Yoga: A New Way to Approach Environmental Education?

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January, 2015

Submitted in fulfillment of the senior thesis requirements of the Department of Environmental Science at Allegheny College and approved by the senior thesis committee.

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ABSTRACT

Environmental educators are beginning to realize that individuals need more than just information to evoke real behavioral change that benefits the environment. Instead, individuals need experiences (e.g. hands-on activities, field trips, etc.) to bring about such change. Yoga, which is a mind, body, and spirit experience, emphasizes physical activity as well as evokes environmental awareness through its philosophical viewpoints. Thus, yoga has the capacity to evoke environmental behavioral change. This project sought to determine if incorporating yoga into environmental education increases environmental understanding among elementary school students. This work took place at the Environmental Charter School in Pittsburgh, PA where I taught four environmental life cycles to two sections of kindergarten students with twenty-five students per section. I met with both sections four times over the course of one month for sixty minutes each time. In teaching the four lessons, one section was taught about the given environmental life cycle only (control group) whereas the other section was taught about the given environmental life cycle in conjunction with yoga. In order to account for a multitude of variables, I alternated the section that received yoga in conjunction with the lesson each time I taught. To assess the effectiveness of incorporating yoga into environmental education, I administered pre- and post-assessments that directly related to each of the four environmental life cycles taught. Overall, the presence of yoga did not increase students' environmental understanding. However, variations were detected between the two sections and among topics, suggesting that in some cases, yoga did increase student learning of environmental lessons. These findings indicate that age, level of complexity of the topics, previous exposure to the topics, the type of school, and teaching and learning styles all influence the results.

INTRODUCTION

Environmental Education

According to a recent survey conducted by the National Science Foundation, 25% of Americans thought the sun revolves around the earth (Grossman, 2014). This lack of basic scientific knowledge is not unusual, however. Similarly, a lack of basic environmental knowledge exists despite decades of environmental education programs and the overwhelming number of people who indicate they want to protect the environment (Feinberg, 2013; Kollmuss & Agyeman, 2002; Schultz, 2002; Pooley & O'Connor, 2000; Scott & Willits, 1994). It is curious then, why does such a disconnect exist? To answer this question, it is important first to consider how environmental education is defined and what it aims to accomplish.

Historically, environmental education is defined as "…producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution" (Stapp, 1970). Although this is still a widely accepted and cited definition, there has been some debate among scholars of environmental education on defining the term (Disinger, 1998; Archie & McCrea, 1996). Specifically, as the field of environmental education has progressed and evolved, so too has its definition. In 1996, The National Environmental Education Advisory Council (NEEAC) defined environmental education as "…a learning process that increases people's knowledge and awareness about the environment and associated challenges, develop[ing] the necessary skills and expertise to address these challenges, and foster[ing] attitudes, motivations, and commitments to make informed decisions and take responsible action" (Disinger, 1998). Although there are several other definitions of environmental education, the majority of them still include terms such as 'knowledge,' 'aware,' 'motivate,' 'critical thinking,' and 'responsible actions' (Disinger, 2001). Further, many of the other definitions are just modifications, extensions, and/or re-considerations of the definitions provided by Stapp and the NEEAC (Disinger, 1998).

As environmental education is evolving in the 21st century, environmental educators and scholars are not as interested in re-defining environmental education (Monroe, *et al*., 2008). Rather, the interest lies in providing environmental educators with a framework that aids them in conveying information, building understanding, improving skills, and enabling sustainable

actions (Monroe, *et al*., 2008; Gahl Cole, 2007). More recently, the United States Environmental Protection Agency (EPA) (2014) defined environmental education as "…a process that allows individuals to explore environmental issues, engage in problem-solving, and take action to improve the environment. As a result, individuals develop a deeper understanding of environmental issues and have the skills to make informed and responsible decisions." Although this is considered to be a "newer" definition of environmental education, it is evident that it is merely a modification of the original definition.

Based on its definitions, environmental education has several goals. Considered to be a seminal article, the Tbilisi Declaration provides the framework for the goals and objectives of environmental education. According to this document, the *goals* of environmental education are three-fold: 1) to nurture a clear understanding of how ecological, political, social, and economic factors influence each other, 2) to offer individuals opportunities to gain the "…knowledge, values, attitudes, commitment and skills needed to protect and improve the environment," and 3) to encourage individuals, groups, and societies to develop new behaviors towards the environment (UNESCO-UNEP, 1978; Stapp, 1970). Thus, it can be said that the primary goals of environmental education are to cultivate citizens that are environmentally literate and to encourage behavior that is environmentally responsible (Culen, 1998; Stapp 1970). Further, the *objectives* of environmental education are to impart knowledge and skills, foster awareness, refine attitudes, and encourage active participation so as to "create" an individual that interacts with the environment in a more positive way (UNESCO-UNEP, 1978; Stapp, 1970).

Environmental education, stemming from nature study and conservation education, has been in existence since the eighteenth century, but it was not until 1970 that the environmental education movement really began (Hungerford, 2010; McCrea, 2006). During the next seven years, the Stockholm Declaration, Belgrade Charter, and Tbilisi Declaration laid out goals, objectives, and guiding principles of environmental education (Hungerford, 2010; McCrea, 2006; Palmer, 1998). More recently, Congress passed the National Environmental Education Act in 1990 which put pressure on the United States EPA to provide nationwide leadership in increasing environmental literacy (Potter, 2010). With the increased awareness and attention given to current environmental concerns such as global climate change, scholars are now suggesting that it is time to think about new environmental education legislation that is more

universal in nature and that allots more funding for grants, research, and teacher training (Potter, 2010).

Challenges of Environmental Education

Environmental education has many good intentions; however, much like with any field, there are critics of environmental education who point out the challenges that interfere with this type of education from reaching its primary goals. If the goals of environmental education are to create environmentally literate and responsible citizens, it is important to acknowledge what these shortcomings are so that they can be addressed and solutions to rectify them can be instituted.

Environmental education is interdisciplinary in nature as is evident in the definitions. Therefore, to teach environmental education well requires the educator to integrate scientific knowledge (e.g. teaching about natural resources), incorporate psychological understanding (e.g. influencing a change in attitudes and behaviors), provide insight into political science (e.g. teaching skills necessary for responsible action), and impart understanding in economics (e.g. teaching about weighing costs and benefits) (Saylan & Blumstein, 2011; Sanera, 1998). However, for most educators, especially those teaching kindergarten through twelfth grade, this is challenging because many schools want teachers to be trained in one particular area of study (e.g. math, English, social studies, etc.) (Sanera, 1998). Consequently, for those educators who do bring environmental education into their classrooms, they typically only pick one piece of the definition (e.g. teaching the knowledge, imparting the skills, or promoting the action) (Disinger, 2010; Sanera, 1998). Thus, for those students lucky enough to have exposure to environmental education, they are often only receiving a small portion of the larger and more complex environmental "story" (Weilbacher, 2009).

When students are exposed to environmental education, they are often preached to or given large amounts of information to try to digest rather than actively engaging in problem-solving, field trips, or hands-on activities. Saylan and Blumstein (2011) conclude that environmental education experiences that are meaningful to educators are not necessarily meaningful to students because the experiences often fail to make a relevant connection to the students' personal experiences. Moreover, much of the environmental information that students receive is coated with elements of propaganda and/or despair (Marcinkowski, 2010). As a result,

environmental education distances students from the environment by making them feel powerless to bring about change and causing them to believe they are incapable of dealing with environmental problems (Saylan & Blumstein, 2011; Orr, 2004; Sobel, 1996). Thus, for environmental education to be successful, it must place an emphasis on instilling hope and confidence while also informing individuals and asking them to act on what they are being taught (Saylan & Blumstein, 2011).

Another primary obstacle to environmental education and literacy is the disconnect between individuals, primarily students, and the environment. This disconnect is driven by several factors. First, as a result of technology, children have become more removed from interaction in and with the natural world (Weilbacher, 2009; Louv, 2005). The current generation of children and young adults seldom go outside to interact with nature and would rather be indoors "…where the electrical outlets are" (Louv, 2005). Louv (2005) points out that one-third of children six months to six years of age live in households with the television on all or most of the day while children eight years to eighteen years of age spend a daily average of six and a half hours (forty-five hours per week) plugged in electronically, often to multiple devices at the same time. Second, it is thought that another pivotal force driving the disconnect is fear parents have of letting their children play outside whether it be a fear of traffic, crime, and/or strangers (Saylan and Blumstein, 2011; Louv, 2005). This disconnect has negative consequences for the individual such as problems focusing, increased rates of physical and emotional illness, and decreased use of the senses (Weilbacher 2009, Louv 2005). Thus, Louv (2005) argues that playing and being outside in nature is no longer a luxury, but a necessity vital to ensure the health of current and future generations.

Finally, governmental policy has further contributed to deficiencies in environmental education, specifically with the enactment of the No Child Left Behind Act (NCLB) of 2001. As a result of this act, emphasis is placed on testing students' knowledge in core subjects, primarily math and language arts (Chesapeake Bay Foundation, 2009). Consequently, the amount of instructional time for science and social studies – the subjects in which environmental education are traditionally taught – is drastically reduced (Chesapeake Bay Foundation, 2009). Sadly, at a time in our history when environmental education is needed, NCLB has caused it to be pushed aside just because environmental literacy/education does not appear on state-wide tests (Saylan & Blumstein 2011; Chesapeake Bay Foundation, 2009). Therefore, current and future

generations of students who graduate will not be equipped with the knowledge and skills to tackle the environmental challenges they will encounter on an individual, national, and global level.

As critiques of environmental education have shown, a disconnect remains between individuals and the natural environment. Thus, environmental educators are starting to realize that individuals need more than just information to evoke real behavioral change. It was once believed that knowledge led to a change in attitude which ultimately resulted in individuals changing their behavior(s) and taking action (Heimlich *et al.*, 2013). However, recent studies have shown that although knowledge does appear to have significance, generally it is not enough to change behavior (Heimlich *et al.*, 2013). Rather, it has been shown that when individuals have experiences (e.g. field trips, hands-on activities, etc.), they are more inclined to evoke behavioral change as a result of those experiences (Heimlich *et al.*, 2013). Further, environmental educators are suggesting that environmental education incorporate other disciplines that approach sociocultural and environmental concerns in unique and holistic ways (Gahl Cole, 2007).

Yoga as a Lifestyle

In popular Western culture, yoga is often merely viewed as a form of physical activity. However, while it certainly is a form of exercise, in its truest sense and for individuals who practice it in other cultures, such as India – where it originated thousands of years ago – yoga is a holistic lifestyle and/or philosophy. When yoga is practiced in this way, the practitioner brings awareness to all aspects of life such as how one is in relationship with others, how one interacts with the world around oneself, one's attitudes towards oneself, and one's diet. In this respect, yoga is not only about the physical practice of doing asanas (yoga poses), but it is also a mental and spiritual practice. Consequently, yoga – which is translated to mean 'union' – is often said to be for the purpose of uniting, integrating, and/or balancing the body, mind, and spirit. In uniting these three causal bodies, yoga can cultivate awareness, self-regulation, higher consciousness, and harmony in the body, mind, and spirit of the practitioner (Surrenda, 2012). In addition to it being a lifestyle, this increased self-awareness and refined mindfulness that yoga fosters are what distinguish it from other forms of exercise (Surrenda, 2012).

