

Creating the Connections



Grand Challenges Scholars Program Portfolio

Sarah Ingram

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Introduction

About Me

I came to Colorado School of Mines with the goal to be prepared to make a difference when I left. Little did I know I had no idea what this would entail. I wanted a well-rounded education that would prepare me. This meant that I wanted to know more than how to compute integrals and write papers. I wanted to be able to see the big picture and find the connections between my work and others.

I moved to Golden, Colorado from Austin, Texas. A big move but a good one no less. I am excitable and want to be a part of as many things as possible which can often get me into trouble. But it is because of this that I had the opportunity to be a part of the Grand Challenges Scholars Program (GCSP) and many other budding and successful groups on campus. I am a member of the Women's Club Ultimate Frisbee Team. I have also been fortunate enough to train to be a University Innovation Fellow. During my time at Mines I have studied under the guidance of the Materials and Metallurgical Engineering Department. Following my undergraduate studies, I will start my work as an asset integrity engineer for Tallgrass Energy where I will spearhead their metallurgical work.

About My Journey

My journey with the Engineering Grand Challenges (EGC) began before I started college. I had the opportunity to apply to a living learning community called the EGC TLC. Not knowing what the Engineering Grand Challenges were, I began to research what they are, where they come from, and ponder if they were something I wanted to be a part of. What I found surprised me. I knew that many of these problems existed but didn't fully understand what they had to do with engineering or why they were so grand. Regardless, I was interested in them and decided that living with other people who were also interested in them would be a good way to meet some new people and put me in an environment that fostered learning and discovery. This sparked my interest in the EGCs but was only the beginning.

My journey through the Grand Challenges Scholars Program follows the theme of creating connections. Often, students are told to make connections between different concepts. I feel that this program has created a foundation that relies on the creation of connections instead of connecting what is already present. As a student in college I am always learning new skills. These skills are great on their own, but when combined become a force to be reckoned with. I started this journey with a motivation to be a force to be reckoned with by the time I graduate. Through these connections, I have learned how to be that force.

Interdisciplinary Pillar

Introduction

During my freshman year at Mines, I took the Engineering Grand Challenges Design and Ethics course. This course focused on combining the design practices of an engineer with the ethical awareness that is needed to approach any problem. But, its projects were focused around the Engineering Grand Challenges which is where I got my first real exposure to them. After much consideration and research on the Grand Challenges, I elected Advancing Personalized Learning as the focus of my semester long project. I was on a team with two other individuals who were just as passionate about the education system as I was, and I could not wait to begin solving this challenge. Through research, ideation, debate, immersion experiences, and many hours of hard team work, we put together a solution to advancing personalized learning in elementary schools. Our idea was met with some apprehension, but more excitement about putting education back into the hands of the students.

The semester of working on my project for advancing personalized learning came to an end, but my involvement in the Engineering Grand Challenges did not. After being a student in the class, I had come up with many ways I thought the class could be improved. After great lengths of discussion with my professor, it was decided that I would serve as a student mentor for the next year's class. Transitioning from being a student in the class, to a figure of greater influence was a drastic change and would continue to help my understanding of the Engineering Grand Challenges, as well as what skills would be required to tackle them.

Putting Power Back into the Hands of the Students

Advancing Personalized Learning for Elementary School Students

At the beginning of the Spring 2017 semester, all of the students in the EGC class were to research and choose a Grand Challenge to give a short presentation over to help educate the entire class. When I first looked over the list of challenges, I was dead set on pursuing Reverse Engineering the Brain. Biology had been one of my passions since my first year of high school and I figured that this would be the best way to start this journey. But after further research, I realized how complex a challenge it is, and that it may be out of my scope. I was, after all, a freshman whose only experience included Fundamentals of Biology I. I continued my research to figure out which challenge I could truly get behind and feel passionate about. All of the challenges were interesting to me, but not many jumped out and said "pick me!" I was even confused as to why some of them were on the list. Advancing Personalized Learning and Enhancing Virtual Reality did not seem like pressing matters to me, and I wondered why they had been chosen. We had a couple days before our selections were

due and I continued to contemplate why each challenge had been chosen. I came to the realization that these challenges don't have to be life or death. While looking at these challenges, I began to notice a relationship. Some challenges depended on each other. Securing Cyber Space might make virtual reality easier to implement, Engineering the Tools of Scientific Discovery could help to create what we need to Reverse Engineer the Brain, and Advancing Personalized Learning would create smarter and more passionate students that leave school ready to tackle these challenges. This is what led me to choose Advancing Personalized Learning for my topic. The connection it has with every other challenge jumped out to me. What better challenge to choose then the one that could help solve them all?

