

INTERACTIVE DISPLAYS AND EDUCATION

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Abstract:

Since the 1960s a growing body of research has emerged which seeks to determine the effectiveness of interactive educational displays on improving information retention, and the development of a sounder understanding of biological processes. Through analyzing this research, I have developed a concept that seeks to incorporate an interactive type display into the Texas State University Department of Agriculture. The display utilizes both the indoor space as well as the gardens that surround the agriculture building. The aim of this project is to create an interactive display that corresponds to the Economic Entomology class in order to give students a deeper understanding of the course material as it relates to real world applications. The project consists of four shadow box style display cases to be installed in the Agriculture building. Inside of the display cases will be agriculturally important insect specimens. Accompanying the shadow boxes will be a poster with information relating to the field of Entomology. The poster will also direct students and visitors to the gardens where they will look for insects of agricultural importance as described in the Economic Entomology course. A series of aluminum signs will be placed throughout the gardens containing information on particular insect orders. In addition to creating a more comprehensive learning environment, this project is an attempt to give back to the Texas State University Agriculture Program which has been a huge part of my professional development over the past few years.

Keywords:

Interactive exhibits, education, entomology, museum displays, outdoor education

Preface

Before getting too deep into this paper I want you to take a moment and think about what the word improvement means to you. Maybe think of a time when you took the opportunity to improve a situation, your surroundings, or maybe even a time when you set out to improve the circumstances of someone unrelated to you. Even if you can't think of something off the top of your head there is no need to fret. I believe that in reading the following pages, something will pop into your head. In fact, I am almost certain that there is a moment in your life that you took the initiative to improve a situation. The reason I am so certain of this fact is because the desire to improve a situation, or a state of being, whether physical or mental, is something that almost all humans share. It is an innate drive that motivates people from the moment they are born. The process of learning to crawl, and then walk, and eventually to run are all driven by a desire to improve your situation.

Now why is the drive to improve important to this paper?

When I began my college career at Texas State University in 2014, I was a nontraditional student returning to school at the age of 26. I had earned an associate's degree a few years earlier in welding technology from Austin Community College, and had spent the past few years working in a small welding and fabrication shop in Austin, TX. Perhaps my career in welding was the catalyst, or even better, the spark, that precipitated my return to school. For me, welding is a creative outlet that allows me to physically create objects that enhance people's lives. I found my sculptures could evoke

emotions and memories in people that they had long forgotten, perhaps improving their mood even if just for a brief moment in time. As for my architectural, and more functional welding work, this too was often commissioned by clients who had a vision that they wanted me to create in order to enhance their lives in some way. Garden beds, sconces, desks, you name it. People had all sorts of visions of things that could improve their lives.

This brings me back to my decision to return to college. When I first began looking at colleges I envisioned myself getting a bachelor's degree in studio art. Creating welded sculptures did, and still does hold a very dear place in my heart. I thought that getting a studio art degree would help me to refine my artwork so that it could become something I did full time. With this in mind I visited the school of fine arts at Texas State University. My first visit to the University was during a warm day in the summer of 2014. During this initial visit I was shown around by one of the faculty members of the fine arts department. He explained the program, showed me around the building, and took me to the different art studios where students were busy painting, sculpting, and yes, even welding.

As the morning turned to afternoon, and our tour drew to a close, I thanked the professor for showing me around, and began to make my way back out of the fine arts building. On the way out, I decided to look at some of the art that was on display throughout the department. In doing so I began to reflect on where exactly I was trying to go, or perhaps more importantly, what I was trying to accomplish by returning to school. Suddenly it was clear. I wanted to be a Landscape Architect. Now this might seem like a leap, but this realization wasn't so crazy when I began to think about it.

Landscape architecture is heavily rooted in art and design, and as a welder I had worked on multiple projects designing and fabricating metal elements for people's homes. I had even become familiar with a few common design principles along the way.