Yoga is a lifestyle. This lifestyle includes physical activities and philosophical viewpoints that have demonstrated a capacity to alter mental and physical well-being. A ten-day

study found that incorporating yoga reduced the risk for cardiovascular diseases and diabetes mellitus (Bijlani *et al*., 2005). The intervention, which placed emphasis on asanas (postures), pranayama (breathing), yoga theory and yoga in daily life, and nutrition, found that even a short lifestyle alteration among the participants yielded a reduced risk for cardiovascular diseases and/or diabetes mellitus. Another study, which evaluated changes in pain, anxiety, depression, and spinal mobility in patients with chronic lower back pain (CLBP), employed a seven-day intervention program consisting of asanas that specifically targeted back pain as well as pranayama, meditation, and lectures on yoga theory (Tekur *et al*., 2012). The results from the study indicated that of the 80 participants, 49% experienced a reduction in pain, 20.4% had reduced anxiety, 47% experienced a reduction in depression, and 50% had improved spinal mobility. Similar to the conclusions drawn by Bijlani *et al*., this study also found that a short-term, but intensive and comprehensive yoga program can reduce pain, anxiety, and depression while improving spinal mobility in patients with CLBP more effectively than physical therapy exercises. Of the 81 studies reviewed that compared the effects of yoga and exercise, yoga is as effective as if not better than exercise at improving a variety of health-related outcome measures in both healthy and diseased populations because yoga is a holistic approach that includes a multitude of components (e.g. nutrition, exercise, attitudes, etc.) (Ross and Thomas, 2010). Moreover, yoga has the capacity to play a protective and preventative role in maintaining mental health as well as aiding in the treatment of mental health disorders, thus suggesting the ability for yoga to impact behavioral changes (Balasubramaniam *et al*., 2013; Khalsa *et al*., 2012; Harvard University – Medical School, 2009). Although I found no studies documenting the influence of yoga on environmental education, it is clear that when people have adopted the physical activities and philosophical approaches of yoga, one's quality of living and well-being has physically and mentally improved.

Yoga & Environmental Education

Development of a holistic intervention program on environmental education could help to link the components of knowledge → attitudes → behaviors/action together. An intervention that is holistic and involves all aspects of an individual's life has real potential to change targeted habits and instill long-term behavioral change (Tekur *et al*., 2012; Bijlani *et al*., 2005). One way

to achieve this is to incorporate yoga into an environmental education program because yoga not only emphasizes physical activity, but also environmental awareness (Kraftsow, 2002).

Yoga, which means 'union,' is about more than just exercise. Rather, it is about a certain lifestyle that places emphasis on a union among mind, body, and spirit as well as interconnectedness to all living things (Living Yoga – Living Building, 2013; Comstock, 2010; Fields, 1998). Thus, it becomes clear how there is a connection between yoga and the environment. Every time union is experienced, the individual becomes more sensitive to the positives and negatives of the world and a deeper sense of compassion is cultivated (Living Yoga – Living Building, 2013). Moreover, the tradition of yoga consists of techniques that can raise environmental awareness. For example, the practice of asana (postures) and pranayama (conscious breathing) nurture "enhanced awareness" of the environment by increasing sensitivity (Bertzeletos, 2006; Bowery, 2003). As many yoga poses draw on inspiration from nature and the environment (e.g. mountain pose, cobra pose, camel pose, fish pose, and tree pose), the poses teach an individual how to stand and be like that which they represent (Burkhart, 2011; Fields, 1998). The poses also help the individual to explore similarities with, and acknowledge their connections to the other beings with which they co-inhabit the earth. Consequently, on the yoga mat, the individual can cultivate the passion and skills needed so that when one is off the mat, the interconnection can be remembered (Comstock, 2010). Although time spent on the mat is important, yoga is about more than just being on the mat. Rather, it is a way for an individual to fully engage in the story of the earth (Comstock, 2010).

Further, yoga enables the practitioner to come into one's body and experience the present moment. Through bringing one's attention to the now, one is able to slow down and become more aware of one's actions and the effect such actions have not only on the individual, but on others and on one's natural surroundings (Comstock, 2010). It is through tuning into the interconnection that activism can happen (Comstock, 2010). More specifically, over time, the effect of experiencing union is collective and a greater appreciation for the complexity and pricelessness of life results (Living Yoga – Living Building, 2013). Thus, as a practitioner of yoga experiences deeper connections, s/he understands that all decisions really do matter and affect the collective web of life (Living Yoga – Living Building, 2013; Saraswati, 2002).

Finally, the ethical teachings of yoga fit appropriately with those of environmental precepts. For example, non-violence (ahimsa) limits the harm and destruction done to animals

and the earth and as the body becomes more sensitive, it becomes more difficult to cause harm to any life form (Yoga Loka, 2014; Fields, 1998). Furthermore, non-possession/non-attachment (aparigraha) encourages a decrease in consumption of unnecessary material items (Yoga Loka, 2014; Fields, 1998, Chapple, 1995). Through the ethical practice of purity (saucha), the practitioner becomes more attuned to environmental issues such as pollution (Fields, 1998). Lastly, the ethical teaching of acknowledging and being aware of the divine (ishvar-pranidhana) in everything makes it difficult to knowingly hurt and/or misuse the earth and the environment (Yoga Loka, 2014; Rubin, 2014).

This project seeks to answer the question: does yoga in conjunction with environmental education increase environmental understanding in elementary school students? Considering the high success rate yoga has had in improving health-related ailments, it would seem as though yoga could be incorporated into environmental education and used as a holistic intervention tool to help enhance environmental awareness and change attitudes because it highlights the interconnectedness of all life forces. Furthermore, because yoga does take a stance on how one should interact with the natural world, it could help participants come to understand the importance of the environment and perhaps make them want to begin to take more ownership for how they interact with it.

METHODS

Research Design & Data Collection

To assess the effectiveness of incorporating yoga into environmental education as a means to increase students' environmental understanding, I implemented a program in which I taught four environmental life cycles as well as yoga to two kindergarten sections of twenty-five students per section. I met with both of the sections four times over the course of four weeks for sixty minutes each time.

The lessons delivered, which both sections received, included: the water cycle, the carbon dioxide-oxygen cycle, the life cycle of a corn plant, and the life cycle of a chicken. These four life cycles were chosen because each cycle builds upon and impacts the other. For example, the corn plant, which relies on the water and carbon dioxide-oxygen cycles for growth, is relied upon for food by the chicken. Thus, in teaching these four life cycles, it was hoped that students would begin to understand how environmental life cycles are interconnected and interdependent.

Upon receiving permission from the Environmental Charter School (ECS) and Allegheny College's Institutional Review Board, I conducted my work with the ECS in Pittsburgh, PA throughout May 2014. The Environmental Charter School is a tuition-free, public charter school that serves six hundred thirty-five students in kindergarten through eighth grade. The education at the ECS has a strong focus on the environment and social action. Moreover, a hands-on approach is frequently incorporated in the curriculum.

In delivering the four lessons, one kindergarten section was taught one of the environmental life cycle lessons without incorporation of yoga (control group) whereas the other section was taught about the given environmental life cycle in conjunction with yoga. To account for a multitude of variables, including the intelligence quotient of both sections, I alternated the section that received yoga in conjunction with the lesson each time I taught (Table 1). Hence, each section received two lessons with and two lessons without yoga.

Table 1. List of kindergarten sections receiving yoga for the four environmental life cycle lessons that were taught.

Topic	Section	Yoga
Water Cycle	1	No
	2	Yes
CO_2-O_2 Cycle	1	Yes
	2	No
Corn Cycle	1	No
	2	Yes
Chicken Cycle	1	Yes
	2	No

Throughout all four of the lessons, both sections participated in in-class discussions through answering questions as well as hands-on activities that corroborated what had been taught earlier in each of the lessons. In addition to this, students in the yoga section, which alternated each time, learned about the given environmental life cycle while simultaneously learning yoga postures (asanas) that complemented and reinforced the content presented about the environmental life cycle (Appendix 1). For example, to demonstrate 'precipitation' from the

water cycle, students were asked to be in Rain Pose – Wide Angle Forward Bend as the yoga pose is classically called – while bringing their arms and hands down in front of them as if they were water droplets. Students in this section actively participated through performing the yoga postures which had them embodying the life cycle (Fig. 1).



Figure 1. One section of kindergarten students learning about the life cycle of corn through discussion (above) and embodying the steps of the life cycle through participating in yoga (below).

Pre- and Post-Assessments

To gauge the students' environmental understanding before and after participating in the program, I administered pre- and post-assessments that directly related to each of the four lessons. More specifically, I created assessments that had four images of the given life cycle that I was teaching about on that particular day. Before any of the lessons were taught, I administered all four pre-assessments (Fig. 2) that corresponded to the four lessons that I would be teaching. The students received the assessments that had four images per assessment and they were asked to circle which image they thought correctly depicted the particular life cycle. These assessments, which had the student's name on it, were collected and then the first lesson – the water cycle – was delivered. At the conclusion of each lesson, I administered an assessment to the students. This post-assessment (Fig. 3) corresponded to the lesson that had just been taught and had the same images as the pre-assessment, except that the images had been rearranged on the page. Based on what they had learned in the given lesson, the students were asked to circle which image they thought correctly demonstrated that particular life cycle. The pre- and post-assessments were used as a way to measure changes in students' comprehension of environmental topics.

Lesson Plans

Lesson plans were prepared for each of the four environmental life cycles in the assessment (Appendix 1).

Statistical Analyses

I used SigmaPlot Version 12.5 to perform the Wilcoxon Signed Rank Test to compare differences among topics, between class sections, and between yoga versus no yoga.

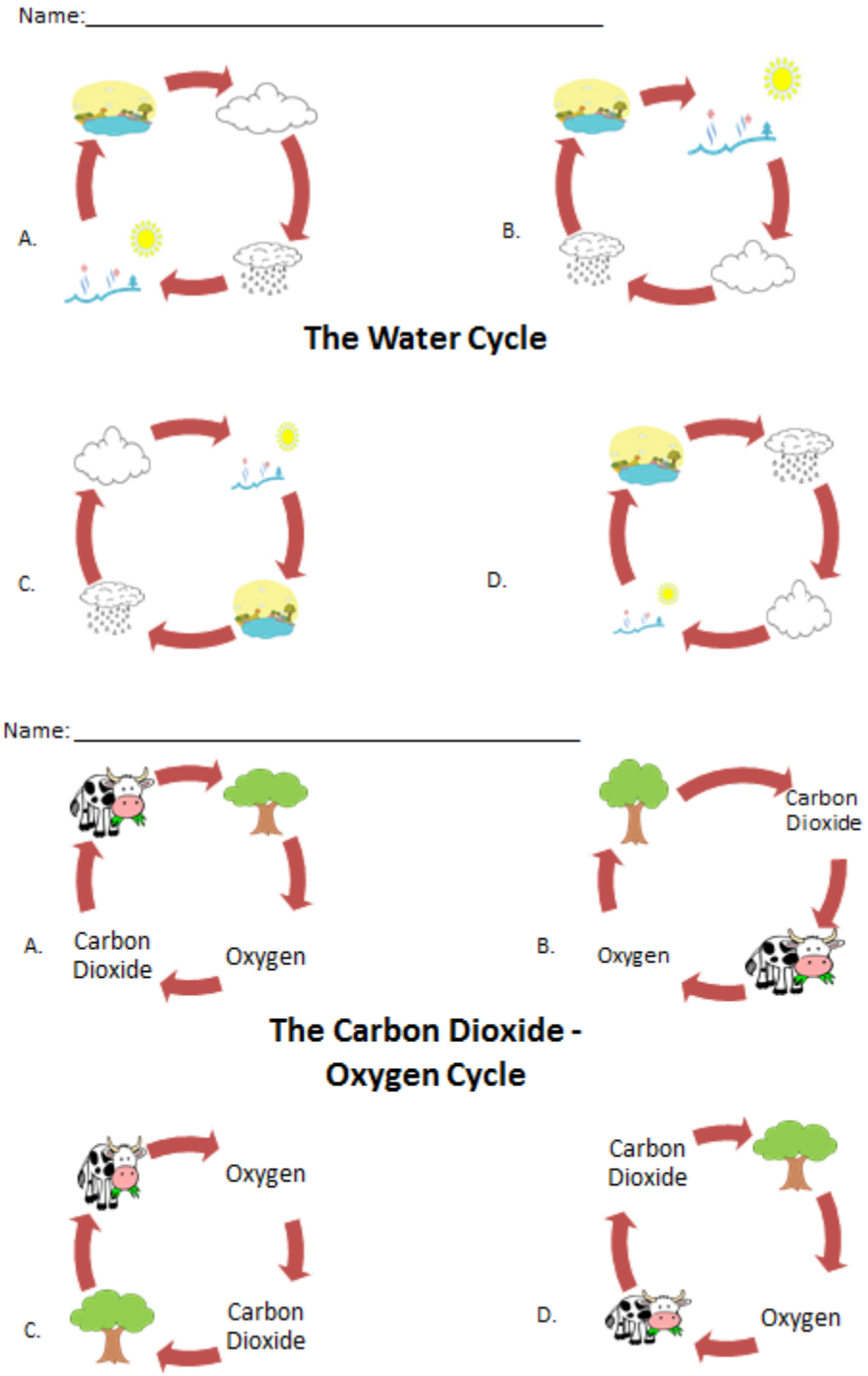

Figure 2. Pre-assessments used to assess the effectivness of incorporating yoga into environmental education for kindergarten students.

