My Senior Thesis Project, Fly Sci with Miss Ontai, was an interactive web-series designed to engage middle school students in Texas with standardized testing objectives within Texas called the TEKS. The seeds of this project were first planted all the way back in my freshman year at St. Edward's University, when I switched my major from biology to biology education. Upon taking my first Foundations of Education classes, I realized that high-stakes standardized testing puts a rather large burden on teachers and school districts, as teachers' salaries and school budgets are often determined by the students' scores on these end-of-the-year tests. As I began to observe teachers in the actual middle school classroom, I saw what a burden it was to teach kids all of this content within an allotted amount of time while simultaneously trying to teach testing strategies, and I often saw teachers use lectures to get through the material quickly enough with enough time to devote to test preparation. Unfortunately, I also saw that students were routinely disengaged with this particular style of teaching, with many students just going through the motions every day in class.

My sophomore year at St. Edward's, I took a course called Integrating Educational Technology, where we talked about different ways to integrate technology into the classrooms in order to engage the "Net Generation" that we are currently teaching. In this class, we had to create several videos, one of which was a flipped lesson plan, and I found that I not only enjoyed this particular mode of teaching, but that I also enjoyed the process of video editing and filming. Judging from the feedback I received from my teachers and peers on my videos, I realized that I had developed a talent for creating educational videos. As I continued to observe in the field, I noticed the lack of smooth integration of technology into classrooms at most schools, and I noted that schools that incorporated technology seamlessly into their lessons seemed to have higher levels of student achievement, engagement, and enjoyment.

In my junior year, I began to observe and teach in the field more frequently, and I began my first block of teaching at Covington Middle School, a South Austin school made up of roughly 65% low-income students and a large population of minority students. When I started to get more involved with the classroom, I discovered that one of my little quirks of rapping about science really resonated with the students, and it helped focus them in on a subject and get their attention. Additionally, when I took over the class, I would dress in silly costumes and try to create fun, real-world examples of science in the classroom, so that the students could see the relevancy of the subject to their own lives. My mentor teacher, Mrs. Sellars, really liked the techniques that I used, and so I continued to implement the use of rap, music, costumes, and humor in my next placement at Travis High School, another low-income, high minority population high school. Here, too, these methods of teaching were well-received, and I took note of this as I continued on in my educational career.

The second half of my junior year of college, I was in Senior Thesis Preparation with Caroline Morris when I jokingly pitched the idea of creating a Bill Nye-esque web-series for middle school students in Austin ISD, and Professor Morris immediately jumped at the idea and suggested that I pursue it seriously. Thus, I began research on the topic, and as I began to develop the idea of my web-series more firmly, I found that research had backed up a lot of what I had anecdotally observed in the field. Various studies have shown that, in the United States, there is

a precipitous drop in engagement with science at the middle school level that does not recover throughout a student's high school career. These drops in engagement have been linked to lower levels of student achievement in science. Additionally, teachers across the United States have increasingly implemented lecture-driven, teacher-based curricula in their classrooms, as time for teaching content has been cut to devote more time to test preparation in order to secure the financial future of the school and the teachers. This increase in lecture time has also been linked to student disengagement across subjects, and thus the problem is further exacerbated, and students are caught in a vortex of disengagement, lower academic achievement, and misunderstanding of scientific concepts. The result of this has been that the United States consistently ranks low on student achievement in the sciences in comparison to other developed countries across the globe. Thus, my web-series, by aligning to TEKS and compressing topics into a 10-20 minute video integrated with a worksheet, would allow the teacher to either supplement or replace a lesson with one of my videos, which would allow them to both engage the class while still keeping to a timetable and teaching important standardized testing objectives.

I also found that the implementation of a lesson through the use of video was a valid way to engage the "Net Generation," as students today have grown up in a world of technology. Research shows that N-geners prefer a greater level of autonomy not only over the technology they use, but over learning in general. Thus, displaying a lesson in the form of an interactive video, where students can replay, pause, or skip forward at their own pace, allows the N-geners to have the level of autonomy in their learning that they crave. In addition to this, well-tailored interactive video allows incorporation of technology into the classroom in a very seamless way, which meets the demands of adolescent students who, in a national survey, noted that they would feel more engaged and welcome at school if technology became a bigger part of learning.

