UCLA

Sustainability Action Research

Team Krieger

2016 Sustainability Action Research

Final Report

Stephanie Ng

Sagarika Subramanian

Manali McCarthy

June Tran

Lauren Yang

Stakeholder: Moisés Román

Introduction

Team Krieger aimed to increase sustainability at the Krieger Center through piloting a compost program, performing educational outreach about waste management and making recommendations for greener products. This is the first year the Krieger Center has worked with a SAR team to improve the sustainability of their child care center. We ambitiously chose to explore multiple pathways with our project in order to lay the foundation for future sustainability projects at the Krieger Center. As our project evolved, we quickly realized that any topic we chose would impact the center on multiple levels. We had to be mindful that each population group at Krieger— staff, parents, and children— would have a different response to the implementation of any sustainable practice. Additionally, any program piloted at the Krieger Center has the potential to spark a movement in the child care centers across the UC system. With this in mind we tackled a topic that would be prevalent in any child care center: waste.

Without a precedent to follow, the project had a slow start. We had to go through the trials and errors of proposing sustainability projects to our stakeholder. Luckily we were able to utilize SAR's extensive network and resources to get our project rolling. While waste management was a new topic at the Krieger Center, it was no stranger to SAR. Through very helpful contacts affiliated with UCLA and SAR, we were able to formulate the plan of conducting waste audits in order to establish a baseline to measure the impact of our project. The stunning results of our waste audit fully convinced our stakeholder to approve our proposal of piloting a compost program with the overall theme of improving waste management practices at the center.

Background

The Krieger Center services the 165 children of UCLA faculty, staff and students, ranging from infants to preschoolers. Our stakeholder and the center's curriculum director, Moisés Román, explained that some of the key features of the center include incorporating hands-on learning and highlighting scientific reasoning in everyday routines and lessons. The center stays true to their science-based approach by encompassing the importance of the environment and ecology in classrooms and involving the children in the "greening" process.

Our team was brought on by Moisés to assist in the undertaking of creating a more sustainable operation of the Krieger Center. Moisés, along with the Parent Sustainability Committee at the center, truly understands the significance of early child development, especially in influencing the children's future lifestyles. With this in mind, Moisés and the committee hoped to create a more sustainable center that would in turn help the children grow into conscientious, "green," citizens. In partnering with the Krieger Center, our SAR team's main objective was to increase sustainability at the center through piloting a compost program, performing educational outreach about waste management and making recommendations for greener products.

Upon discussing with Moisés and Professor Andrea Goldman, head of the Parent Staff Association, about improvements that could be made at the center, our team discovered there were various paths we could take. However, for any of our proposed improvements, we would have to be especially mindful of the children, as they are very sensitive to any changes in their surroundings.

To gain more insight on how to "green" a child care center, we conducted preliminary research on child care health and safety regulations to determine what changes would be feasible. California's Title 22 Regulations dictate the requirements for

the physical environment of the facility, teachers and administrators and services provided. These strict regulations also specify the products and procedures that must be used, making the shift to more sustainable practices difficult. Diapers, for instance, must be changed frequently to ensure sanitary conditions. Soiled diapers should be disposed of as recommended by packaging or in an airtight container for daily disposal outside the center (Department of Social Services). With 4,500 diapers disposed of every month, such regulations have contributed to well over 350,000 tons of landfill waste (United Kingdom Environment Agency, 2005).

In addition, we examined existing models of sustainable child care centers and the effects of sustainability and environmental education on early childhood development (ECD). In California, programs such as the Green Schools Initiative and LAUSD's low impact development (LID) projects provide recommendations for creating sustainable environments for schools. Some suggestions include ways to improve and implement water/energy conservation, eco-friendly buildings, green roofs, storm water capture, and green spaces. Most significantly, these programs emphasize student and faculty engagement in such green changes. This ended up being a significant part of our project as well. In order for any changes to be implemented on a long-term scale, we had to ensure the willingness of teachers and staff at the Krieger Center.

Green products have also been implemented in some LAUSD schools by the Collaborative for High Performance Schools (LAUSD, 2010). Furthermore, highlighting sustainability and environmental issues in schools will play an integral part in creating a more eco-friendly society. Research has shown that increasing exposure to nature at a young age tends to deepen children's "environmental sensitivity", or an inclination to learn about and conserve nature (Ernst and Theimer, 2011). Thus, implementing

sustainability at the Krieger Center will have a significant impact, especially since the formation of our brains in early years strongly influences our behavior for the rest of our lives (Young, 2014).