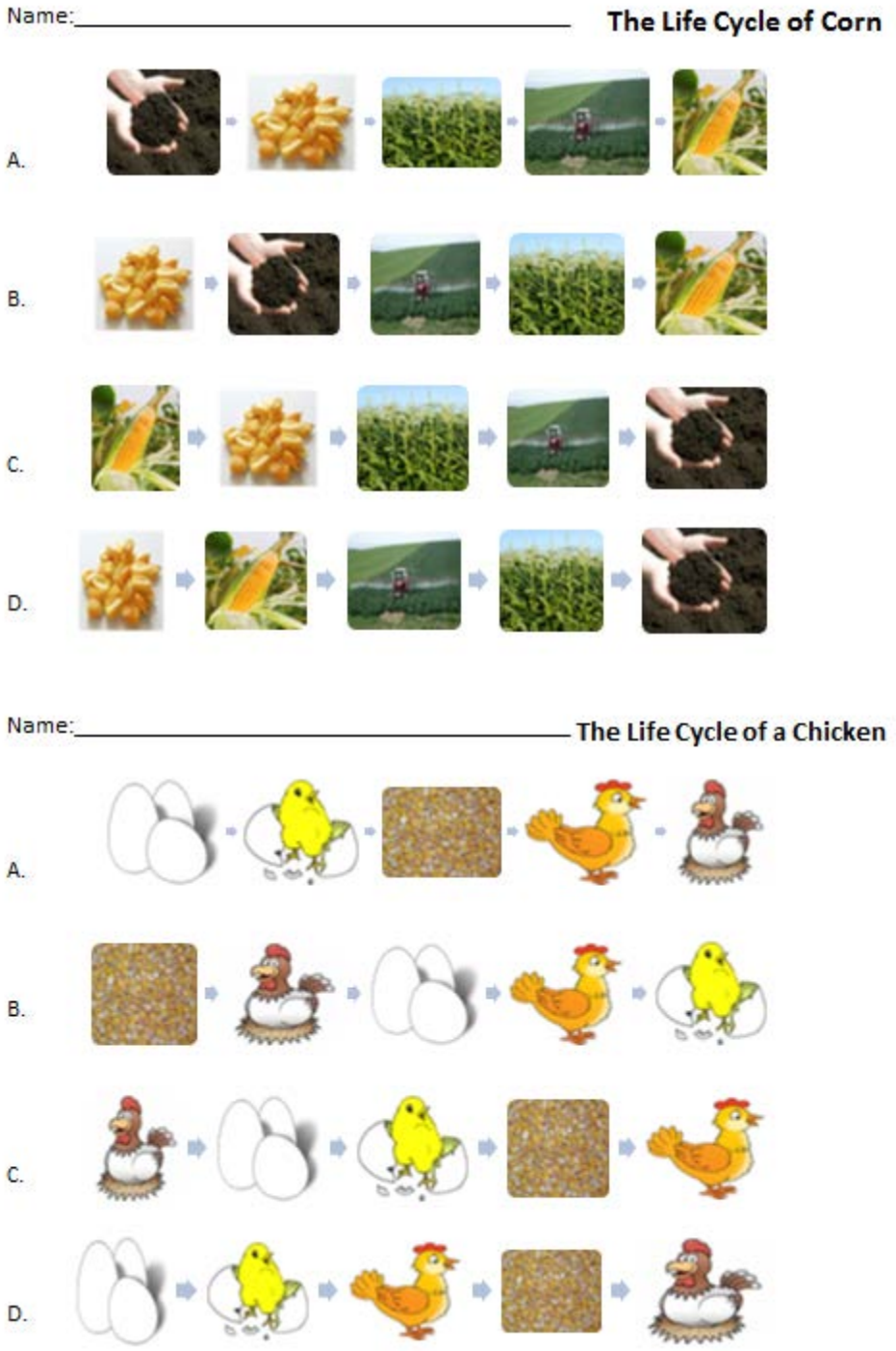

Figure 2. Continued

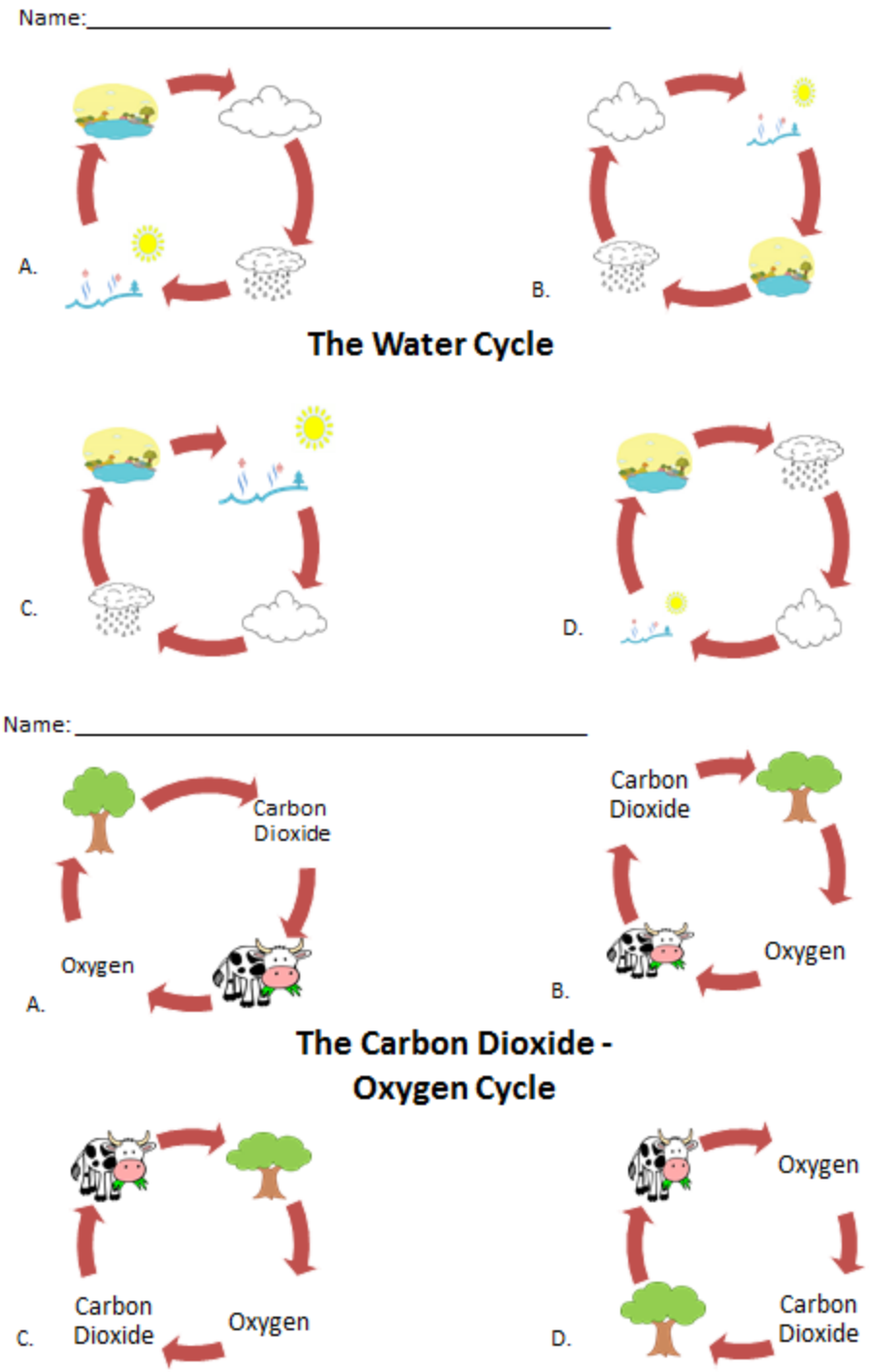

Figure 3. Post-assessments used to assess the effectivness of incorporating yoga into environmental education for kindergarten students.