Unfortunately, it was quickly brought to my attention that Texas State does not have a Landscape Architecture program, and the schools in Texas that did would require me to basically start my college career from scratch if I wanted to earn a degree in Landscape Architecture. This was not something I was willing to do. With this in mind I decided to check out the Department of Agriculture at Texas State to see what classes they had to offer that would correspond to landscape design and/or architecture. When I came up to the agriculture building I was greeted by students busily planting, watering and weeding the gardens that run around the periphery of the building. I also noticed multiple metal sculptures placed throughout the gardens. This felt like a good omen to me, and I was already feeling very inclined towards the Department of Agriculture. As I entered the building I was greeted by a row of indoor plants lining the hall that leads to the back door. I decided to take a look out back. Upon doing so I found myself in a shaded courtyard with the sound of running water trickling up from a fountain to my right. Plants large and small filled the garden beds around the edges of the courtyard. The candy-like aroma of flowers, and herbaceous plants filled my nose. It was at that very moment that I knew this is where I wanted to spend the next few years earning my bachelor's degree.

I soon learned that the Department of Agriculture at Texas State offers an agriculture business and management degree with a specialization in horticulture. There were classes where I would learn about hundreds of native plants as well as trees

commonly found in our area. There were also classes on soil health, electrical and mechanical systems, and even classes in landscape design. Even though I would not be earning a degree in landscape architecture, I knew that this was a program that would put me on a path towards achieving my dream of becoming a licensed Landscape Architect.

Over the years I have gotten to know the faculty, staff and students that make up the Department of Agriculture. I feel blessed to have made new friends, and to have watched as the program expanded, and improved in many ways. The gardens around the building are fuller than they have ever been, and the construction of new garden areas is currently underway. It is amazing to reflect on the first time I walked into the courtyard outside of the agriculture building on that warm summer day. As I reflect, I feel very strongly that the outdoor garden, or “living library” as it is known in the department is one of the most valuable resources that the department has to offer. It is a vital part of not just the herbaceous and woody plants classes, but also the soil sciences classes, landscape design classes, and organic gardening class as well. Seeing the gardens develop, and the plants cycle through the seasons has been one of my favorite parts of the program, and I have spent hundreds, if not thousands of hours nestled among the sights and smells of the gardens studying and relaxing.

Yet, despite the many strong points of the living library, I feel that there are areas in which it could be improved. More specifically, I think that the garden could be linked with the inside of the building in a way that better integrates a larger number of classes within the agriculture program. Of course, the plant identification classes and landscape design courses are well affiliated with the living library, but I believe there are many other classes which could be taught through the use of the living library.

With this in mind, I have developed a design concept that utilizes prior research on outdoor education and interactive museum displays to increase student interest and understanding of the Economic Entomology course taught in the Department of Agriculture. In its simplest form, the concept involves hanging a series of display cases inside of the agriculture building which will house interesting and agriculturally significant insect specimens. The display cases will be accompanied by a poster describing the agricultural and social importance of these insects, as well as where they are commonly found. Finally, the poster will invite students and visitors to enter the gardens around the agriculture building where they can look for insects and expand on what they have learned inside. My design also incorporates the use of signage throughout the garden indicating where certain insects might be found, as well as expanding on the information found on the poster. This design is especially geared towards targeting students in the Entomology course, which requires the collection, identification, and preservation of particular insect orders. The thought, however, is that the presence of the display boxes, and the signs outside will increase student interest before they begin taking the Economic Entomology course.

Introduction

It really is amazing to think that modern psychology has only been practiced since the mid 1800s. In fact, it was Wilhelm Wundt who created the first laboratory devoted exclusively to the study of psychological research in 1879. Since that time, researchers and psychologists have made great strides in understanding human, as well as animal psychology through self-exploration and reflection. The self-examination process, and the research performed by modern psychologists has helped humans to unlock mysteries

about themselves and their complex history, while at the same time providing insights into how humans develop and learn from birth onwards.