My team began researching how learning could be personalized and what methods had already been implemented. We learned about different learning styles, modular learning, online learning, and other ways educators were trying to change the current system. No more grades, emphasis on creativity, getting rid of standardized testing, the list went on and on. This was overwhelming. We realized that we wouldn't be able to solve the entire Grand Challenge. There was a reason after all that they are labeled as grand. We began thinking that about our own experiences and the conformity that school often emphasizes in young students. This brought us to focus on elementary school students. We reasoned that changing the education system at its roots was the best way to have the greatest impact.

Unfortunately, as first year college students, we didn't have the minds of elementary school students. We needed a way to get into their minds and see what struggles they were facing in class. This is where the design and ethics portion of this class came together. In order to empathize with these students, we formulated an activity that would give insight into learning styles and the way students provide feedback. Luckily, we were able to go to a fourth grade classroom to try our activity. Our idea was to give each student a piece of origami paper and present them the challenge of making it into a box. We originally gave no instruction for creating a box. The students attempted to complete the challenge and we found many creative ways that students tried to make a box. For the second part of the challenge, we showed them a completed origami box and then let them try to make a box again. This time, many of the students tried to replicate the box, decreasing the amount of creativity, but increasing the success. For the last part of the challenge, the students were put into three groups. The first group had visual instructions, the second group had auditory instructions, and the third group had a member of our team working with them to create the previously shown box. The results were similar to what we predicted, students wanted more guidance, and those in the first two groups gave feedback that there wasn't enough instruction. This was extremely interesting for my group. First, we realized that we weren't giving these students enough credit. Their communication skills were much better than we anticipated, and they had a feeling of what was missing from their experience. They were also excited. It is easy to forget how fun learning can be when it is presented in a way that is accessible to you. This idea of accessibility guided us further towards our solution.

My group ended up developing a system for students to progress through topics that they were more interested in or faster at than others. This would allow extra time for topics that were difficult to grasp, while preventing students from getting bored in classes that were moving too slow for them. This would also allow students to create a schedule with an order that meshed well with them. If the students didn't work well in the morning, then they could put their harder classes in the afternoon. Or, if they get tired and lose focus in the afternoon, they could choose to have an elective class such as art or theater during that time to get their energy back. Along with this idea, we proposed an online platform that would help students, teachers, and parents keep track of the student's progression through their studies. We were able to present our idea at the project trade fair with great success.

We had visual to show how our program would benefit all types of students, example curricula and schedules of different types of students, and an interactive schedule builder to help people feel how empowering it is to be given the chance to design something that is right for you. Below is a picture of my group at the trade fair.



Figure 1: Advancing Personalized Learning Presentation. From left to right: Sarah Ingram, Blue O'Brennan, Tanner McAdoo

Our project ended after the trade fair and our idea came to a halt. This saddened me. We had put in so much hard work to come up with this idea, and now nothing would come of it and we would reach no students. I began to understand how difficult it would be to truly solve even a small portion of these Grand Challenges. Not only do you need a solution, you need the implementation of the solution. I wasn't ready to give up on advancing personalized learning. I wanted to find a way to pursue it even though I was no longer in the class. This led me to the Grand Challenges Scholars Program. A program that is dedicated to providing students the opportunity to create a curriculum that best fits their wants and needs while encouraging them to continue working towards solutions to these grand challenges. If that isn't a method of personalized learning, then I don't know what is.

The Student Becomes the Teacher... Well Mentor

My time being a student in the Engineering Grand Challenges class came to an end, but my involvement did not. This class had opened new doorways for me and demonstrated how it takes more than being scientific and calculated to solve these Grand Challenges. I wanted to make sure that the next group of students who came through the class have a similar, and hopefully even better experience than I did.