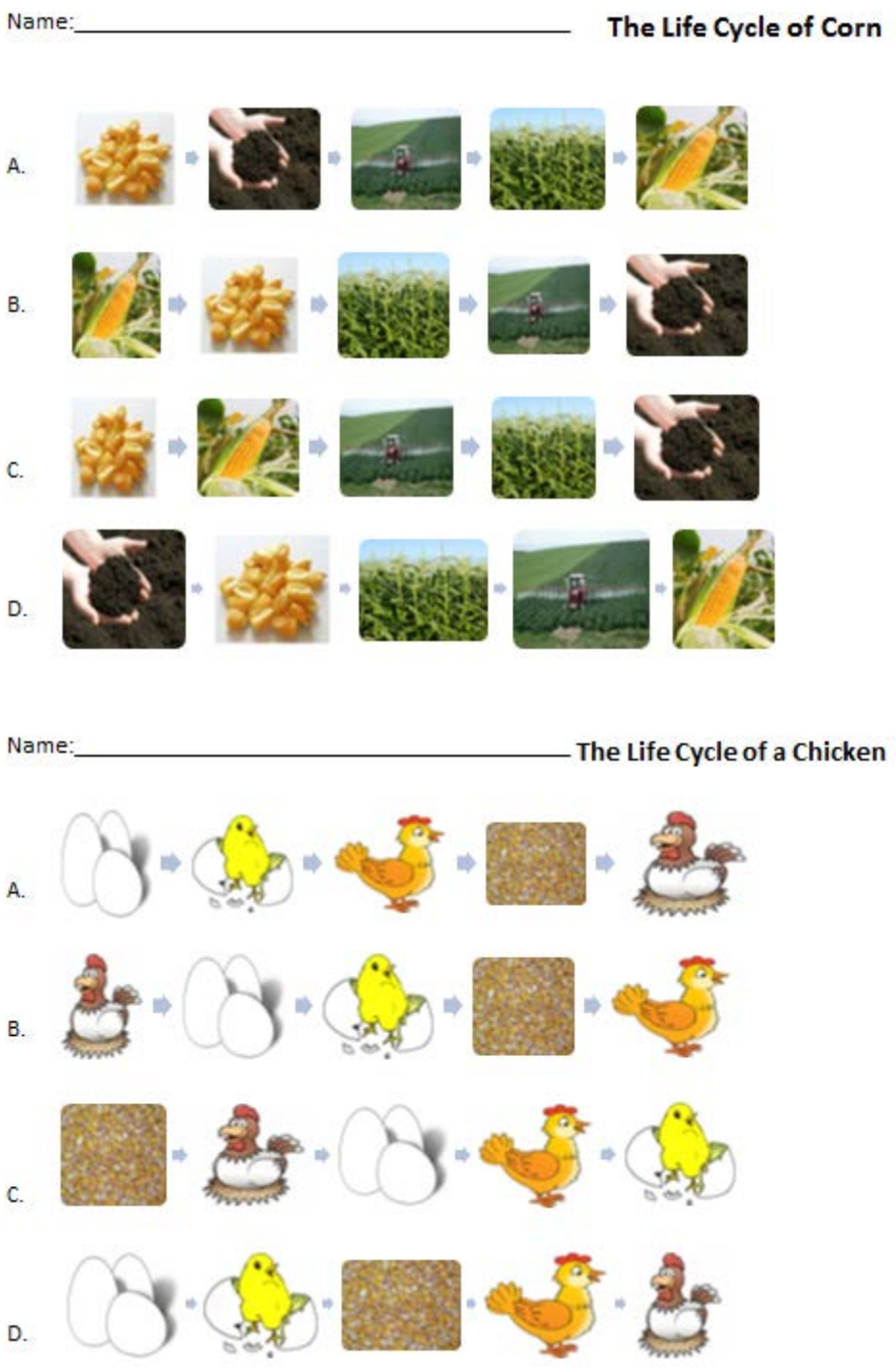

Figure 3. Continued

RESULTS

By Section, Topic, & Yoga

Throughout the four lessons, there was variability in responses among topics and sections, where a section is one class of kindergarten students. In the water cycle lesson, taught to the first section without yoga, students showed an increase in comprehension (160%, Table 2) based on the test results from pre-assessment (x=0.20) to post-assessment (x=0.52). In contrast, the water cycle lesson, taught to the second section with yoga, showed no change in comprehension. The carbon dioxide-oxygen cycle lesson with yoga, taught to the first section, was significantly increased, with a four-fold increase in understanding of the lesson. In contrast, the same lesson taught without yoga to the second section had no significant change in comprehension as demonstrated by the test scores. Finally, neither the corn nor the chicken lessons taught with or without yoga to the two sections yielded significant differences in understanding.

By Section & Yoga

Of the two sections, the test scores of the first section increased significantly (63.3%, Table 3) between pre-assessment (x=0.40) and post-assessment (x=0.65) with yoga. Without yoga, section one increased 93.3% from pre-assessment (x=0.30) to post-assessment (x=0.58). Section two displayed no significant change in scores from pre-assessment to post-assessment, either with or without yoga.

By Yoga vs. No Yoga

For both sections combined, incorporation of yoga yielded no significant difference in learning outcomes based on post-teaching assessment scores (Fig. 4). In contrast, no yoga yielded a significant difference in comprehension with a 49.3% increase from pre-assessment (x=0.39) to post-assessment for the combined sections (x=0.58).

Table 2. Pre- and post-assessment scores by topic and section with and without yoga (x=mean; SE = standard error).

Topic	Section	Yoga		Before	After	% Increase	p -value	Significance?
Water Cycle	1	No	x	0.20	0.52	160.0	0.020	Yes
			SE	0.08	0.10			
	2	Yes	x	0.38	0.30	-21.3	0.563	No
			SE	0.10	0.10			
CO_2-O_2 Cycle	1	Yes	x	0.08	0.42	420.8	0.008	Yes
			SE	0.05	0.10			
	2	No	x	0.24	0.47	98.9	0.250	No
			SE	0.10	0.10			
Corn Cycle	1	No	x	0.40	0.64	60.0	0.105	No
			SE	0.10	0.10			
	2	Yes	x	0.67	0.65	-2.5	0.820	No
			SE	0.10	0.10			
Chicken Cycle	1	Yes	x	0.72	0.88	22.2	0.250	No
			SE	0.09	0.06			
	2	No	x	0.76	0.70	-8.1	0.750	No
			SE	0.09	0.10			

Table 3. Pre- and post-assessment scores by section with and without yoga (x=mean; SE=standard error).

Sections	Yoga?		Before	After	% Increase	p -value	Significance?
1	No	x	0.30	0.58	93.3	0.004	Yes
		SE	0.06	0.07			
1	Yes	x	0.40	0.65	63.3	0.006	Yes
		SE	0.07	0.07			
2	No	x	0.50	0.59	17.9	0.465	No
		SE	0.08	0.14			
2	Yes	x	0.52	0.50	-3.4	0.524	No
		SE	0.08	0.11			

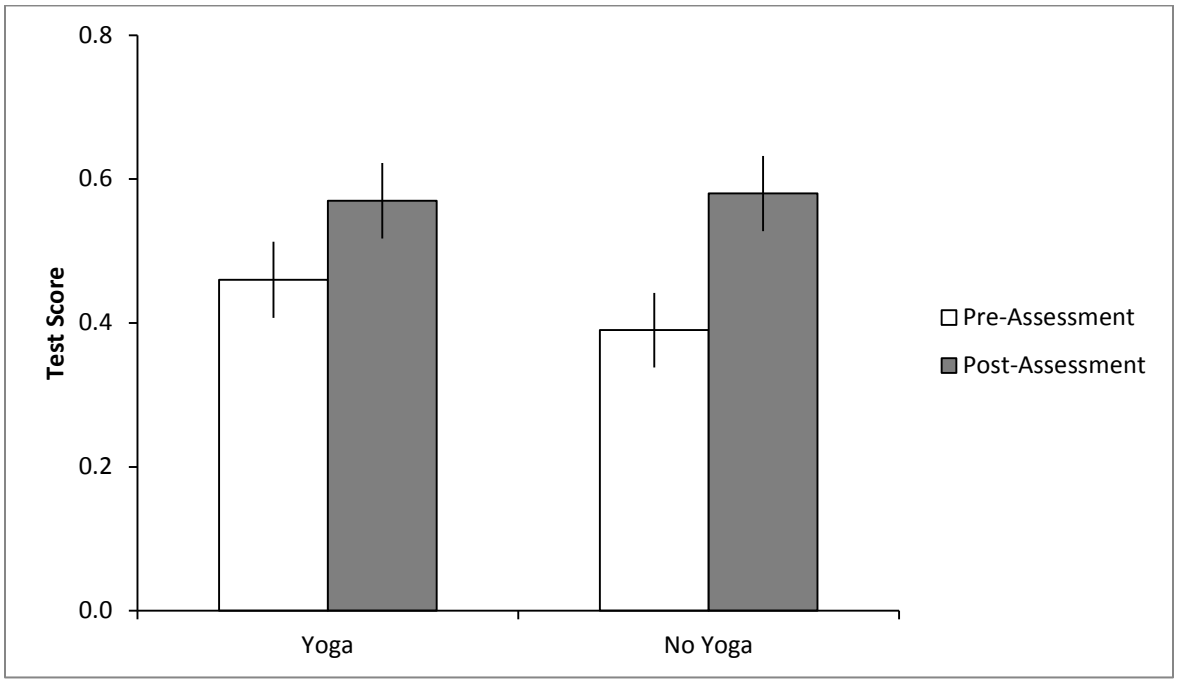

Figure 4. Pre- and post-assessment scores of kindergarten students receiving four environmental life cycle lessons. Scores include lessons delivered with and without yoga to both kindergarten sections combined.

DISCUSSION

By Section, Topic, & Yoga

Yoga did have an influence on student learning of one section of kindergarten with one of the environmental topics taught. Specifically, learning of the carbon dioxide-oxygen lesson improved in the presence of yoga for the first section. Variations among the effectiveness of yoga are most likely due to the level of complexity of the four lessons that were taught. The first two lessons presented – the water cycle and carbon dioxide-oxygen cycle – are much more complex cycles to understand, especially for kindergarten students. For example, the water cycle involves abstract concepts such as "evaporation" and "condensation" which, to fully understand, requires the learner to employ higher-order thinking skills (e.g. analyze, synthesize, and evaluate) (Patsalides & Cosmato, 2012; Teach for America, 2011). Similarly, the carbon dioxide-oxygen cycle is not easily understood because it is a cycle that involves the transfer and exchange of oxygen molecules to animals from plants and carbon dioxide molecules to plants from animals. To add to the complexity, oxygen and carbon-dioxide molecules are gases and thus, invisible and not tangible. Therefore, this makes it a much more difficult cycle for young students, such as kindergarteners, to understand and relate to since most of them have not yet developed the necessary higher-order thinking skills to make sense of this complex cycle.

As early childhood research has shown, children in their first several years of school tend to be literalists who are still developing the ability to think abstractly (Teach for America, 2011; Trundle, 2009). Although young students *can* think abstractly (Gerdes *et al*., 2013), they still need concrete experiences (e.g. touch, taste, see, smell, and hear) because it is through these experiences that learning occurs for young students (Scholastic, 2014; Teacher Vision, 2014; Gerdes *et al*., 2013; Willis, 1993). Moreover, several studies on early childhood development found that children's ideas tend to be unwavering, so even after being taught and having their ideas challenged in the classroom, children often do not change their ideas (Trundle, 2009; Schneps & Sadler, 2003; Russell & Watt, 1990). Teaching abstract environmental concepts to children of this age is possible and worthwhile, however. Nevertheless, these studies suggest that early childhood educators need to consider young children's limited cognitive processing capacities and adapt their teaching approaches accordingly. As studies have shown, the most effective way for young students to learn and engage with topics is through inquiry-based teaching (Davidson, 2009; Trundle, 2009). Although this type of instruction is led by the teacher,

students are still expected to be active participants in the learning activities with the goal of encouraging students to find answers to questions themselves and ask new questions along the way (Davidson, 2009; Trundle, 2009).

Even though incorporating yoga did not increase the students' understanding of the water cycle, yoga did enhance their knowledge of the carbon dioxide-oxygen cycle. As it has been shown, children – especially when they are young and/or the material is difficult – can better understand concepts when they use movement to physically act out the concepts (Fiore, 2014). Thus, this suggests that yoga might be helpful in explaining and making abstract concepts more understandable if presented to engaged, active, motivated students.

I expected that yoga would have had the greatest impact on knowledge in the corn and chicken cycles. Because these two cycles were more concrete concepts and research has shown that young students favor concrete ideas and objects (Gerdes *et al*., 2013; Teach for America, 2011; Trundle, 2009), I was surprised to find that it had no impact on the students' understanding of the lessons. However, students came into both of the lessons with higher pre-assessment scores than they did with the water cycle and carbon dioxide-oxygen cycle pre-assessments, thus demonstrating that they had pre-existing knowledge about the topics. These higher scores could be due to them having prior exposure to the cycles, specifically the chicken cycle. When I taught them the chicken cycle lesson, I was unaware that the students were in the process of raising their own chickens from eggs and were already learning about the life cycle of a chicken. Moreover, the higher pre-assessment scores could be the result of these two lessons being much more tangible, relatable, and concrete than the abstract water and carbon dioxide-oxygen cycles, especially for kindergarten students who are only beginning to think in complex ways (Gerdes *et al*., 2013; Teach for America, 2011).

