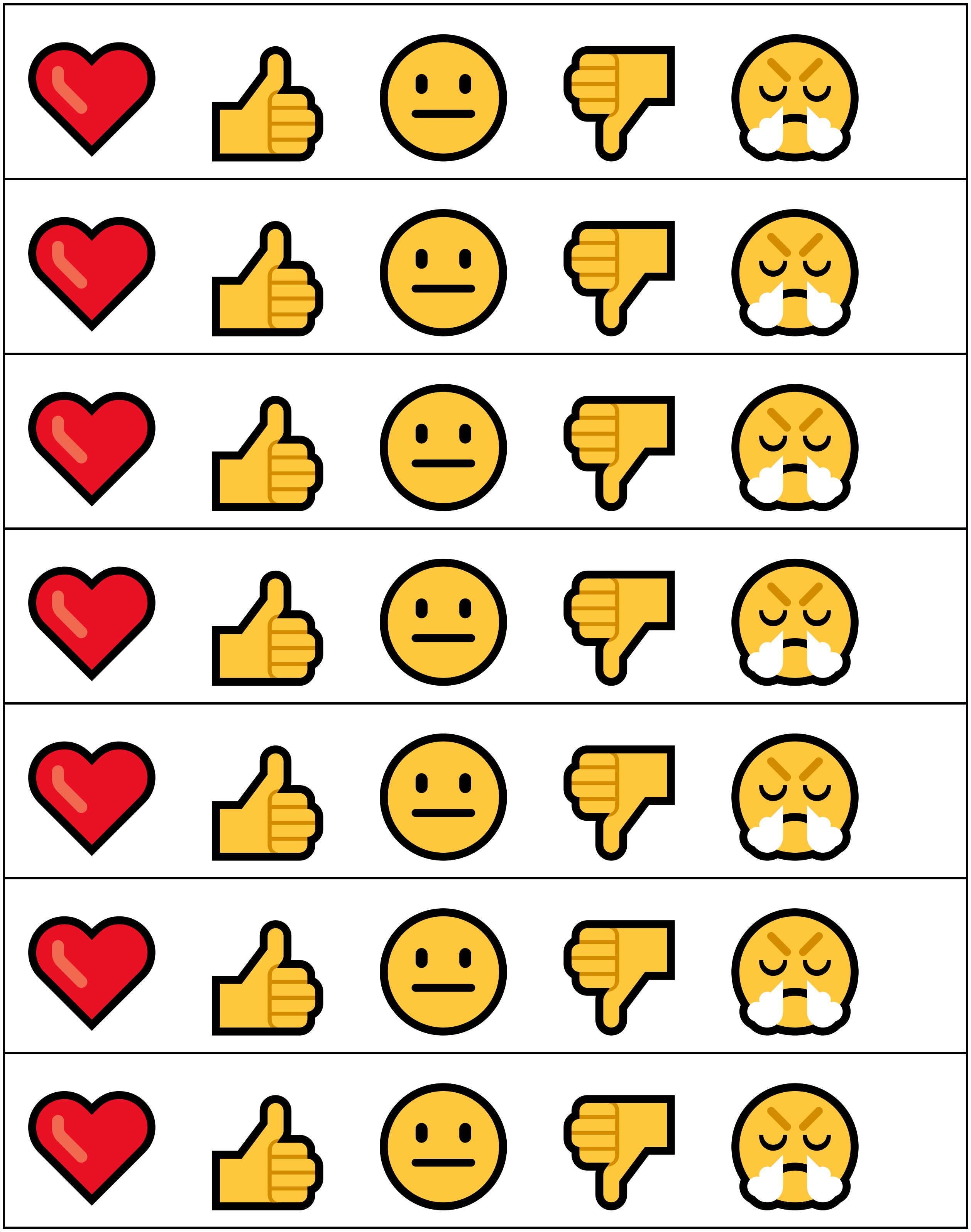
APPENDIX D

INTERVIEW FORM

Date	Question + Response	Connecting Themes
	What did you notice? Wonder? Would you like to tell anyone about *(insert content target area)* ? Would you like to do this activity again tomorrow?	

APPENDIX E

ATTITUDE EXIT TICKET



APPENDIX F

ATTITUDE NOTES FORM

Week _______	
Common Response Themes	Sample Quotations
Activity sparked interest	
Activity didn't go as hoped	
Missing a relative or trusted adult	
Unsure of the cause	
Outliers	

APPENDIX G

OBSERVATIONAL DATA ANALYSIS SHEET

Standard Area	Common Themes in Student Behavior
Ex. "**K-PS3-1** Make observations to determine the effect of sunlight on Earth's surface"	**Example** • Noticing that rainwater dries more quickly on plants in the direct sunlight (observations 1, 3, and 4) • Asking questions about where to move the classroom plants (observations 3 and 6)

APPENDIX H

INTERVIEW PATTERNS RECORDING SHEET

Week _______	
Common Response Themes	Sample Quotations
Outliers	

APPENDIX I

ATTITUDE RECORDING CALENDAR

Encoding for Attitude States Love it (5) Like it (4) It was fine (3) Don't like it (2) Hated it (1)										
Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date

APPENDIX J

SUMMATIVE ASSESSMENT RUBRIC

	1	2	3
Depict anatomy of a tree	Includes fewer elements than outlined in 2	Includes canopy, trunk, and roots (or drawn connection to ground)	Displays anatomical features beyond 2 (i.e. detailed roots, branches, fruit)
Depict needs of a tree	Includes fewer elements than outlined in 2	Includes rain/water, soil, and sunlight	Displays advanced detail beyond 2 (i.e. human care, storms, fires)
Depict basic ecosystem components	Does not include any components of an ecosystem	Includes at least one living companion of a tree (i.e. animals or plants)	Includes more than one living companion of a tree