While modern psychology began in the late 19th century, it wasn't until the 1960s that psychologists began to apply their theories and understandings to the way children and adults learn in school, and more specifically, in museum settings. Over the past 50+ years, researchers have provided keys to setting up learning environments in which children, as well as adults can reach their highest potentials of learning. Examples of this research include realizing the impacts of outdoor education on memory retention and understanding how interactive museum displays engage visitors in different ways. Research has also been conducted on the ways in which orienting students to the physical features of a museum aid in the ability of visitors to remember key information later on. These are only a few examples of the ways in which research is helping museums, schools, and learning institutions to setup their educational materials. The goal of this paper is to present research related to the topic of modern educational resources found in museums, while at the same time developing, and laying out an integrative educational concept that could be used in schools to help students engage more with their education. In reviewing past research, it seems that connecting abstract ideas and understanding how this relates to real world applications is of the utmost importance to educators. For this reason, the design concepts presented in this paper will focus heavily on aiding students in understanding the sometimes-abstract concepts found in the field of entomology.

Body

The Economic Entomology program at Texas State is an integral part of the agriculture and biology programs within the University. Currently, Economic

Entomology is taught by Dr. Ken Mix. The class outline is fairly straightforward but relies heavily on students working outside of the classroom to understand and engage with the concepts taught by Dr. Mix. In fact, one of the main components of the Entomology course is having students collect, identify, and preserve insects of various orders that are agriculturally important. *Araneae* (spiders), *Lepidoptera* (Butterflies and moths), and *Hymenoptera* (Wasps, bees and ants) are a few examples of such insects. While most students have some awareness of these types of insects, their understanding of how these insects relate to agriculture, and the roles they serve in nature are often misunderstood or incomplete.

For this reason, developing resources outside of the Entomology classroom that support the materials taught within, could be an extremely helpful link that motivates a more concrete understanding of insect functions within students. Setting up this type of resource does not necessarily require excessive resources or time. In fact, the Department of Agriculture at Texas State already has a large garden that surrounds the building comprised of smaller perennial, annual, shade, organic, and xeric gardens. This garden, aptly named the “living library,” lends itself well to the study of plants as well as insects and can easily be improved upon to better support students understanding of entomological principals.

The principles that a student should grasp when coming into an entomology, or biology classroom are similar. To begin, a student needs to have a solid understanding of evolution. Without this fundamental knowledge a student will be deprived of a sense of order and coherence found within the disciplines (Shtulman and Checa 2012). Furthermore, it helps for students to have an idea of common biological, and

physiological functions and how they relate to human, animal, and insect development. Research has shown that this “prior knowledge” provides a more solid foundation on which a student can learn and connect increasingly more complex ideas (Roschelle 1995). Unfortunately, many students enter college with incomplete, limited, and often misinformed prior knowledge. With this in mind, it is important for educators to analyzing their own prior knowledge, so as to better tailor their educational approach in order to support the assimilation of new, or more technically sounds concepts (Roschelle 1995).

The understanding of how prior knowledge impacts learning can also be useful for designers of interactive exhibits/experiences. In fact, there are three important factors to keep in mind when designing an interactive learning experiences. First, designers should aim to refine prior knowledge, rather than to try and replace this knowledge with their own. Second, designers need to understand that the learning process is just that, a process. It takes time for true understanding to become rooted, with each experience acting as a small link in a larger chain. Third, designers need to keep in mind that learning is dependent on social interaction, the support of which can aid in the understanding of new information (Roschelle 1995). By being mindful of these principles an interactive experience can be provided to students that will act as an assistant to what they are learning in the classroom.