By Section & Yoga

Yoga had varying effects on student learning of the two sections of kindergarten taught. Specifically, the students of section one showed that the presence of yoga influenced and increased their understanding of the four environmental life cycles whereas the students of section two did not show an improvement in understanding. This discovery did not come as a complete surprise given that children develop at different rates (Hooper & Umansky, 2010), thus creating variations among individuals. Children in the first several years of their education are

experiencing rapid conceptual and language development as they learn how to read, write, problem solve, and think critically (Teach for America, 2011; Hooper & Umanksy, 2010). In these regards, when I taught the lessons, I found that the students of the first section were more engaged with the topics in that they were able to problem solve their way through the information presented. The second section was more verbal and asked more inquiry-based questions specific to the topic being taught. The teachers of the sections with whom I did my work had similar observations of the two classes. After working with both sections of students for a year, they found that the first section of students were generally more science-oriented and therefore, had sharper critical thinking and problem-solving skills whereas the second section was, overall, more literacy-oriented (e.g. articulate, verbal, and better with words).

The students that I worked with attended a full-day kindergarten program. When compared to a half-day kindergarten program, students that are in a full-day program perform at a higher level academically than those that do not (Lee *et al*., 2006; Gullo, 2006; Walston & West, 2004). However, this means that five- and six-year olds are at school for about seven hours, five days per week. According to the teachers that I worked with, the Environmental Charter School has very demanding academics for kindergarten and the students are not provided with any rest time, naps, and very little "free" play time. Therefore, this could suggest that the time of day which I taught the lessons to the two sections could have been a factor contributing to the differences seen between the two sections. The first section received the lesson in the morning and the second section was taught the lesson in the afternoon right after lunch. The students in the first section seemed more engaged and more focused because it was earlier in the day while the students in the second section seemed more tired and not as focused because they had already been engaged in learning for four hours.

Finally, the teachers with whom I coordinated my research suggested that another possibility for the difference in results between the two sections could have been due to who they viewed as their "primary" authority figures. The classroom that I taught in was the first section of students' "homeroom" and therefore, because those were their homeroom teachers, perhaps they took the lesson that I taught them more seriously. Overall, the teachers I worked with found that their homeroom class always followed their directions and met expectations better because they were their home base teachers and thus, the students viewed them as the primary authority figures. For the second section of students, however, this was not their homeroom and they

would often try to get away with more in the classroom (e.g. did not always behave as well or follow directions as well) because they did not view the teachers as the primary authority figures. When I taught, I found that I often had to repeat activity directions more to the second section than I did to the first section, validating what was observed by the teachers.

By Yoga vs. No Yoga

This work revealed that overall, the presence of yoga did not increase students' environmental understanding. Although this was contrary to my expectations, upon further contemplation, this is most likely because when young children interact with their surroundings, movement is often involved in some form. Most children are usually quite comfortable with movement (Kaiser, 2014). They begin to learn about the world by acting on objects and people and they think with their bodies well before they think with words (Kaiser, 2014; NDEO, 2014). It is through movement that students integrate and anchor new information into neural networks (Hannaford, 2014). A student may sit quietly to think, but to remember a thought, there must be an action used to solidify it (Hannaford, 2014). Moreover, movement has been shown to be one of the best ways to get all children to engage with and retain what is being taught to them (Fiore, 2014). It has been so successful that some schools are incorporating movement into the actual lesson plan because they have discovered that the lessons that students understand more readily and retain the longest are those lessons that involve movement (Fiore, 2014; Kuczala & McCall, 2011).

Because movement is clearly essential to learning, it was surprising to find that yoga did not impact the overall learning of the students who I taught. I suspect that the reason for this occurrence is two-fold. First, although movement benefits learning, five and six year olds are already engaged in movement frequently. Thus, perhaps yoga was not "different" enough for them and was instead, just like any other movement activity in which they engage. Second, unlike a traditional public school where students spend the majority of their time sitting at desks listening to the teacher lecture, students at the Environmental Charter School are engaged, active participants of their learning and are encouraged to be curious and creative. Further, at the Environmental Charter School, teachers do not just teach; rather, they try to demonstrate to students how their choices have an impact on the world. Thus, to foster these values, the Environmental Charter School operates differently than a "normal," highly-structured, rigid,

public school. On multiple occasions when I visited the school, I witnessed students engaged in problem-solving activities as well as movement and physical activity. For example, to learn how to tell time, the kindergarten class did a song and dance about telling time. Moreover, the kindergarten class had to design a pulley system and think through what would happen to the objects that they put on the pulley system. I rarely saw students sitting at their desks for extended periods. The students were just as much thinkers, innovators, and collaborators as were the teachers. Thus, it seems as though the kind of program that I taught to the kindergarten sections is something that happens more regularly at the Environmental Charter School than at a traditional public school. This then suggests that, once again, the age as well as the school at which yoga is used as an "intervention tool" is important in its success.

CONCLUSION

This work revealed that overall, the presence of yoga did not influence kindergarten student understanding of environmental lessons. However, variations were detected between the two sections and among topics, suggesting that in some cases, yoga did increase student learning of environmental lessons. These findings indicate that among other things, age, level of complexity of the topic, previous exposure to topics, the type of school, and teaching and learning styles all influence the results. Thus, this work has led me to wonder the following: If this research was conducted with an older group of students who no longer move as freely or as often and who are beginning to have a better understanding of complex, abstract concepts, could yoga have made more of a difference on student learning? Further, if this research were conducted at a traditional school where programs such as this are not as frequent and students are more passive learners who are required to sit for the majority of the day listening to lectures, could the presence of yoga impact student learning? Based on this work, I believe that yoga does indeed have the capability to positively impact student learning of environmental lessons provided the right conditions (e.g. age and type of school) are present.

ACKNOWLEDGEMENTS

Without the help of the following people, my senior comprehensive project would not have been possible. I am appreciative to all of you for your support, encouragement, and advice along the way. Thank you so much!

Eric Pallant – Thank you for agreeing to be my first reader; I could not have asked for a better advisor to work with on this project. You have provided me with invaluable support, encouragement, insight, and guidance throughout my senior project as well as my time at Allegheny. You have been highly influential throughout my career at Allegheny and I could not have asked for a better academic advisor. Thank you for pushing me out of my comfort zone and encouraging me to try things that otherwise would feel uncomfortable. It is those experiences that have helped to shape me into the person I am today. I always joked with my family that you would probably want to retire once you were done working with me; however, it looks like we both survived! I will always be thankful for everything you have done for me during my time at Allegheny!

Eleanor Weisman – Thank you for agreeing to be my second reader. It has been an honor and a privilege to be able to work with you on this project. The knowledge, support, and inspiration that you have offered me throughout this project as well as my time at Allegheny have been invaluable. It is because of you that my passion for yoga developed and this project took place. You have helped me to grow so much as a person by introducing me to the world of dance and helping me come to realize that I am a dancer. I will forever be thankful for all that you have done for me!

Nikole, Lauren, Tamra, and Melanie – First, thank you for introducing me to the Environmental Charter School and the amazing work you are doing there. It was truly inspiring and comforting to see such a school in operation with faculty and staff dedicated to educating students who are active and engaged members of this world in which we live. Thank you so much for agreeing to work with me, supporting my project, and providing me guidance and insight along the way. This will be an experience I will always remember and each of you was an influential part of making my project a success. I sincerely thank you.

The Environmental Charter School Kindergarten Class of 2014 – Thank you so much for being such wonderful students. Your engagement with and enthusiasm for the material that I taught you was so exciting and rewarding for me. It was a pleasure to work with all of you. Keep up the awesome work!

Dad, Mom, and Adena – Thank you so much for always supporting and encouraging me. Even when I did not believe in myself and was ready to give up, you always knew that I could do it and succeed. You have always known what to say to keep me going, even if it was not what I wanted to hear at the time. You have provided me with invaluable advice, support, and encouragement throughout this project and my time at Allegheny. You have nurtured my dreams and inspired me to go after what I feel passionate about. Without you, I would not be the person I am today. There are truly no words to express how thankful I am for everything that you have done for me! I love you!

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APPENDIX I –

Lesson plans created and used to aid in assessing the effectiveness of incorporating yoga in environmental education.

Lesson Plan 1 – The Water Cycle

Objectives:

- Students will:
    - discuss the water cycle
    - identify key components of the water cycle, including evaporation, condensation, precipitation, and collection

Goals/Intentions:

- The goals and intentions of this lesson are to help students become aware of the steps involved in the water cycle.

***NOTE:** Before the lesson beings, **administer** all four pre-assessments.

Introduction of New Material:

- Today, we are going to talk about the **water cycle**.
- Ask students if they have ever seen rain. Tell them that another word for rain is "precipitation." Today, in learning about the **water cycle**, we will discover answers to the following questions:
    - Where does rain come from?
    - How does rain/water get into clouds?

- **Read**: *The Falling Raindrop* by Neil Johnson & Joel Chin to learn more about water and how it moves.

Guided Practice:

- **NOTE:** Pictures to support/explain concepts at bottom of lesson
- As we learned from the book, water goes through a cycle. This cycle is known as the **water cycle**.
- Water, which keeps going around, and around, and around, is in constant motion and is continuously being recycled via the **water cycle**.
    - The **water cycle** is the path that water takes from the Earth, to the clouds, and back again. Because it is a cycle, it has no beginning or end.

- Let's go over the stages in the **water cycle** together again:
    - **Evaporation**: when water disappears into the air after being warmed up by the sun.
    - **Condensation**: when water becomes cold and forms into clouds.
    - **Precipitation**: occurs when the clouds get SO heavy that the clouds cannot hold the water anymore and water falls back on the earth in the form of precipitation (i.e. rain, hail, sleet, or snow).
    - **Collection**: when water falls back to earth as precipitation, it falls back in oceans, lakes, rivers, or land and the cycle starts **ALL OVER AGAIN!**

Water Cycle Yoga Sequence:

- Begin in **Water Droplet Pose** (Child's Pose/Small Ball) → body of water (e.g. stream, river, lake, ocean)
- **Wave Pose/Water Warming Up Pose** (Cat/Cow Pose) → sun is heating up water
- **Disappearing Pose** (Forward Fold, slowly unfold to stand up) → water disappears into the air
- **Evaporation Pose** (Mountain Pose) → water has evaporated
- **Cloud Pose** (Mountain Pose) → arms in cloud shape, water becomes cold and forms clouds
- **Heavy Cloud Pose** (Crane Pose) → cloud arms get larger and larger, filling up with many water droplets
- **Rain Pose** (Wide Angle Forward Bend) → release Cloud Pose, bring arms/hands down in front as water droplets because the cloud becomes so heavy that it cannot hold any more water so it is released in the form of precipitation (e.g. rain, sleet, hail, snow)
- **River Pose** (Cobra Pose) → moving body side-to-side similar to a river or other body of water moving → represents collection
- End in **Water Droplet Pose** (Child's Pose/Small Ball) → body of water (e.g. stream, river, lake, ocean)
- **Repeat** → to demonstrate that the cycle is continuous

Activities:

- Demonstrate the **water cycle** "in action" → to be performed by instructor as students watch what happens
    - Items: tissue and spray bottle
    - Directions:
        - Gather the sides of the tissue to make a "cloud"

        - Spray the tissue → to show that when more and more water evaporates and then condenses into the cloud, the cloud gets heavier and heavier until finally the cloud is so full that precipitation occurs.