Methodology

Stage I: Project Proposal

This is the first year that a SAR team has partnered with the Krieger Center, which has given us a lot of freedom in pursuing a project to tackle. At first, the prospect of even coming up with a research question seemed intimidating. After much brainstorming, our team decided to present a few ideas to our stakeholder at our first meeting, including: conducting an environmental impact assessment with water, energy or waste audits, switching to green products to reduce Krieger's carbon footprint while maintaining health standards and exploring ways to include the children in changes made to supplement their "green" education. This included creating a type of curriculum or educational tool in order to connect things such as gardening, food waste, and composting to one another. We also had the idea to possibly implement organic food in the center.

After presenting these ideas to our stakeholder, we assessed which ones would be feasible and asked if the center had any ideas of their own. Moisés and parents expressed their concern for the amount of diaper waste generated, and overall had great interest in reducing waste at the center. Ultimately we decided to settle on green products, compostable diapers, and a waste diversion program.

Stage II: Preliminary Research

At this stage we consciously decided to be overambitious with our project goals and later determine the focus of our project once we finished our preliminary research. Our main goals included measuring, quantifying, and categorizing the center's waste; implementing a successful recycling and composting program; finding more sustainable and environmentally friendly products to replace existing diapers, wipes and sanitizing products that still meet health requirements; and performing a cost analysis of current products and practices as compared to their more environmental counterparts.

Our alternative diaper research was heavily focused on finding a cost-effective yet practical diaper. Currently, the Krieger Center purchases their diapers for $0.03 as part of a contract with Mattel Children's Hospital. Some options we decided to research included compostable diapers, cloth diapers, and hybrid diapers. We planned to deliver a cost-analysis of each alternative.

Our green product research first began with looking into the rules and regulations that the Krieger Center is obligated to follow when it comes to sanitation and health practices. Currently, the Krieger Center uses bleach as its main cleaning solution. Title 22 Regulations specify bleach as the cleaning agent that meets disinfecting and sanitizing requirements. It is inexpensive and offers quick results, which makes it a popular choice among many child care providers. However, its corrosive nature can cause irritation to skin, eyes, and nose and in more serious cases, burns, damage to the nervous system and vomiting. Thus, we are working on compiling a list of products that would be suitable for use to put as an appendix of this report.

We reached out to facilities, including other child care centers or schools in the US and internationally, that follow green practices. This was accomplished through Google searches. An email was sent asking about: experience with or advice using

compostable diapers, sustainable cleaning products used at the facility, and if there were any barriers or limitations to implementing environmentally friendly products. We heard back from two facilities and hope to include their feedback as an appendix to this report.

Often times, using environmentally friendly products incurs higher costs. This was a concern of the Krieger Center because if they chose to use the products, costs get passed on to parents through a rise in tuition or they could opt to not use the products at all. Hence, a component of our research is to investigate grants to supplement the costs of switching to environmentally friendly products.

Stage III: Laying the Foundation for Waste Diversion

After our extensive research, we focused the bulk of our efforts towards what we deemed the most feasible goal- increasing waste diversion at the center. In trying to increase waste diversion, we reached out to the UCLA Recycling Coordinator, Jesse Escobar, who has been crucial to moving our research forward. He referred us to the cheapest bins possible, provided advice for compostable products and guided us through the process of a waste audit. With Jesse's advice, we decided to break the waste audit into four main steps: visual baseline, three baseline audits, implementation of bins and changes in signage, and three week post-implementation audit.

For the visual baseline, we walked around Krieger and identified locations or specific bins that we thought were representative of the center as a whole or could benefit from changes. For the baseline audit, we collected the waste from Krieger, sorted it into mixed recyclables, compostable materials and trash, and weighed each component. After our second baseline audit, we agreed that the results were conclusive enough to forego the third audit we planned.

Stage IV: Gathering Resources for a Compost Program

At the time, Krieger had no composting program, but a large amount of their waste could be composted if the right systems were put into place. After sharing our baseline results with Moisés, he gave us the green light to purchase a 3-stream waste station, which included trash, recycling, and compost. We applied to the TGIF mini fund in order to subsidize the cost and Moisés agreed to supplement any cost the grant did not cover.

Additional research was conducted in order to recommend a visually pleasing yet effective bin set. We learned that purchasing these bin sets is slightly more complicated than picking out a pre-made set. Instead, multiple stream waste bins are typically customized based on the buyer's needs. We were required to call multiple companies and ask for quotes based on the Krieger Center's specific needs and desired aesthetic. This quote requisition process took an unexpectedly long time as we had to specify information about the desired bin dimensions, material, and signage all the while trying to maintain a reasonable price range. To our surprise, 3-stream bin sets could reach upwards to thousands of dollars so we had to take that into consideration before pitching it to Moisés.