The museum setting is often much different than those that are found in schools. In fact, museums often have a leg up on formal education due to the fact that visitors to museums are not required to pass tests, and the experience of visiting a museum is usually more open ended. This means there is freedom of visitors to choose where they

go, and what exhibits they engage in. Even in a museum, however, provoking curiosity is the means of getting visitors to explore certain exhibits (Allen 2004). Provoking curiosity can be used in a university setting as well. By setting up “exhibits” inside of departments, whether that be the Department of Agriculture, Engineering, etc., professors could potentially spark student interest well before they even enter into the classroom. These exhibits could give students an idea of what to expect, as well as provide important information that might be useful to know before they enter into a particular course. In fact, ideal learning has been characterized as being initially driven by curiosity and interest, and is sustained via a “flow state,” in which visitors become fully involved with mind and body in an intrinsically motivated activity (Allen 2004). The idea of getting students into a “flow state” can be supported by using the “living library” at Texas State to immerse students in an outdoor activity in which they lose themselves while exploring the different garden areas in search of insects.

Researchers have found that visitors to museums have improved cognitive learning when they are pre-oriented to the physical features of the museum (Anderson and Lucas 1997). The pre-orientation is thought to reduce novelty in visitors, where novelty implies distraction and a loss of attention to the task called for by the exhibit. Pre-orientation in the Department of Agriculture could include showing students a map of the “living library” with labels that show where the different types of gardens are located, and what type of flora, and fauna they might find within those areas. Professors could also ask that students visit the “living library” to create a report or describe what they found when they return to class. In addition to pre-orienting students, it was found that a large physical size of an exhibit, prominence of placement, and an increase in the number

of senses employed while interacting with an exhibit all improve a visitor's ability to recall an exhibit once they had left the museum (Anderson and Lucas 1997).

In setting up an interactive display at Texas State, indoor space is often limited. By utilizing the outdoor gardens, however, the scope of the "exhibit" can be greatly expanded to include more prominent locations. This idea could be likened to a butterfly or bird sanctuary. Furthermore, while the indoor space might contain some specimens and literature, the outdoor space would engage senses of touch, smell, hearing, and sight. Expanding on the idea of involving the senses, is invoking some sort of emotional response in visitors. It has been shown that museums have more success communicating a message to visitors when the exhibits have some sort of emotional impact (Jeffery and Wandersee 1996). In one study, visitors were asked questions relating to exhibits they had visited two weeks after their trip to the museum. It was shown that visitors were best able to recall a touch tank, in which they could touch sting rays, and an exhibit where they could feel an electric shock similar to that of an electric eel. Researchers believe that the fear and excitement that these exhibits evoked enhanced the experience for visitors in some way, enabling them to better recall facts about the exhibit (Jeffery and Wandersee 1996, Meyer 2003). While evoking fear is not the primary goal of the proposed concept to be installed at Texas State, the act of looking for, and discovering new insects could be exciting for students, and at times nerve wracking when trying to study a potentially threatening insect such as a wasp, or a spider.

This type of learning in which individuals take part in concrete experiences that fully involve their intellect, feelings, and behaviors is known as experiential learning (Meyer 2003). The foundation of this principle is that these concrete experiences

provoke further reflection within the mind of the individual. These reflections can lead to changes in prior concepts, and the formation of new understandings that helps an individual in conceptualizing their surroundings. Educators can use this knowledge to enhance not only students understanding of biological principles, but in students better understanding of the curriculum as a whole within the university department in which they are enrolled. This could potentially set them up for better success from the time they enter the program through graduation.

While the advantages of outdoor education and interactive displays are well documented, there are important principles that need to be minded in order to have the highest chance of success. The following are five common pitfalls to be avoided when designing interactive displays. First, setting up multiple exhibits with equal interest or prominence can reduce visitor enjoyment. Second, when setting up interactive experiences it is important to try and reduce interference between visitors. Interference can cause distraction, as well as frustration by preventing students becoming fully engaged in an experience (Allen and Gutwill 2004). Third, it is important to try and reduce the ability of visitors to negatively impact the phenomena being displayed. This could mean clearly defined rules, or instructions on how an interactive exhibit is to be handled, as well as reducing the possibility of failure within an exhibit. Fourth, the intended phenomena should be easy to find. In a school setting this means making it easy for visitors/students to locate and observe the intended phenomena. If locating insects is part of the experience, having an ant farm, or a well-maintained butterfly garden could provide a better chance for students to observe targeted insect orders. Finally, it is important to reduce secondary features that may obscure the primary feature being