I became a student mentor for the EGC class. This entailed most of the roles of a teaching assistant, but, left out all aspects of grading. I really wanted my role in the class to be a helping hand for when students got stuck during the design thinking process. To my surprise, this was no easy task. I thought the idea of having an extra person in class to help the students was a great idea and that everyone who was in the class would agree. The students were hesitant around me, not wanting to interact or get my feedback. I was confused to say the least. During the beginning of the year, they completed skill building projects, but towards the end of the first semester they began working on their guided project: advancing personalized learning on the Mines campus. I knew that this was my time to shine. I was fully prepared to help them develop their ideas and share my own journey through advancing personalized learning. Little did I know, this wasn't my role. This is a class of discovery, so much of my role was to help students discover instead of sharing what I discovered. I wasn't exactly sure how to do this for quite a while. But what I soon figured out is that the perception of what information professors are giving students and the comprehension that they expect, does not always

align with what the students are comprehending. Since I knew what the professors were trying to teach, and, from a student's perspective, what was coming across during class, I was able to bridge the gap. I clarified points that were unclear and helped translate the students' misconceptions into a form that was more accessible for the professor.

Helping in this way was great, but I could tell that the students didn't have the same passion for personalized learning that I had. I wanted to help them find their own motivation to pursue this challenge. I spoke with the professors of the course and proposed a day where I would lead class in a discussion on personalized learning and how it could impact each and every one of our lives. The professors loved it and I began to plan everything out. My main focus was to find a way for students to relate to advancing personalized learning and then help them find a motivation or investment correlating to their own connection. I had the students prepare a list of things they liked and didn't like about elementary, middle, and high school. This was a fun activity to share during class, as it helped the students remember what they enjoyed, and thought could be improved while also relating to each other. As a class, we discussed the background of advancing personalized learning and why it is a pressing matter. Following this discussion, I presented a video of Sir Ken Robinson's talk on changing education paradigms. I had them create lists in their journals about what surprised and confused them, as well as what they found relatable. After watching the video, we discussed their thoughts and many students were very forthcoming in their experiences and opinions. At the end of the discussion I had them reflect and write a short paragraph about how they could relate to advancing personalized learning or how they connected to it. This was a defining day for me. One student approached me after class and thanked me for the presentation and discussion. This is when my role as a mentor and helper to the students started to take on a new form. I could do more than bridging the gap between student and professor. I could help the students think in different ways without giving them the answers to their problems.

This mindset stuck with me throughout the rest of their advancing personalized learning project and into the following semester. With this new mindset I was better prepared to help in any way I could.

Creating the Connection

Advancing personalized learning is where my journey into the Grand Challenges truly started. As my education has continued throughout my time at Mines, I notice places where things could be changed to better benefit the students. These changes seemed so simple to me, and from a student perspective they are. It was only when I was on the other side of the classroom that I realized just how difficult teaching students can be. You can't force the students to learn, have fun, or have the motivation to be successful. Participation can be forced by making it grade dependent, but at a certain point the students will resent you for this. Passion is special in that it is unique to every single person. I couldn't force the students to be as passionate about advancing personalized learning as I was, but I learned that that's okay. They will be able to find their passion elsewhere. As a student in this class, I was lucky to work with a challenge that I was passionate about. But my progress stopped with the end of the class. The Grand Challenges Scholars Program has encouraged me to continue working with personalized learning. Even if it isn't the same solution that I came up with in the class, I can continue to learn more about it and use my experiences to ideate and prototype ideas that will eventually lead to an implementable solution. The connection created between student and teacher helped me to better understand how important it is to consider the challenge from many perspectives, and I will continue to do so as I approach more challenges in life.

Project Pillar

Introduction

University Innovation Fellows (UIF) is a program dedicated to training and empowering students to become changemakers in higher education. I was fortunate enough to have the opportunity to apply for the program during my first semester at Mines. I had no idea what I was getting myself into. Once my cohort was accepted to the program, we went through six weeks of intense training that led us to discover opportunities for change on our campus. We learned the logistics of the Lean Start Up method and how to dissect an issue into its smallest components to put together a solution that would address it. Following training we attended the Silicon Valley meetup at Stanford University. There we got to meet students from other cohorts and put all of the material we learned into practice. My cohort focused on the mental health of students at Mines. We determined that there needed to be a place on campus that was always open to students relaxing - somewhere free of stress.