Before purchasing the bins, we consulted with Jesse once more. We became aware of how expensive bins were, so we began brainstorming how to reduce costs while still gathering all the items we needed. Jesse brought to our attention that existing bins could be utilized to collect compost—it was just a matter of changing the liner inside to a compost liner. After sharing our idea with Moisés- also mentioning that UCLA Facilities would provide the liners- he agreed it was a practical way to implement composting. However, we still intended to purchase one nice 3-stream bin system to place in front of

the reception area to make the waste diversion initiative visible to patrons. Additional walkthroughs of the Krieger Center were conducted in order to catalogue the locations of the bins, as we intended to have receptacles for compost and recycling in each room.

Lastly, a separate dumpster was required in order for the waste collection company to service the compost waste. Jesse informed us that UCLA Facilities would provide the dumpster at no additional cost, and it was just a matter of ordering and delivering it to the center. Due to delays in ordering the 3-stream bin and rearranging existing bins, we were unable to complete the post-implementation audits.

Stage V: Compost Educational Outreach

We quickly realized during our waste audits that the definitions for compostables, recyclables, and trash were quite confusing. Additionally, the definitions varied by location and which waste service was collecting the material. Jesse directed us to the UCLA-specific waste diversion guidelines and gave us tips on how to create signage that would clearly denote to the general population how to sort their waste. Moisés agreed to the idea of posting signage, and heavily encouraged the use of familiar imagery to be able to convey the message to all age groups. We brainstormed what items were commonly found at the Krieger Center and created highly visual and appropriately labeled signage.

With the introduction of composting, we realized the center's teachers and staff would shoulder most of the responsibility for correctly sorting and disposing of waste. We were concerned with some staff opposing the idea of implementing compost, but everyone was welcoming of the idea after we clearly explained our intentions and how seamless the integration of the 3 stream system would be.

With their cooperation, it was just a matter of training the staff on how to utilize the color-coded liner system and how to properly sort waste. We prepared and delivered a presentation regarding these topics to the teachers, who were all very receptive and eager to increase waste diversion. We also intend to prepare a more child-friendly version of the presentation for the children at the center. However, due to time constraints, we are unable to deliver it ourselves and will leave that task to the teachers.

Stage VI: Launching the Compost Program

As we reach the end of the school year, the pieces have finally all fallen in place to pilot the program. We plan to implement the bin lining system, signage and compost dumpster at the end of the quarter. Additionally, the Krieger Center planning on ordering the 3-stream bin before the end of the quarter as well.

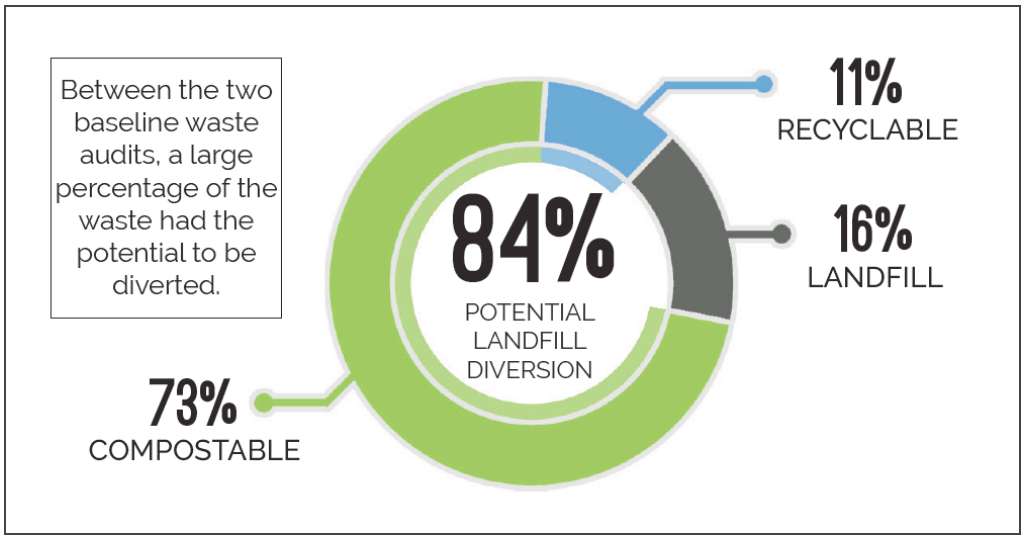
Results and Discussion

Our decision to implement a compost program at the Krieger Center was further supported by the results of our waste audits. We analyzed the waste from one toddler classroom, one preschool classroom, and an outside recycling bin to get a representative look at Krieger's total waste. Upon conducting our audits, we were surprised to discover that non-recyclable or non-compostable trash accounted for only a small portion of the center's total waste. From our first waste audit (Fig. 1), we found that most of the total waste consisted of compostables. After our two waste audits, we found that on average 73% of Krieger's waste would be compostable (Fig. 2).