exhibited. Due to the extremely high volume of insects that exist in the world, and even in a single garden, a design concept that involves students observing insects in nature could involve some sort of challenge. The challenge could be locating insects in a particular size range, or challenging students to find only insects that fall within a particular order, such as Lepidoptera (butterflies), or Hymenoptera (bees, ants, and wasps). By focusing attention, designers can help to reduce the chance of secondary features obscuring a student's attention (Allen and Gutwill 2004).

In addition to the five common pitfalls, outdoor education and novelty can cause adversity in a structured learning environment. While novelty can be an important element in learning, too much novelty can cause an individual to lose focus while performing required tasks (Martin et al. 1981). Research on animals, as well as humans, suggests that novel environments can arouse behaviors that create a drive to explore (Martin et al. 1981). While this might be advantageous in some situations, it is undesirable in a classroom setting where task learning is imposed on the students. Therefore, when setting up interactive learning environments it is important to be mindful of the tasks imposed on a visitor or student. Tasks that involve reflection on an experience, or ones that involve sensory experiences are often better suited to information retention and success.

Conclusion

The research that has been done on interactive displays and how particular settings can influence learning has helped museums as well as educators to create better learning environments. However, due to the fact that this field of research is so young, there is still much to be learned, and ideas are constantly being presented that challenge

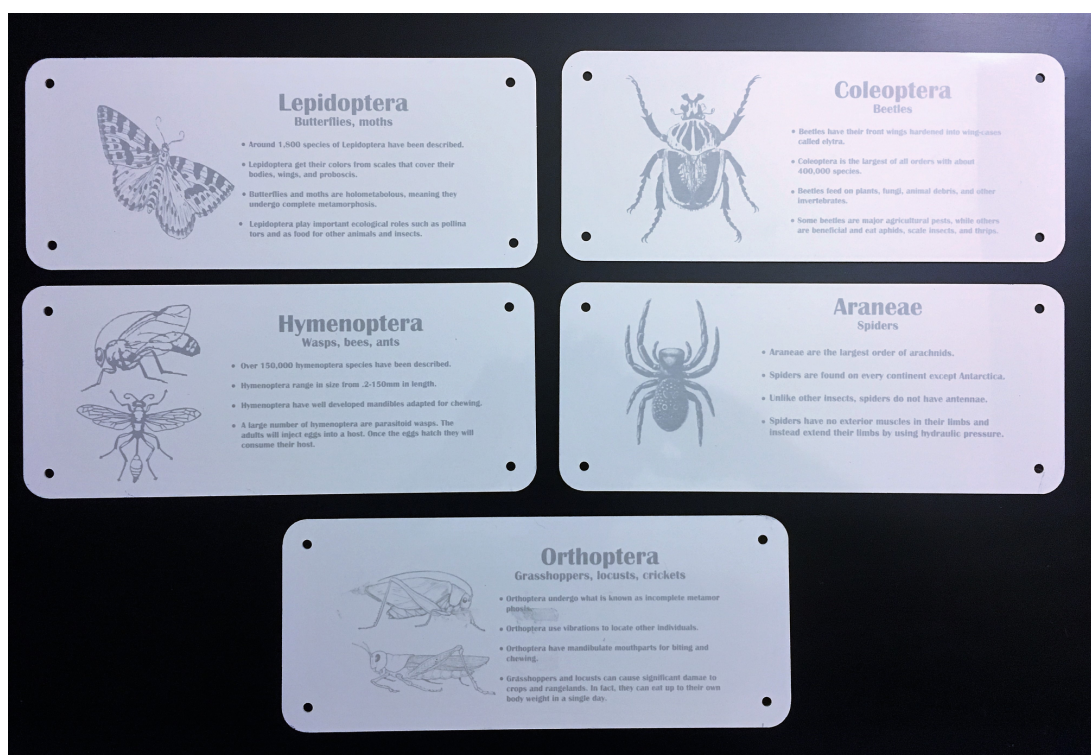
traditional approaches to education through displays and environments. Furthermore, while most of the research focuses on interactive displays in museum settings, there is little attention paid to how this type of education could be applied in a classroom setting. While classrooms and museums have a number of differences in how they approach education, there are commonalities that could make interactive displays just as effective in school as they are in museums.