Additionally, in my research process, I found that interactive video would be a good way to differentiate the classroom. With the diverse classrooms that teachers are tasked with teaching today, many different accommodations and modifications need to be made for every individual learner. However, with the interactive web-series that I sought to make, there would be multiple modes of learning, including visual, auditory, and logical modes, to name a few. In addition to that, students with special needs would be able to go at their own pace and rewatch the videos as needed, while students who have English as a second language would be able to turn on translation if the video were uploaded onto YouTube or other popular sites.

Upon researching useful pedagogies to use to teach science, I found that the most effective way to teach science was to use demonstrations, as science is often viewed by students as an abstract concept and requires concrete visuals to accompany them. I also found research to back up my claims that humor, music, and relevant, real-world examples were ways to engage students with scientific concepts, as these teaching elements have been shown to evoke an emotional response within the students, which helps with memory retention and engagement.

One of the most interesting things that I found in my research, however, was the lack of women and minority representation in the sciences. An article that particularly stood out to me was a

1983 study where researchers asked students grades K-12 to draw a picture of a scientist. The overwhelming majority of them drew older white males in lab coats as scientists, and less that 0.01% of them drew a woman as a scientist. What was further disheartening is that I found that in 2010, over 50% of the jobs in the National Health Institutes in the U.S. related to STEM were held by white males, proving that the stereotype was not only still pervasive, but self-fulfilling in society today. I also found that science in particular is a subject where minority students and women feel alienated and unwelcome, and that even within scientific shows, the vast majority of main character scientists were white males, with females and minorities playing smaller roles with less screen time and less scientific prestige. This is a particularly disturbing trend in the field of science, as research has consistently shown that the more diverse a group of scientists tackling a certain problem, the better the quality of work produced from such groups. This made my commitment to being a prominent minority woman figure in STEM even greater, which solidified my choice to serve as the web-series host and star, to give voice and representation to a demographic that often feels excluded by science.

While simultaneously researching more about my thesis topic, in order to keep up with the timeline for my senior thesis, I began filming my web-series in the summer after my junior year. I decided to make the first episode on DNA and chromosomes, as I'd anecdotally observed at Covington that the students struggled with this concept, possibly because of the abstract nature of the topic. I began the process of creating my web-series by obtaining AISD lesson plans on the topic from my former mentor teacher Shelly Sellars, along with powerpoints and other supporting materials. After identifying key TEKS, objectives, and vocabulary, I then began writing my script, which would incorporate each of these elements along with the elements of music, rap, humor, and relevant examples I'd hoped to include in the videos. I then sent the script to Dr. Fletcher, who would read over it and greenlight me to start filming. To film, I checked out a DSLR camera to do a stop motion series for the introduction song, a HD Sony camera to film the main parts of the video, and a Zoom H2 to record audio for the songs and the raps. Film sites were around St. Edward's University campus, usually in empty classrooms, and other parts were shot in my apartment in order to keep filming costs low. After I finished filming, I edited the footage in iMovie and the songs in Garageband. Since I'd won the Summer Academic Excellence Award for my project, I was able to hire a graphic designer, Gerry Silguero, and so after I finished editing the video together, I sent the draft to Gerry to add in animations to parts where I explained the concepts of DNA and chromosomes. The finished product was then viewed by Dr. Fletcher and myself, and suggestions for edits were made.

After completing the first episode, I presented the finished product, along with a powerpoint explaining the project, at the Austin Area STEM conference in front of other middle school science teachers. While teachers viewed the video, they were able to follow along with sample worksheet I'd created to go along with the video. After the viewing, I provided surveys about the quality of the educational content, the graphics, and the level of engagement these teachers felt their children would have with the video. The feedback that I received from the conference was used to inform the next installment of my series.

Following the completion of the first video, I began work on my second video that fall, where I covered the topics of work, force, and energy as suggested by one of the teachers at the conference. The process I followed was very similar to the first video, and upon completion of this project, I presented the two finished episodes to a group of college peers, and afterwards, I had them take a survey about the level of engagement that they had from the videos, what they learned from the videos, what elements they found engaging, and whether the topics were clearly presented to them. What I found was that even those students were typically unengaged with science or did not like it very much is a topic, they found the videos to be entertaining and helpful in helping them understand scientific concepts; additionally, some mentioned that it made them feel more comfortable with the science content on a whole, and that they could definitely see the benefit of a teacher using this in a classroom. I gathered this data from the survey and again looked at my videos with Dr. Fletcher to see how I could improve them. I then presented the finished product at the Senior Thesis Symposium in Fall 2016 as well as the McNair Induction Ceremony in Fall 2016.