- "The Water Cycle Song" sung to the tune of "She'll Be Coming Around the Mountain"
    - **Water travels in a cycle, yes it does** (Use pointer finger to make a big circle)
    - **Water travels in a cycle, yes it does** (Repeat finger circle)
    - **It goes up as <u>evaporation</u>** (Move hands up to sky)
    - **Forms clouds as <u>condensation</u>** (Make a cloud overhead with arms)
    - **Then comes back down as <u>precipitation</u>, yes it does!** (Wiggle fingers while bringing arms down in front of you)

- Water Cycle Bracelets:
    - Items:
        - Paper plates (to put the beads on)
        - Bags (to put the beads and string in)
        - String
        - Clear beads (steam/vapor)
        - White beads (clouds)
        - Yellow beads (sun)
        - Blue beads (precipitation)
        - Brown or green beads (land)
    - Preparation:
        - place beads and string (knotted on one end) into bag
    - Directions:
        - String the beads in the following order to represent the **water cycle**: yellow, clear, white, blue, brown/green → repeat until the bracelet is big enough and then tie.

<u>Wrap-Up:</u>

- To demonstrate their understanding, ask students to explain the stages of the water cycle. Tell them that they can use their bracelets as a reference.
- **Assessments:** Have students complete post-assessment for water cycle.

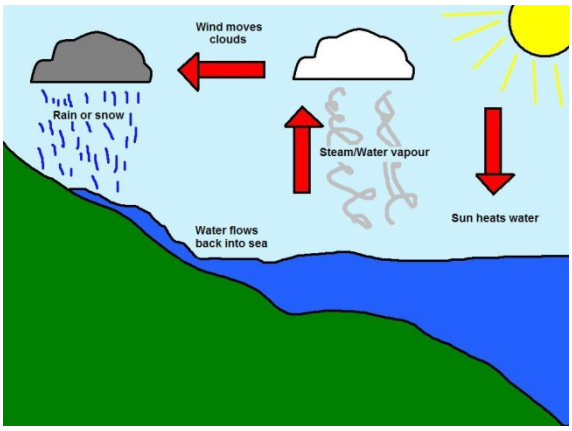
<u>Resources:</u>

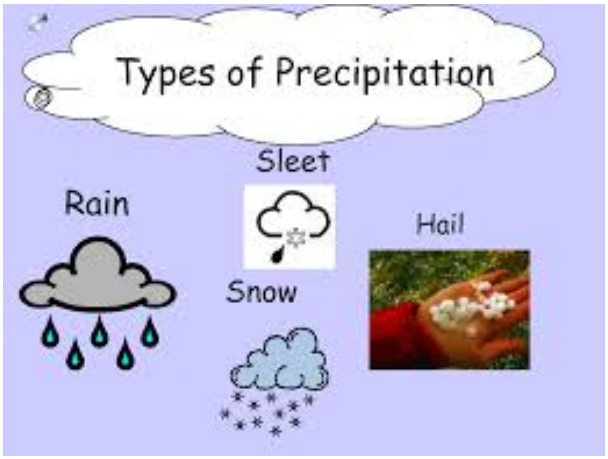
http://www.kidzone.ws/water/

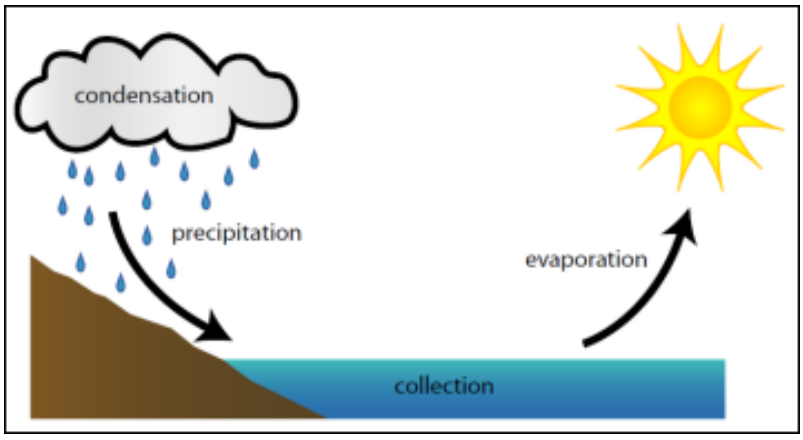
http://www.mrslirettesleaningdetectives.com/2011/12/water-cycle-activities-resources-and.html

http://www.sciencekids.co.nz/sciencefacts/weather/thewatercycle.html

http://ckisloski.blogspot.com/2014/02/the-water-cycle.html







Lesson Plan 2 – The Carbon Dioxide-Oxygen Cycle

Objectives:

- Students will:
  - discuss the carbon dioxide-oxygen cycle
  - identify key components of the carbon dioxide-oxygen cycle, including photosynthesis and respiration

Goals/Intentions:

- The goals and intentions of this lesson are to help students become aware of how the carbon dioxide-oxygen cycle works. More specifically, this lesson is aimed at helping students understand that this cycle is a give-take, interdependent relationship between plants and animals/humans and that both groups rely on the other.

Introduction of New Material:

- Today we are going to talk about the **carbon dioxide-oxygen cycle**.
  - All living things on earth need oxygen to survive
  - Today, in learning about the **carbon dioxide-oxygen cycle**, we will discover answers to the following questions:
    - Where does oxygen come from?
    - Why is this cycle so important?

Guided Practice:

- **NOTE:** Pictures to support/explain concept at bottom of lesson
- As humans, you and I use oxygen for breathing. Although we cannot see this, we breathe in (inhale) oxygen and breathe out (exhale) carbon dioxide through the **carbon dioxide-oxygen cycle**. Take a deep breath…breathe in…breathe out. We have just inhaled oxygen and exhaled carbon dioxide.
- The **carbon dioxide-oxygen cycle** works as follows and has two (2) important processes – photosynthesis and respiration:
  - **Photosynthesis**: Plants and trees use sunlight and carbon dioxide (we cannot see this, but what we exhale) to make food and to grow. Their "waste" product is oxygen (again, we cannot see this, but what we inhale).
  - **Respiration**: Animals and humans breathe in (inhale) oxygen (what plants and trees release) and breathe out (exhale) carbon dioxide as a "waste" product (what plants and trees take in).
  - Plants and trees then use the carbon dioxide that we breathe out and the cycle repeats itself
  - Based on this, can anyone tell me where most of our oxygen comes from?

- ANSWER: plants and trees
- Plants/trees and animals/humans depend on each other to survive through the **carbon dioxide-oxygen cycle**

Carbon Dioxide-Oxygen Cycle Yoga Sequence:

- **Note:** This yoga sequence will take students through various animal and plant yoga poses. The purpose of this yoga sequence is meant to show students that plants and animals depend on one another for oxygen and carbon dioxide supply through emphasis on the inhale and exhale during each pose.

- **Butterfly Pose** (Cobbler's Pose) – inhale oxygen, exhale carbon dioxide
  - Have students imagine that they are butterflies as they flap their "wings" and place strong emphasis on the inhale of oxygen and exhale of carbon dioxide
- **Flower Pose** – inhale carbon dioxide, exhale oxygen
  - As students were butterflies, they spot a flower → have students imagine they become a flower and place strong emphasis on the inhale of carbon dioxide (released by the butterfly) and exhale of oxygen (used by the butterfly)
- **Cat Pose** – inhale oxygen, exhale carbon dioxide
  - Have students imagine that they have become cats that are stretching their spines in the sunshine. Have students meow and place strong emphasis on the inhale of oxygen (released by the flower for the kitty to use) and exhale of carbon dioxide (used by the flower).
- **Cow Pose** – inhale oxygen, exhale carbon dioxide
  - Have students imagine that they have become cows. Have students moo, swish their "tails," and place strong emphasis on the inhale of oxygen (released by the flower for the cow to use) and exhale of carbon dioxide (used by the flower).
- **Grass Pose** (Mountain Pose) – inhale carbon dioxide, exhale oxygen
  - As students were cows, they were standing out in the middle of a pasture filled with grass → have students imagine they become a blade of grass and place strong emphasis on the inhale of carbon dioxide (released by the cow) and exhale of oxygen (used by the cow)
- **Tree Pose** – inhale carbon dioxide, exhale oxygen
  - As students were cows, they were standing out in the middle of a pasture filled with grass and trees → have students imagine they become a tree that sways in the breeze and place strong emphasis on the inhale of carbon dioxide (released by the cow) by bringing arms in towards center and exhale of oxygen (used by the cow) by reaching arms towards sky
- **Giraffe Pose** (Half Moon Pose) – inhale oxygen, exhale carbon dioxide
  - Have students imagine that they have become a giraffe who is trying to reach the leaves off of the trees that they just were. Have students pretend to eat leaves off

of trees and place strong emphasis on the inhale of oxygen (released by the tree for the giraffe to use) and exhale of carbon dioxide (used by the tree).

- **Monkey Pose** (Standing Forward Bend) – inhale oxygen, exhale carbon dioxide
    - Have students imagine that as they were a giraffe, they saw monkeys swinging in the trees. As students are bent over, have them swing their arms side to side, imagining they too are swinging in the trees. Place strong emphasis on the inhale of oxygen (released by the tree for the monkey to use) and exhale of carbon dioxide (used by the tree).
- **Cobra Pose** – inhale oxygen, exhale carbon dioxide
    - Have students imagine that as they were a monkey swinging in the trees, they saw a cobra slithering along the ground. Have students move bodies side-to-side and hiss like a snake. Place strong emphasis on the inhale of oxygen (released by the tree for the cobra to use) and exhale of carbon dioxide (used by the tree).
- **Seed Pose** (Child's Pose/Small Ball) – inhale carbon dioxide, exhale oxygen
    - As students were cobras, the wind was blowing and a seed fell from the tree above. Have students imagine that they are that seed and place strong emphasis on the inhale of carbon dioxide (released by the cobra) by tucking arms in by sides and exhale of oxygen (used by the cow, cat, cobra, monkey, giraffe and butterfly) by reaching arms in front of head on ground.
- **To End:**
    - Have students sit in a cross-legged position. Tell students that they are now themselves – humans. Just like the animals that they just were, humans inhale oxygen and exhale carbon dioxide which we get from the plants that they just were.
    - Have students take several inhales and exhales.

Activity:

- Planting Seeds
    - Items:
        - Seeds (100 total – 2/child)
        - Soil
        - Bucket or deep container (2-3; for soil)
        - Hand shovel (2-3; for soil)
        - Plastic cups (50 total; hole in bottom)
        - Small plates/saucers (50 total)
    - Preparation:
        - To speed sprouting, soak seeds in water overnight.
        - Punch hole in bottom of cups
    - Directions:
        - Fill cup ¾ full with soil.

- Help students plant seeds at a depth about twice the length of the seed.
- Water well.
- If both seeds sprout, pinch one out.

Wrap-Up:

- **Assessments:** Have students complete post-assessment for carbon dioxide-oxygen cycle.