Fig. 1: Summary statistics on March 6, 2016 baseline waste audit

03/06 Sum in poun	Mixed Recyclab	Composta Materia	Non-Recyclabl Non-Composta Trash	Tot	% of Total W
Younge	1.6	2.6	3	7.2	38%
Older	1.4	7.8	0.8	10	52%
Recycli	0	2	0	2	10%
Total	3	12.4	3.8	19.	
% of Total W	16%	65%	20%		

Fig. 2: Summary statistics of 2 baseline audits



As we conducted our waste audits and walked through the center, we also took careful note of the waste itself. From the classrooms, much of the compostable waste consists of wet paper towels, tissues, and leftover food. Each classroom has its own kitchen area and shared bathroom. Since the trash bins near the sinks typically only have wet paper towels, they could easily be converted into compost bins. In addition, the children have their meals inside their classrooms, producing a significant amount of food waste. To determine whether we should add new composting bins or rearrange bins to accommodate this compost, we walked through the center and catalogued all the

bins in the classrooms and common areas (Appendix A). Most classrooms had one recycling bin near their crafts area and trash bins near their bathroom, kitchens, and outdoor common areas. We discovered that some classrooms had two trash bins, so we decided that one of the trash bins could be converted into a compost bin. However, three classrooms only have one trash bin each, so the center may have to purchase 3 additional compost bins to truly implement the program in every classroom. In addition, Jesse helped us obtain a 96-gallon dumpster for the center's compost, making it possible for compost to be serviced by Athens Services.

Besides determining the logistics of composting, we knew that educating the teachers as well as the students would be crucial in sustaining the program. We gave a presentation about our research and our planned changes to the teachers at Krieger. Having received a positive response and supportive suggestions from the teachers, we are confident that they will actively help educate the children about proper waste management in the classroom. Although we were not able to give a presentation to the children, we still kept in mind that they would play a vital role in the success of the composting program. Therefore, our team member June Tran created kid-friendly signage with labeled pictures of commonly disposed items at the center (Appendix B). These signs will be affixed to all the bins at the center. To make our improvements transparent to everyone at the center, we also intend to change the liners to the proper color-coded system while school is in session, so that we can educate the children and student workers simultaneously.

Challenges and Difficulties

Since this was the first year that a team was working on sustainability at the

Krieger Center, there were inherent challenges and difficulties that accompanied the project. Our very first challenge was to narrow down our goals and identify a direction for the project. There are so many aspects of sustainability that could have been addressed so our team was tasked with figuring out which ones were most important to our stakeholder as well as which ones were feasible to accomplish in six months. Early on in the winter quarter, Moisés, as well as the parents on the sustainability committee, provided us with numerous potential projects to work on. This made it challenging for the team to narrow the scope of the project, without compromising on the wishes of our stakeholder and the parents.

Once we set some objectives for the project, we then ran into the problem of achieving our very first objective. A significant amount of waste is created from the usage of diapers and wipes in general. The parents at the Krieger Center had particular concerns about this issue, which is why our team endeavored to work on reducing diaper waste. However, the regulatory, monetary and political aspects of diaper waste proved to be hard to work around.

The Krieger Center purchases their diapers in bulk from the Mattel's children's hospital, which allows them to buy diapers at the extremely low cost of three cents a diaper. After researching and conferring with Moisés about viable options for diapers, our team decided that compostable diapers was the best way to go. Unfortunately, cloth diapers would require new loads of laundry to be done every day, which would not only be costly to implement but would also substantially increase the water footprint of Krieger.

After researching compostable diapers, we discovered that there were issues with durability and the fact that many companies only claimed to be 80% compostable. The

first problem was that the diaper would have to be absolutely 100% compostable in order to be accepted to a composting landfill. The second problem was that the cost of compostable diapers was around triple that of the regular diapers purchased from Mattel. Finally, Jesse informed us that Athens Services would not be able to accept compostable diapers in their waste stream, as the market for diapers has not taken off yet. While that was the end of our plans to implement compostable diapers at Krieger, we still attempted to find other "green" alternatives to the current diapers that had a reduced carbon footprint (Appendix C).

After encountering similar issues with sanitizing products, such as regulatory policies for health as well as higher costs, our team decided to focus on general waste reduction at the Krieger Center. Naturally, this came with its own set of challenges. As mentioned earlier, our team gained funding for 3 stream bins from TGIF to place near the reception area at Krieger. However, we were only able to obtain $200, which does not cover the expense of the set of bins. The parents of the sustainability committee were extremely generous and offered to pay for the rest. However, it took almost the entirety of Spring Quarter to coordinate with the parents to choose the exact type of bin that they wanted. The team understood that this decision was an important one because of the extra cost that the parents had to take on, but delayed our plans of conducting further waste audits. To overcome this delay, our team continued to analyze the data collected from our baseline waste audits to inform our educational outreach program. Although we were not able to analyze waste generated from the new 3 stream bins, we hope that our educational program will incentivize visitors, staff and the children to sort their waste correctly. We hope that the Krieger Center implements the changes that we have suggested and utilizes the procedures for the three stream waste program that our

team has set up for them.