Although the design concepts presented in this paper do not involve an analytical component, it would be a simple and logical process to determine if students benefit positively from having well thought out, interactive type displays in their departments/schools. The simplest way to determine if there is a correlation between interactive displays and learning would be to analyze student's final grades at the end of a semester. This, however, could have a number of elements that might produce inaccurate results. Furthermore, the idea of installing these displays is to enhance a student's overall understanding of biological processes as they relate to real world scenarios, which might not be reflected in end of semester grades. For this reason, a questionnaire could be presented to students at the beginning and end of each semester, with one group of students having not been exposed to interactive displays, and the other group having been exposed to these displays. By analyzing the accuracy of answers within each group, researchers and teachers could determine whether the displays do in fact have the ability to improve student understanding.

The main idea behind the development of interactive displays is to constantly improve the ways in which students learn and understand information. Enjoyment of school, and comfort in an educational setting are major components that should be

considered when weighing the use of new or novel concepts. By analyzing the research and developing new methods of education, teachers can continue a tradition of education that puts students first. Hopefully these types of interactive displays become more common, especially in the earliest levels of education when students are first being introduced to concepts that will form the foundation of their learning throughout their lives.

Signs



The above signs were made in the Bobcat Made Makerspace on the Texas State Campus. To begin, the sign blanks were ordered from amazon.com. They are roughly 10.25 x 4.25". These dimensions were used to create the layout and design, which was completed with Adobe Acrobat. Once each sign had been designed and formatted correctly, the files were saved to a zip drive and taken to the Makerspace where they were sent directly to the laser etching and engraving machine. There was a fair amount

of trial and error in getting the files in the correct format, and then orienting the text in the correct position on the signs. After a few tries, however, the correct settings were determined, and the signs were etched. Once everything was set correctly it took roughly 1.5 hours to complete the etching of the signs. Now that the signs are completed they will be attached to stakes and placed throughout the gardens that surround the Department of Agriculture Building. I would like to give a special thank you to Richard in the Bobcat Made Makerspace. His help was indispensable in the etching of these signs. There were a number of other volunteers that work at the Bobcat Made Makerspace, without whom this part of my project would probably not have come to fruition.

Poster

The display poster that will go along with the shadow boxes can be seen below. The poster contains a brief overview of insects in general terms and lists the most common agriculturally significant insect orders. On the poster there are also text boxes that highlight four insect orders corresponding to the shadow boxes that house the insect specimens. The insect orders highlighted on the poster also correspond to the signs that were made and placed throughout the gardens. At the bottom of the poster is a prompt for observers to go out into the gardens to search for insects within these orders. The poster was created using Microsoft PowerPoint and was printed through the Texas State Honors College.

Insects in the Garden

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Lepidoptera

It shouldn't be too tough to find insects from this order. Butterflies and moths are well known and easy to spot insects in the Lepidoptera order. One of the most well known butterflies in this region is the Monarch, but there are hundreds of other butterfly and moth species that can be found around Central Texas.



The World Of Insects

The world of insects is immense and fascinating. Today, there are more than 1,000,000 described insect species. That is more than half of all known living organisms! Some of these insects are microscopic, while others, such as the Atlas Moth can have a wing span of up to 1 foot across.