The finished product turned out to be two episodes of the web-series, instead of the initial three that I had scripted. The he first video it was around eight minutes long and the second video was around 17 minutes long. These videos were created to be less than 20 minutes, as research has shown that middle school students could not pay attention much longer than that. However, after collecting data from the viewing, I believe that they should each be around ten minutes long, as the college students that I had tested were beginning to lose interest and disengage around the ten minute mark. The general structure of these videos was that there was an eye-catching intro, either a ridiculous parody of a show or a cheesy infomercial, that would misrepresent the scientific concept central to the show's theme for the day. The clip would then be interrupted by Miss Ontai saying that the facts were misrepresented, and then the show would cut to the theme music. After the theme song ended, Miss Ontai would reappear and introduce the main topic of today, usually starting the episode off with a free write on the worksheets provided to the class on what the students already know about the topic. Then, key vocabulary words would be introduced, and concepts would be illustrated with links to everyday life, like linking DNA to a code in a videogame, or describing how Newton's Laws of Motion play out in a game of pool. There would also be intermittent illustrations and animations by my graphic designer Gerry to accompany any explanations I would be giving of content. In addition to that, various wacky characters would make their appearances throughout the episode, like a character from the spoof of Man v. Wild in the DNA episode, or Miss Ontai dressed as Princess Leia in the work, force, and energy episode. Various skits would also be cut throughout the show, like the Newton's Laws and Order SVU skit in the work, force, and energy episode. After the episode concluded, there would be a song with a rap at the end of the episode summarizing key points and concepts that were learned. The first episode, I wrote an original song about Chromosomes and filmed an original music video to go along with it, while in the second episode, I made a parody of a popular song and made a parody of the popular music video that went along with it. In regards to the audience's reception, of the two videos, they were received similarly, except for the fact that episode two covered a lot more material, and that the test group seemed to be more interested in episode one's music video, since the lyrics were original and unfamiliar. Something else that I learned from the screening was that in order to maximally

differentiate the videos, I needed to make captions for the music videos, as some of the words would go by too quickly in order for them to be heard correctly.

This project, in its long-winded conception and complicated execution, impacted me in ways that I never imagined it could. First of all, this web-series pushed me to desire to become a champion for women and minorities in STEM. Before researching more thoroughly about the topic, I wasn't aware just how underrepresented people like myself were in STEM fields, not only as educators but also as researchers. Through this web-series, I was able to be a prominent figure in STEM for others like me to be able to look to as an example, and I wish to continue to increase diversity within the field of STEM by becoming an accomplished scientist myself. This has somewhat changed the course of my career path, as I am no longer going to pursue a career as a middle school teacher, but as a graduate student this coming Fall. I want to commit to getting my P.h.D. and increasing the diversity within the field of science, so that I can continue to increase diversity in STEM researchers and also in educators of STEM. This project also made me realize the great passion that I hold for making science accessible to the general public. After showing the two episodes of Fly Sci with Miss Ontai to my college focus group, I realized that the majority of adult Americans probably have about the same amount of understanding of science as the average seventh-grade student. Additionally, after viewing their survey responses, I found that a vast majority of my participants were not very comfortable with or interested in science as a subject in school. I also found that a majority of my participants had had a lot of misconceptions and misunderstandings about the basic scientific concepts that I taught. Distilling these complex concepts down into sound bytes that seventh graders can understand was an invaluable process, and I believe that it is a skill that not only seventh-grade teachers should have, but that scientists in general should have, as many average Americans view science as an esoteric and inaccessible discipline. I actually mentioned all of these concerns and revelations that I had received through working on this project to several graduate schools during my application and interview process, and I was accepted into Yale and will be attending their microbiology P.h.D. program this fall.

This project changed me as a teacher, as a scientist, and as a person. I never realized how much impact a simple undergraduate thesis could have on my, and I am pleasantly surprised and also quite grateful to be able to work on this project under the supportive community of the Honors Program at St. Edward's University.