Conclusion

The research we completed most specifically impacts the children, staff and parents at the Krieger Center. The changes we made were especially important to the children because ingraining habits, such as the proper sorting of waste, at a young age creates a next generation of environmentally responsible citizens. Furthermore, habits that the children learn at Krieger Center get brought home and also effect change in families. Although the Krieger Center is not the first early education and education center on campus that has adapted sustainable programs like composting, it stands at the forefront of child care centers in its concern for sustainability and the environment. We hope that changes made during our project can inspire other child care centers to also make sustainability a priority.

Although this project is near completion, we have several recommendations to maintain and expand our efforts. In order to maintain the composting program, UCLA custodians and Krieger staff and teachers will need to follow the proper color coding of the liners and throw bags of waste into the proper dumpsters. They will also need to continue encouraging children to throw waste into the proper receptacles. In the future, we would recommend expanding the composting program throughout the whole Center. Currently, we are piloting this program in several classrooms, the sink/bathroom areas, and the kitchen. Implementing the lining system in the remaining classrooms, administrative offices and staff lounge would fully transition Krieger and move it towards zero waste.

While we could not find a suitable alternative to reduce diaper waste, we do

recommend pursuing this topic in the future. Currently, we found that there was not a huge market for compostable diapers, thus it was not a cost effective option. However, with the introduction of AB-1826, a composting law that requires businesses that generate a specific amount of organic waste to recycle it, we expect to see an increase in composting in California and hope this will lower costs of diapers and push for proper infrastructure to compost diapers at most landfills. Our team also explored the possibility of lowering compostable diaper costs by negotiating a purchasing deal by involving other child care centers to increase demand. Because of the relatively lower demand for compostable diapers, not only are they more expensive, but they also are not available in large volumes. While Mattel offers diapers at an extremely low cost, we saw potential to negotiate a agreement with other child care centers, possibly at a UC level, to provide a compostable diaper company enough revenue to lower costs and provide reliable and large supply. This would be a huge undertaking and require time and extensive collaboration, but it could have the potential to significantly decrease volumes of waste.

Although we wanted to pursue environmentally friendly cleaning products, we found the topic difficult to address due to health regulations and cost. However, it could be the subject of further investigation, including cleaning systems that only use water. Another area for further research is understanding total water usage. Given our limited time, we were unable to gather any data regarding daily water usage or what activities result in highest usage. Additionally, the Parent Sustainability Committee brought up their desire to switch to organic food; however we were unable to address this topic. And while this was of significant interest, our stakeholder informed us that this was a fairly political issue at that time at Krieger and may not have been good to pursue. This is a

topic that can be revisited in a later project. Finally, we recommend that any changes made should involve the children. The Krieger Center is especially interested in engaging the children in the process so that they fully understand the importance of the change and have the opportunity to adapt to it.

While the Krieger Center stands at the forefront of sustainability in child care centers, there are still many opportunities to make changes to further improve the lives of the children, the staff and the environment.

Appendices

Appendix A: Child Care Center Sustainability Literature Review

Introduction

The Krieger Center, a child care center on UCLA's campus, follows a progressive STEM-based curriculum called "Pathways to Science". With 165 students ranging from infants to preschoolers, the center stays true to their science-based approach by incorporating the environment and ecology in classrooms and involving the children in the "greening" process. The Krieger center has several target areas of focus to improve sustainability, including high volumes of diaper waste, high water usage and lack of existing recycling infrastructure.

When trying to implement changes, the child care center must follow stringent regulations and policies to ensure the health and safety of the children. For this reason, researching regulations is useful in determining changes that are compliant with any health codes. Additionally, it is beneficial to get a sense for what is already being done in existing programs to see policies that did or did not work. Through its innovative STEM program and strong focus on sustainability, the Krieger Center hopes to act as a model for existing and future child care centers. Hence, it is important to have scientific research that confirms the mission of the center and shows the benefits of environmental education on early child development. This literature review aims to cover these topics to provide adequate information for the Krieger Center to implement sustainable changes.

Regulations and Policies Regarding Sustainability in Child Care Centers

In California, licensed child care facilities must comply with the California Department of Social Services, Community Care Licensing Division's Title 22 Regulations. These regulations cover a wide array of requirements for the physical environment of the facility, teachers and administrators and services provided. While these regulations are designed to ensure the safety of the children, they often restrict child care centers from seeking more sustainable and environmentally friendly solutions.