While many people find insects to be mysterious and often intimidating creatures, a little bit of understanding will help people to accept insects for the vital ecological roles they play. That right! Insects act as pest control agents, pollinators, and even as a food source to humans!

There are a few insect orders that play major roles in agricultural systems. These orders include...

- Lepidoptera (Butterflies)
- Hymenoptera (Bees and Wasps)
- Coleoptera (Beetles)
- Orthoptera (Crickets and Grasshoppers)
- Araneae (Spiders)
- Diptera (Flies and Mosquitoes)

Can you find an insect from each of the orders above?

Now that you know a little more about common insects in our area, why not take a look around outside? There are white metal signs throughout the gardens that surround the agriculture building where you are likely to find some of the insects mentioned here.

TEXAS STATE UNIVERSITY
The rising STAR of Texas

Coleoptera

This large order is made up of what we know as beetles. In fact, there are over 350,000 described beetle species to date. That's about 25% of all described animals on the planet. Look high and low, because these insects can be found under the soil, climbing on tree branches, and even flying through the air.



Orthoptera

Crickets, grasshoppers, and locusts are some of the most well known insects in this order. Ask most any farmer in Texas and they will tell you that some of these insects can cause serious crop damage! In fact, a locust can eat up to its own body weight in a single day.



Araneae

Although they are not true insects because they have 8 legs instead of 6, spiders are still of extreme agricultural importance. Spiders are predators and act as nature's pest control. In fact, one spider eats around 2,000 other insects per year.



Display boxes

Below is an example of the display boxes that will be used to house the insect specimens.



These too were ordered from amazon.com. They are 12" x 12" and will be installed alongside the display poster.

Final Thoughts

It is often said that as one door closes another door opens. In my case this is absolutely true. As my last semester of undergraduate study at Texas State comes to a close, another, equally daunting adventure awaits. Before my senior semester at Texas State I decided to apply to graduate school to pursue a Master's in Landscape Architecture. My decision came on the heels of finishing a 15-week summer internship at Benchmark Landscape's where I had my first real taste of what it is like working as a landscape architect. My internship confirmed my desire to become a landscape architect and prompted me to begin the daunting process of applying to Graduate school. I am extremely happy to say that my diligence over these past few months has paid off. Not only did I get into the two schools to which I applied (The University of Texas, and Texas A&M), but I was offered a recruitment scholarship as well.

The Texas State University Department of Agriculture has given me so much over the past few years. Aside from a great education, Texas State has introduced me to new concepts and has given me the confidence to reach ever higher in improving not just myself, but my community as well. Texas State University is a pillar of the community and has a devotion to improving society through education. With this in mind I felt compelled to give something back to the University. The improvements to the Department of Agriculture are a small token of my gratitude, but they are ones that I hope will inspire many students for years to come.

I can honestly say that my experience as a student at Texas State University have given me the confidence to apply to graduate school. I feel extremely competent and able to take on these next adventures head on. In fact, if there is one thing that I regret

looking back on my schooling at Texas State it is having not been more involved with clubs, lectures, etc. that were offered through the university. Reflecting on this has motivated me to really get involved during my graduate studies. I find myself not only wanting to be a part of clubs, but also wanting to commit more time to my friends, family, school, community, and most importantly, to improving the relationships people have with their surroundings.

This drive has always been a part of what motivates me. From the very moment I decided to return to school in pursuit of a bachelor's degree, I knew that I was doing so in order to make the world a better place. To improve on the world that I know today, and hopefully make it a better place to live for generations to come. I know it sounds cliché, but humans have a deep desire to improve themselves, as well as their surroundings, and for me landscape architecture is the way to accomplish this drive. Through sustainable design, mindfulness, and putting the future first, I hope to make an impact through the field of landscape architecture that will not only change the way people conceptualize the landscape, but one which will motivate them to go even further in improving their own lives as well.

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