Resources:

http://www.exploringnature.org/db/detail.php?dbID=27&detID=1186

http://www.ducksters.com/science/ecosystems/oxygen_cycle.php

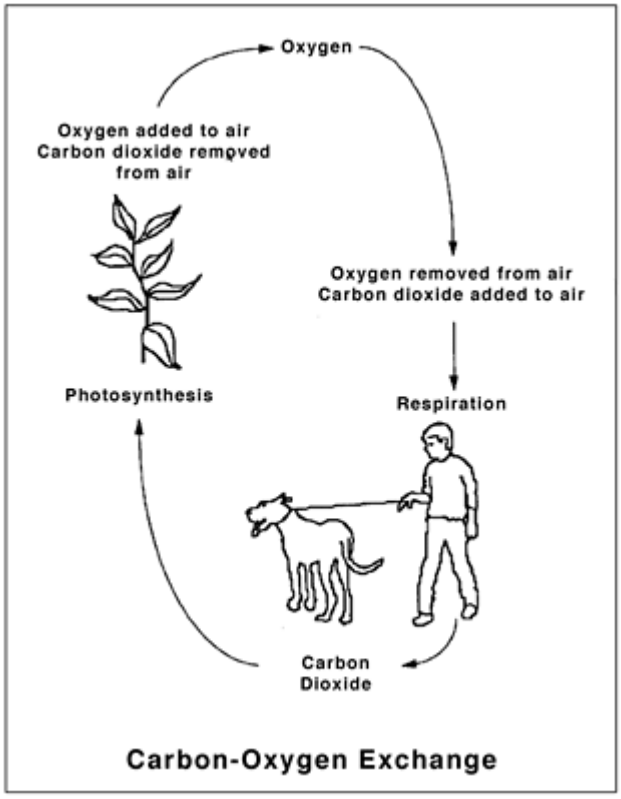
http://www.realtrees4kids.org/sixeight/cycles.htm

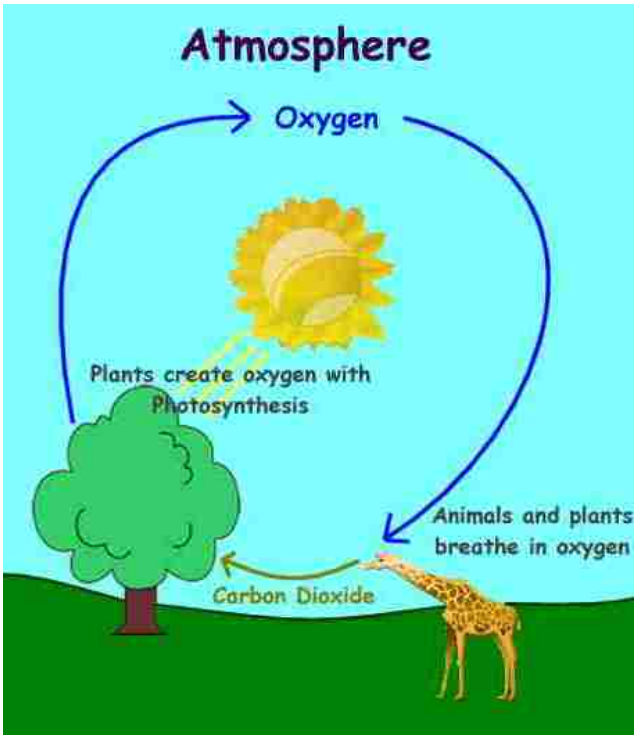
http://www.kidsgeo.com/geography-for-kids/0159-the-carbon-cycle.php

http://www.netplaces.com/kids-environment/understanding-how-our-planet-works/take-a-deep-breath-the-oxygen-cycle.htm

http://www.sciencekids.co.nz/sciencefacts/chemistry/oxygen.html

http://www.uri.edu/smile/documents/goingincycles-water-nitrogen-oxygen-carboncycles.pdf


Oxygen
Oxygen added to air
Carbon dioxide removed
from air
Oxygen removed from air
Carbon dioxide added to air
Photosynthesis
Respiration
Carbon
Dioxide
Carbon-Oxygen Exchange


Atmosphere
Oxygen
Plants create oxygen with
Photosynthesis
Animals and plants
breathe in oxygen
Carbon Dioxide

Lesson Plan 3 – From Kernel to Corn:

The Life Cycle of a Corn Plant

Objectives:

- Students will:
  - discuss the life cycle of corn
  - discuss environmental impacts of corn, specifically how farmers control bugs and weeds and the large amounts of fuel needed for farm machines.

Goals/Intentions:

- The goals and intentions of this lesson are to help students become aware of all of the steps involved in producing an ear of corn. Additionally, this lesson highlights two important environmental impacts in the process of growing corn – large amounts of fuel consumption from farm equipment and the heavy reliance on insecticides and herbicides to control insects and weeds while corn is developing.

Introduction of New Material:

- Today we are going to talk about the life cycle of plants, specifically corn.
  - Corn is an important grain around the world that is grown almost everywhere.
  - Ask students: How many of you have eaten corn on the cob? (Show picture).
    - Then tell students that corn on the cob is just one form that corn can be found in. Today, we will explore other forms that corn can come in.
    - But first, we need to take a look at its life cycle.

Guided Practice:

- **NOTE:** Pictures to support steps in life cycle shown from the book, *From Kernel to Corn* by Robin Nelson. Several additional supporting pictures follow this lesson.
- **A farmer prepares the land for planting**
  - A farmer drives over a field with a big machine called a cultivator. This machine has many blades that turns over the soil and breaks up big clumps so that the soil is smooth and fluffy for planting. (Show picture).
  - Just like you and I need food for nutrients to grow, soil needs nutrients so that plants can get food and grow. To provide soil with nutrients, farmers add fertilizers.

- **The farmer plants seeds**
    - A corn seed is called a kernel. (Pass around kernels). Around May each year, farmers either plant corn seeds by hand or by using another big machine called a row planter to plant the corn seeds, or kernels.
    - A row planter is a machine that digs holes, or ditches, in the ground. The machine then puts the kernels in the ditches and covers them back up with soil. (Show picture).
    - As we are learning, many big machines are needed in the life cycle of corn. Can you think of what these big machines need so that they can move and do their job?
        - Answer: Fuel, more specifically gas which is a type of fuel.
            - Lots and lots of gas is needed to grow corn. Although these big machines make farming much easier for the farmer, gas contributes to air pollution which isn't good for us, animals, or our environment who breathe in the air – remember our carbon dioxide-oxygen cycle lesson?

- **After about 8 days, a tiny plant grows**
    - As long as the seed receives water and sunlight, a young corn plant, called a sprout, grows up out of the soil.
    - Sunlight, water, and carbon dioxide help the sprout to continue growing. (Show picture).

- **Corn plant grows tall**
    - During the first two months, the corn plant produces leaves.
    - Corn grows tall very fast. A stalk is the stem of a corn plant and it can grow five inches in one day. (Show picture).

- **The farmer protects the plant**
    - Now that the corn plant is growing really tall, the farmer wants to keep the plant safe.
        - Can you think of what might like to eat corn while it is growing?
            - Answer: Insects/Bugs
        - If insects start to eat the corn before we get to eat it, what do we do? How do we keep insects from eating corn?
            - Answer: Squash the bugs or spray poison to get rid of them
        - If a farmer has hundreds and hundreds of corn plants, do you think s/he is able to squash every bug?
            - Answer: No.

        - So based on that answer, do you all agree that most farmers who are growing lots and lots of corn are spraying the corn with poisons?
            - Answer: Yes.
        - Can we put poison on food that we are going to eat? Do you think that is safe for us?
            - Answer: No.
        - Remind students: this is not that we cannot eat corn. It is just important to understand how our corn has to be protected from hungry critters like bugs.
    - Lots of corn is often grown together in one HUGE field. This makes it a perfect place for hungry bugs to eat the corn.
    - Weeds might take up the corn's space. Weeds also block out the sunlight, which the corn plant needs to grow tall and strong.
    - To protect their corn plants against bugs and weeds, some farmers spray their crops with a liquid that keeps bugs and weeds away as we just discussed. (Show picture).

- **Corn cobs grow**
    - Now that the corn stalk is tall, cobs begin to grow on the corn stalks. Each stalk will have between 1-2 cobs.
    - Kernels (corn seeds) grow on the cobs. There are about 800 kernels or corn seeds on each cob. Cobs with kernels are called ears of corn.
    - Leaves, called husks, cover each ear to protect it. (Show picture).

- **The corn is harvested (picked)**
    - After about 4 months (August), when the corn cobs are mature, it is time for them to be picked or harvested.
    - Depending on how many corn cobs there are to pick, some farmers will use machines, called combines, to pick the corn. Combines are large tractors that pick the corn as well as remove the leaves and kernels from the cob. Again, these combines require lots of gas to make them move and do their job.
    - Other farmers will pick the corn by hand. (Show picture).

- **The corn is sold**
    - Corn which is sold at farmer's markets or grocery stores is purchased to be eaten as corn on the cob. People take the corn home, take off the husks (leaves), and cook it. (Pass around corn cob).
    - Corn kernels can also be used as: animal feed for cows, chickens, pigs, and turkeys; once processed, as a sweetener for juice, cookies, candy, and cakes

- One example of a "processed" form of corn is cornmeal → show what cornmeal looks like
- Show other "forms" of corn: corn on the cob, popcorn, canned corn, frozen corn, cereal (corn flakes), tortilla chips (white and blue)
- There are also many different types of corn that come in all sorts of colors. (Show pictures).
    - Field corn
    - Indian corn
    - Sweet corn
    - Blue corn
    - Popcorn
    - White corn
    - Rainbow corn
- As we can see, corn comes in all different types and forms and has SO many uses.
- Let's taste a food item that is made with cornmeal → corn bread

From Kernel to Corn Yoga Sequence:

- **Tractor Pose** (Chair Pose) – with arms out in front as if on a steering wheel, pretend that you are driving a tractor that is plowing the land and getting it ready to be planted.
- **Seed Pose** (Child's Pose/Small Ball) – seeds, or kernels of corn are being planted in the freshly prepared land.
- **Little Plant Pose** (Kneeling Pose) – with water and sunlight, your kernel begins to sprout into a little plant. Rise up slowly onto knees, head tipped back towards the sky for sun, arms out at sides as leaves.
- **Tall Plant Pose** (Mountain Pose) – with water and sunlight, your little plant grows into a tall, strong corn plant. Rise up slowly onto feed, head tipped back towards the sky for sun, arms out at sides as leaves. Sway in the breeze and shake in a rainstorm that comes through.
- **Protection Pose** (Wide Leg Standing Squat/Goddess) – now that the corn plant is tall and strong, it needs to be protected. With arms extended out to sides, swing body back and forth as if spraying corn field with poison to keep the bugs and weeds away
- **Corn Cob Pose** (Tree Pose) – as the corn plant grows, it begins to grow corn cobs. Raise leg up slowly to represent growing corn cob.
- **Tractor Pose** (Chair Pose) – with arms out at sides, reach out and pretend you are a tractor harvesting corn cobs. Pull arms in towards center as if putting corn cobs in the tractor.
- **Truck Pose** (Table Top Pose) – now that the corn has been harvested, it was loaded up into a truck. Pretend you are a truck driving the corn to grocery stores to be sold.

- **Eating Pose** (Easy Seated Pose) – you have gone to the store, bought corn, and now it is time to eat!

Activities:

- Planting Corn Seeds
  - Items:
    - Seeds (100 total – 2/child)
    - Soil
    - Bucket or deep container (2-3; for soil)
    - Hand shovel (2-3; for soil)
    - Plastic cups (50 total; hole in bottom)
    - Small plates/saucers (50 total)
  - Preparation:
    - To speed sprouting, soak seeds in water overnight.
    - Punch hole in bottom of cups
  - Directions:
    - Fill cup ¾ full with soil.
    - Help students plant seeds at a depth about twice the length of the seed.
    - Water well.
    - If both seeds sprout, pinch one out.