Title 22 Regulations specify bleach as the cleaning agent that meets disinfecting and sanitizing requirements. It is inexpensive and offers quick results, which makes it a popular choice among many child care providers. However, its corrosive nature can cause irritation to skin, eyes, and nose and in more serious cases, burns, damage to the nervous system and vomiting. Furthermore, occupational health evidence suggests that bleach exposure can exacerbate asthma and is a potential cause of new cases of asthma (San Francisco Asthma Task Force, 2013).

Oftentimes bleach can be diluted in an inaccurate way. In efforts to ensure proper dilution, pumps are used for safer and more accurate results. However, pumps can become unreliable as a result of bleach corrosion. According to a report by the San Francisco Asthma Task Force, the level of 6.15% sodium hypochlorite (the active ingredient for bleach) in bleach products should not be exceeded to minimize exposure. However, the task force discovered that several products contained levels of bleach that exceed 6.15%. Such products include a generic and inexpensive brand called "Regular Bleach" that included 8.25% sodium hypochlorite. At the conclusion of their research, this Task Force recommend three bleach-free and USEPA approved products: Oxivir Tb, SaniDate, and Alpha-HP Multi-Surface Disinfectant (Table 3).

Table 3. Task Force recommended USEPA-registered bleach-free disinfectants and sanitizer

Product	Use	Surface
Oxivir® Tb 	Disinfect hard nonporous, non-food contact surfaces	• Diaper changing tables • Potty training chairs • Cots/cribs • Mouthed objects (including toys) • Sinks • Walls/partitions
SaniDate® 	Sanitize food contact surfaces and non-food contact surfaces	**Food contact surfaces** • Snack/meal tables • High chair tables **Non-food contact surfaces** • Non-mouthed toys
Alpha-HP® Multi-Surface Disinfectant 	Disinfect hard nonporous, non-food contact surfaces	Floors (infant/toddler rooms)

Other products that have the potential to be more sustainable are diapers and wipes, which hugely contribute to waste in child care centers. As child care providers must change diapers frequently, they must be simple and sanitary. Title 22 has relatively concise regulations for diaper use. Soiled diapers should be disposed of as recommended by packaging or in an airtight container for daily disposal outside the center (Department of Social Services). Cloth diapers provided by parents/guardians need to be placed in airtight containers and returned at the end of the day. When soiled, diapers provided by the center should be rinsed, washed and sanitized daily.

Title 22 also notes that diaper changing areas need to be sufficiently sanitized after every change. This includes washing and disinfecting the area where residue could be spattered from soiled diapers and items and areas that are touched by staff.

Existing Models for Sustainable Daycares

Although not many child care centers are completely sustainable, numerous have efforts and practices that are geared toward being environmentally conscious. Possibly deterred in the past due to costs, child care centers and schools are now increasingly recognizing the long term benefits of switching over to green practices. Many aspects of a child care center, such as the architecture, energy and water usage and waste management can be sustainable. Naturally, infrastructural changes are the most challenging to implement due to price, management and policies. However, it has been demonstrated that sustainability class curricula, environmentally friendly products, and other internal practices can produce significant impacts as well.

In Australia, many child care centers have incorporated sustainability into their programs. For example, the Clovelly Child Care Center in New South Wales, has switched over from disposable diapers to cloth ones, claiming to have reduced 450,000 diapers from reaching the landfill. The center also performs water conservation by connecting rainwater tanks to their toilets and washing machines, and energy conservation by possessing efficient lights, and insulation. Furthermore, the center has professional auditors execute water and energy audits in order to record and recommend feasible future changes. Similar to the Krieger Center, lack of water meters and water bills is an issue. This greatly limits their ability to effectively provide estimates of water usage over time or even useful recommendations for the future.

Here in the United States, there are programs such as the Green Schools Initiative in California, that provide reports and recommendations to help schools transition to a more sustainable and healthy environment for students. They utilize an integrated approach, by engaging students, teachers, and stakeholders to change policies and encourage new ways of thinking to solve environmental issues. The initiative builds upon four core tenets, which include being toxics free, using resources efficiently, creating green spaces, and involving students in the process through environmental education.

The Los Angeles Unified School District (LAUSD) Board of Education began to incorporate sustainability and low impact development (LID) projects into their new schools in 2000. Their intention was to allow for a more productive learning environment for students while producing less energy consumption and waste (Anchipolovsky, 2010). While LEED certification was restricted to new buildings, LID projects were added onto existing structures. The LID projects included water saving techniques such as infiltration and biofiltration for stormwater, and the use of native plants and green roofs (LAUSD, 2009). The incorporation of LID met constraints of unique safety regulations associated with a school campus. For example, LID has to be fenced away from the playground area to make sure children could not access it (LAUSD, 2010).

The use of environmentally preferable products (EPP) has also been implemented in select California schools under the sustainability standards of the

Collaborative for High Performance Schools (CHPS) (LAUSD, 2010). School districts have found relevant products to use in the classroom under standards such as the USEPA's Federal Guidance on Environmentally Preferable Purchasing, California Gold Sustainable Carpet Standard, ISO 14024 Principles and Procedures for Type I Environmental Labeling, and ASTM E2129 Data Collection for Sustainability of Building Products (LAUSD, 2010).

Effects of Sustainability and Environmental Education on Child Development

Investment in early child development (ECD) has proven to aid in sustainable development efforts, including increasing financial earnings and reducing crime. According to a UNDP report on investing in ECD, the formation of our brains in early years strongly influences our behavior for the rest of our lives. Although the brain continues to build on its cognitive, emotional, social, and language skills through adolescence, early experiences and environments are especially crucial because the basis of these skills and neural pathways form early on (Young, 2014). Implementing environmental education (EE) at a young age would definitely increase sustainable behavior and gradually shift our society towards a more eco-friendly culture.

Research has shown that increasing exposure to nature at a young age tends to deepen children's "environmental sensitivity", or an inclination to learn about and conserve nature (Ernst and Theimer, 2011). In Ernst and Theimer's (2011) study, the researchers measured students' "connectedness to nature" through a Children's Connection to Nature Index. The index involves statements related to feelings towards nature that students could rate from 1 to 5 (disagree to agree). Ernst and Theimer (2011) also stress that EE may have a greater impact on younger children as studies have found that firm attitudes towards nature already exist at early teenage years. Westervelt and Llewellyn (1985), for example, share that 10 to 12-year-olds are more actively curious about animals, and elementary school students are more likely to have a greater emotional concern for animals. The potential to expand on young children's existing interests in the natural world further supports the need for sustainability and environmental education in ECD.

Besides fostering environmentalism, environmental education has positive implications on student learning. Compared to traditional schools, EE schools allow students to become self-directed learners as they engage with nature. By encouraging hands-on learning through projects with real-world applications, EE curricula gives students important critical thinking, relationship, and leadership skills (NEEF). For example, one EE class in Texas taught by Jane Weaver was completely project-based, utilizing their local prairie environment. Projects, which included prairie restoration and building a bridge, allowed students to problem-solve while learning through teamwork and discussion (Archie, 2003).

Discussion & Conclusion

In attempting to switch to more sustainable products, child care centers are often limited by Title 22 Regulations. Products of greatest interest to the Krieger center include diapers, wipes and cleaning products. Researching simultaneously environmentally-friendly and safe products to be implemented in these facilities will require strict adherence to the rules and regulations.

It is also important to note how environmental education can impact child development. Allowing young children to gain early experiences with nature can not only help increase eco-friendly behavior, but also improve student learning. While a 2011 study by Ernst and Theimer provides some quantitative data, a standardized way to measure the effectiveness of EE is not available. More concrete data is needed to measure how effective EE is in shaping sustainable behavior. In addition, researchers on environmental education admit that further research is needed to explore what types of EE influence sustainable behavior and to what extent it is successful in increasing environmentalism.

There are limited cases of sustainable initiatives being incorporated into early childcare facilities globally. Projects and programs found while researching this topic typically involved incorporating sustainability into the curriculum, rather than facilities. Cases involving sustainable education facilities were largely at collegiate levels of education, with fewer projects ranging from elementary to high school level. Nevertheless, all of the initiatives, programs and practices mentioned earlier in the review, are commendable.

We think that this literature review will be greatly useful to many facets of our project. The rules, regulations and policies discussed above will help us assess which green products are safe to use and how we can reduce diaper waste without compromising the health of the children. The practices and curricula of the schools and child care centers that we researched, will help us formulate similar programs to incorporate sustainability into the facility and in the classroom. Lastly, although our research on the effects of environmental education on child development may not be directly related to our project, it substantiates the significant benefits that our project can potentially create.

Sources

Anchipolovsky, Alla, et al. "LID in new schools: The LAUSD example." *the 2010 International Low Impact Development Conference-Redefining Water in the City*. 2010.

Archie, M. (2003). *Advancing Education through Environmental Literacy*. Alexandria, VA: Association for Supervision and Curriculum Development.

Benefits of Environmental Education. (n.d.). Retrieved January 28, 2016, from http://eeweek.org/benefitsofEE

Department of Social Services. California Code of Regulations, Title 22, Division 12.

Ernst, J., & Theimer, S. (2011). Evaluating the effects of environmental education programming on connectedness to nature. *Environmental Education Research, 17*(5), 577-598. Retrieved January 27, 2016, from http://psychsustain.voices.wooster.edu/files/2014/01/enved.pdf

Los Angeles Unified School District Board of Education. "Resolution on Los Angeles Unified School District. Stormwater Technical Manual. Prepared by Geosyntec Consultants, October 2009.