Wrap-Up:

- **Read**: *Corn is Maize: The Gift of the Indians* by Aliki to review the life cycle of corn.
- **Assessment:** have students complete post-assessment for corn life cycle

Resources:

Websites:

http://urbanext.illinois.edu/corn/guide.html

http://www.soilcropandmore.info/crops/Corn/How-Corn-Grows/

http://www.garden.org/foodguide/browse/veggie/corn_getting_started/397

http://smartyplants.com.au/2012/09/sweet-corn/

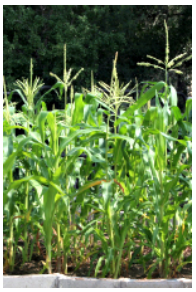
Books:

The Life and Times of Corn by Charles Micucci

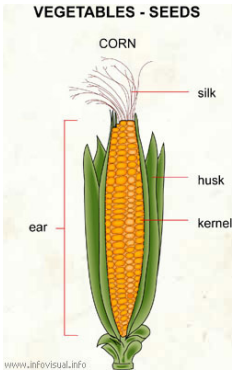
How Does it Grow? by Catherine Nichols

From Kernel to Corn by Robin Nelson

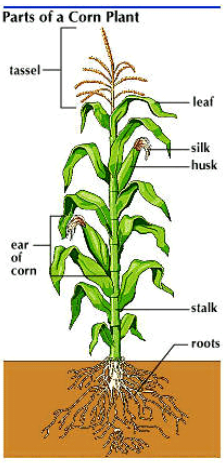
 Corn seedlings

 Crop of corn

 Ready to harvest – ear of corn



Ear of corn – breakdown



Parts of a corn plant

Lesson Plan 4 – From Egg to Chicken:

The Life Cycle of a Chicken

Objectives:

- Students will:
  - discuss the life cycle of a chicken
  - discuss environmental impacts of chickens, specifically poor management of chicken waste and feeding chickens corn that has been sprayed with insecticides/herbicides

Goals/Intentions:

- The goals and intentions of this lesson are to help students become aware of the developmental process a chicken goes through – from egg to chicken. Additionally, this lesson highlights the interconnectedness of the chicken life cycle with that of the corn life cycle. Moreover, environmental impacts of chickens are explored including what happens when chicken waste is not appropriately managed as well as looking at the life cycle of corn and what happens when chickens are fed corn that has been sprayed with insecticides and herbicides.

Introduction of New Material:

- Today we are going to talk about the life cycle of chickens.
  - Ask students: Have any of you ever seen chickens?
  - Tell students: A chicken is a type of bird. Like all birds, chickens have feathers, a beak, and a pair of wings.
  - A female chicken is called a **hen** and a male chicken is called a **rooster**. Baby chickens are called **chicks**. The female chicken or hen lays the eggs.
  - Today, we are going to look at how an egg turns into a chicken.

- **Read:** *Good Morning, Chick* by Mirra Ginsburg to begin our exploration of the life cycle of chickens.
  - As we learned from this story, chickens begin life in an egg. Let's take a closer look at the life cycle of a chicken.

Guided Practice:

- **NOTE:** Supporting pictures follow this lesson.
- **Hen builds nest**
  - Before a hen lays her eggs, she builds a warm, soft nest to keep her eggs safe.
  - She uses straw/hay and her own soft feathers to make the nest.

- **Hen lays eggs**
    - Once the hen has built her nest, she lays her eggs.
    - The egg holds and protects something that will grow into a baby bird.

- **Chick grows inside the egg**
    - At first, the baby chick inside the egg is just a teeny tiny dot called an **embryo**.
    - As the tiny bird, or **embryo** grows, it begins to look more like a bird.
    - As the baby chick is growing inside the egg, the mother hen sits on her eggs to keep them warm. The eggs don't break because the shells are strong and hard.

- **The eggs hatch**
    - After 21 days, the baby chick inside the egg starts to make a cheeping noise.
    - This lets the mother hen know that her chicks are about to hatch.
    - The mother hen makes a clucking noise to encourage the baby chicks to come out of their eggs.
    - To break free from the egg, the chick uses its beak to make a hole in the eggshell. When the hole is big enough, the chick pushes its way out of the shell.
    - When it first hatches, the baby chick is wet and slimy. But soon, the chick dries and looks like a fluffy, round ball.

- **The chick begins to grow**
    - Just like you and I, chicks need food to help them grow.
    - Like their mother hen, young chicks peck and scratch at the ground looking for grains, including corn (which we talked about), seeds, and grubs (similar to worms) to eat.
        - Let's take a moment to consider another life cycle within the chicken life cycle
            - As we talked about in our last lesson, what sometimes eats corn before us or chickens?
                - Answer: Insects/Bugs
            - As we just learned, what do chickens eat/get fed?
                - Answer: Corn
            - The chickens eat this corn and then produce waste (poop).
            - Just like you and I need food for nutrients, the soil also needs food. The chicken poop can be used as food for the soil. So, the waste that the chickens produce can be spread by the farmer onto fields where plants, such as corn, can grow.
            - So, we have:

    - The bugs eating corn. Corn being fed to chickens. Chickens producing waste. That waste being used as food for the soil. And that soil growing corn.

- **The young chicken matures**
    - As the chick gets older, it starts to grow new feathers. In a few months, the chick will lose (or shed) its fluffy yellow feathers and grow brown, white, or grey adult feathers.
    - If the young chicken is a hen (female chicken), she will start to lay her own eggs six months after she is born.
    - Then, the cycle begins again!

- **Environmental Impacts**
    - Adult chickens produce a lot of waste (poop). If the chicken farmer lets the waste pile up, nearby water sources can become contaminated which is harmful to us, animals, and our environment. → Demonstrate what can happen → In a plastic box, create a mock chicken farm scene with a pile of chicken waste. Simulate rainfall and demonstrate what happens to a pile of chicken waste…it washes away to nearby water source(s).
    - In our last lesson, we talked about the life cycle of corn. Can you recall all the steps corn has to go through before it can become food for chickens?
        - Do you remember we talked about farmers having to spray their corn with poison to keep the bugs and weeds away?
            - What happens if we put poison on the corn and feed that corn to chickens?
                - Answers: Will vary. Listen to what students formulate.
        - In order to become food for chickens, corn has to go through a lot of steps that requires a lot of work. Many of these steps involve big machines which take gas.
            - Remember, the gas contributes to air pollution which is harmful to our environment.

<u>From Egg to Chicken Yoga Sequence:</u>

- **Nest Pose** (Hero Pose) – using arms, head, and twisting spine, pretend to create a nest for eggs
- **Egg Pose** (Child's Pose) – mother hen has laid eggs…you are one of those eggs
- **Developing Egg Pose** (Roll on back, knees to chest) – as the months pass by, you are inside the egg developing
- **Hatching Pose** (Happy Baby Pose) – finally, it is time for you to hatch from your egg. Make cheeping noise and use head to "peck" through the egg.

- **Young Chick Pose** (Squat Pose with knees closed – make self small) – act like a young chick → flap wings, peck at ground, making cheeping noise
- **Chicken/Hen Pose** (Squat Pose with knees open – make self big) – act like a chicken → flap wings, peck at ground for food

Activities:

- Making a chicken nest
  - Items:
    - Paper boxes (make these)
    - Straw/Hay
    - Feathers
    - Eggs (Easter eggs that open up)
    - Baby chick pictures (100; to be colored by students)
    - Mother hen pictures (50; to be colored by students)
  - Directions:
    - Provide each student with a paper box, straw/hay, feathers, two eggs, 2 baby chick pictures, and 1 mother hen picture
    - Have students color pictures and then cut out. Place the two baby chicks in the eggs provided. The mother hen sits on top of the nest.
    - Have students build a nest however they would like using the supplies provided.

Wrap-Up:

- **Assessment:** Have students complete the post-assessment for chicken life cycle.

Resources:

Websites:

http://www.kiddyhouse.com/Farm/Chicken/

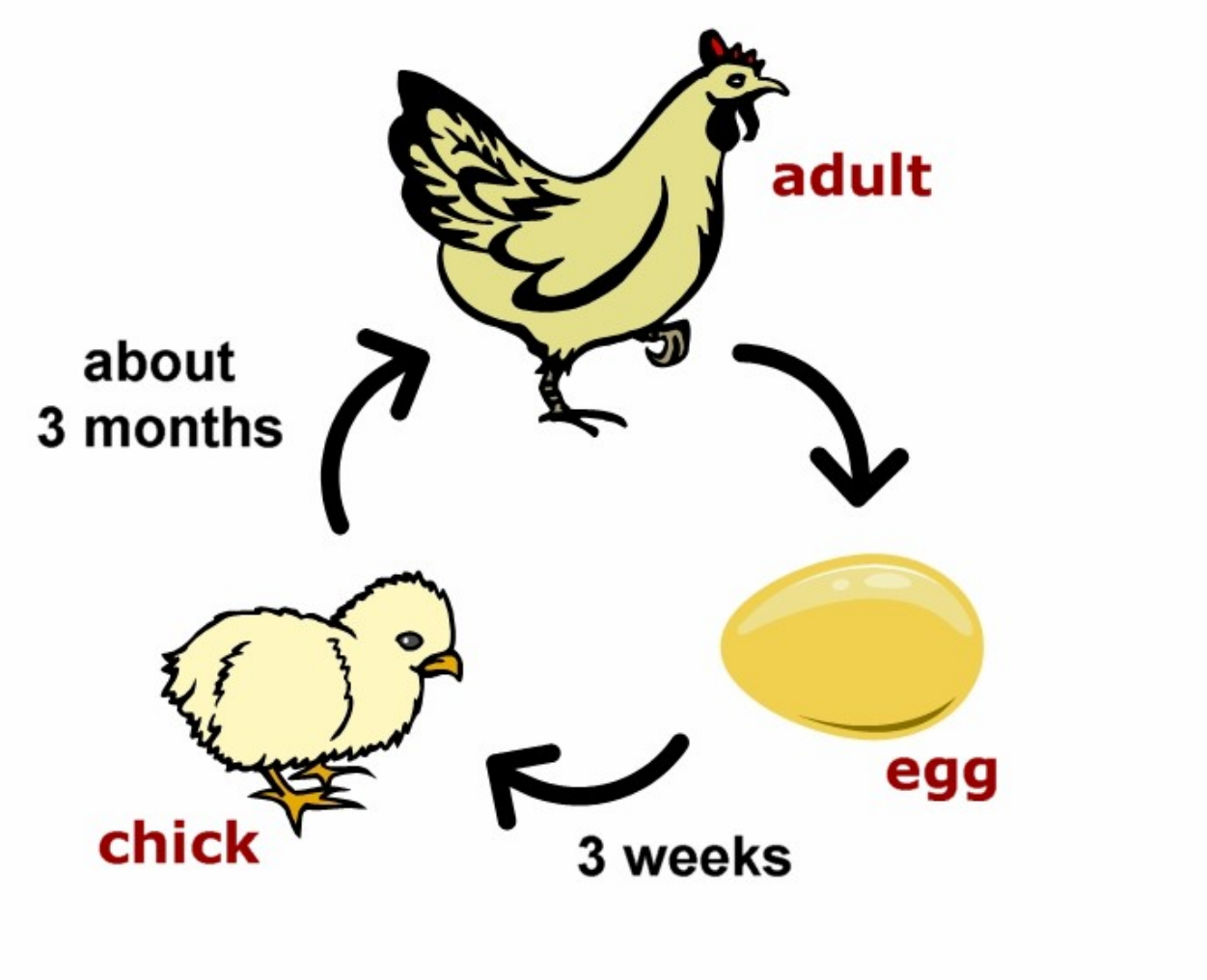
http://applesandabcs.blogspot.com/2012/03/life-cycle-of-chicken.html

Books:

Hens by Tessa Potter

How an Egg Grows Into a Chicken by Tanya Kant

Eggs! Life on a Chicken Farm by Ruth Owen


adult
about
3 months
egg
chick
3 weeks