Los Angeles Unified School District. "School Design Guide." May 2010.

San Francisco Asthma Task Force. "2013 Update: Bleach-free Disinfection and Sanitizing for Child Care." January 2013.

Young, M. E. (2014). *Addressing and Mitigating Vulnerability Across the Life Cycle: The Case for Investing in Early Childhood* (Rep.). Retrieved January 26, 2016, from UN Development Programme website: http://hdr.undp.org/sites/default/files/mary_young_hdr_2014.pdf

Westervelt, M.O., and L.G. Llewellyn. (1985). *Youth and wildlife: The beliefs and behaviors of fifth and sixth grade students regarding nondomestic animals.* (Report to the US Fish and Wildlife Service, Document No. 498-443-42425). Washington, DC: US Government Printing Office.

Appendix B: Map of waste bins before changes

Note: T = Trash; R = Recycling; L = Laundry

Appendix C: Signage created by the team

Contaminated **recyclable** plastic can be salvaged by putting the food waste into the **compost** bin!

TRASH

SNACK WRAPPERS

CHIP BAGS

CANDY WRAPPERS

CONDIMENT PACKAGES

JUICE POUCHES

SOILED PLASTIC

PLASTIC WITH HEAVY FOOD CONTAMINATION

CRAFT MATERIAL

MISC ART SUPPLIES

CERAMICS

FABRICS

HYGIENE ITEMS

GLOVES

DIAPERS

NO liquids - please empty your recyclables

RECYCLE

CARTONS

SHELF STABLE CONTAINERS


JUICE BOXES


STYROFOAM

CLEAN, EMPTY PLASTIC BOTTLES


EMPTY PLASTIC CUPS


EMPTY CANS & GLASS BOTTLES

EMPTY CONTAINERS

MIXED PAPER


EMPTY PIZZA BOXES (GREASE CONTAMINATION OKAY)


CARDBOARD


ANY METAL


ALUMINUM FOIL

CLEAN PAPER

METALS

Appendix D: Cost analysis of environmentally friendly diapers

Brand	Price ($/diaper)	Compostabl	Durabilit
Earth's Best Tende Care	$0.36	No	6
Bambo Nature	$0. 48	80%	8
Honest Co.	$0.41	80%	4
Nature Babycare	$0.49	Partial	3
Broody Chick	$0.64	100%	5
Seventh Generatio	$0.38	No	6

*Durability rated on a scale of 1 to 10 (10 being the best)
Source: BabyGearLab Product Reviews and our own cost analysis

Appendix E: Responses to Team Krieger's questions about sustainability from the Clovelly Child Care Center in Australia

1. **Do you have any experience or advice for using compostable diapers or wipes?**
We do not use compostable nappies. We use cloth nappies which are sluiced, soaked and washed by the staff at the centre on a roster basis and have done so since 1985. We also use cloth rags as wipes and they are also washed accordingly. We did go through a stage of using wet wipes but as part of a waste minimisation strategy we have returned to rags.

2. **What kinds of products does your facility use for sanitation purposes?**
We use a eucalyptus based nappy soak to sanitise nappies and a eucalyptus washing powder. We do have a chemical disinfectant for the nappy change area but this is in the process of being changed. Instead we will be using hot soapy

water and a natural disinfectant based on tea tree oil that we will make at the centre.

3. **We understand that using environmentally friendly products often incurs higher costs, so how do you find funding to offset these costs?**

Our centre has a philosophy that supports our practice. We also have a very supportive Sustainability Committee made up of parents who have the same values. We have successfully applied for grants which have allowed us to install water tanks, solar power, composting and worm farms. We are currently reviewing our purchasing across the board. The most expensive item to purchase made from recycled material is paper towels. This is one of our targets of reduction. There has been some resistance from the parent management committee based on financial concerns but we are working towards sustainability on all levels and this is the mainstay of our centre. Our moniker is "A safe, happy and sustainable place"...so we bloody well should be sustainable!

4. **How easy was it to transition to environmentally friendly products? Were there any limitations or barriers to implementation?**

With the nappies, our centre opened in 1985 and it was the norm for centres to use cloth nappies. When disposables became fashionable the then director kept using cloth because of concerns about the huge contribution to landfill disposables would make. The response and support we get from parents is usually very positive, but we also need to have staff with like minded attitudes towards environmental issues. We have a lot of staff and parents onside. This has been a long road for the centre but one that has not wavered regarding the final destination! We are still not there but will continue and this year hope to finalise our Environmental Purchasing Policy, install a composter to deal with our waste on site and build a garden shed to accommodate equipment and animal food. We also have rabbits and chickens and a very successful kitchen garden program.