Come In and Blow Off Some STEAM

Our idea stemmed from the coveted study spaces on campus. Everyone loved them and they were quick to be taken. They were great for getting work done because there wasn't much else to do in them. We expanded on this idea of having a dedicated space, but instead of studying it would be for de-stressing.

We started work with this idea in January 2017. We interviewed students on their perceptions of campus: what was good, what was bad, and what change they wanted to see on campus. Students often spoke of the Mines mentality and suffering together. We knew that course material couldn't be changed easily, and professors can't just "go easier" on their students. Mines is known for its rigorous course load and had a reputation to uphold. We knew this and tried to figure out a different way to help students. Our idea started as something as simple as a puppy room for students to relax and de-stress, a place people could come together and play with puppies. We knew this wasn't feasible in the long run but took the idea and modified it to a de-stress space to encourage students to take a break from school and hang out with friends, play a game, read a book, or draw something. Basically, we wanted students to take time to focus on anything that wasn't school.

We continued to develop our idea and created this [pitch video](#) to help share our idea. The idea of a de-stress space became the STEAM Vent: a place to put art into STEM and blow off some steam. We held a stakeholder meeting with key parties on campus including professors in the HASS department, deans, and members of the counseling center. We received a lot of positive feedback on our idea and were excited to move forwards with it.

Moving forwards, we decided we needed a project lead and I offered to be it. I was passionate about what we were working on and towards and was excited to sink my teeth into it. We faced two main roadblocks on the journey to make this space a reality: space and funding. Mines is a small campus and space is a coveted resource. We sent in proposals to the Dean of Students, Derek Morgan, to gain access to the space in the Student Center past the bookstore. We were told that the space was

not is use but there were other groups lobbying to use it as well. To address funding, we applied to the Mines Philanthropy Council's (MPC) Philanthrotank. This program, similar to the TV show *Shark Tank* gave students an opportunity to pitch their ideas for campus improvement. We were extremely fortunate and through our hard work won funding from MPC.



Figure 2: The funding we received from Philanthrotank. Pictured from left to right: Emma May, Tanner McAdoo, and Sarah Ingram.

And if our faces don't show it, we were extremely excited to receive this funding. We continued to petition for the space we didn't yet have and put together plans of what would be purchased for the space. After badgering, I mean, sending many emails to Derek Morgan we were finally given a portion of the space we asked for and moved forwards with purchases and began to put the space together. We had to maintain up-to-date communication with Mines administration as well as MPC. After a LOT of hard work, we had a space to show everyone. On January 29, 2018 the STEAM Vent officially opened with our team and many supporters attending including Derek Morgan and President Johnson himself.



Figure 3: Photo collection from the grand opening of the STEAM Vent.

Creating the Connection

It's hard to imagine that my work with the STEAM Vent only spanned my first year and a half at Mines. During this time, I was able to take the lead on a major project which was no small feat. Although I am in full belief that my leadership skills did not come in till later in my Mines career, this project helped to expose me to campus as a whole and meet some key stakeholders who would help me out down the road. What my work through the STEAM Vent really made me realize is that I attend a university that is willing to put faith in me to make the changes I want to see on campus. The responsibility I was given was frightening and I knew that I had to work hard in order to give the UIFs at Mines a good name. I truly believe I was successful in this and that my work was able to help students. How fortunate am I to not only be allowed to make change, but encouraged by my peers and the president of the university? I would say extremely fortunate.

Service Pillar

Introduction

I have been involved in the Grand Challenge Scholars Program at Mines since my freshman year. I was fortunate enough to be in the first wave of students accepted to the program and got to run for a position on the Grand Challenges Grand Council (GCGC). The GCGC is a student organization supporting the GCSP. It provides a voice to the students and allows them to tailor the program to cater to the students. My role on the council was instrumental in me earning some of the experiences that truly shaped not only my journey throughout GCSP, but college as a whole.

Serving the Grand Challenge Scholars Program

Fortunately for me, I got my start in the program at the same time that the GCGC was starting and had the opportunity to run for a position as they were all open. I had to decide which position I wanted to run for. I was very ambitious and thought that running for president would allow me to have a great impact on the program. But then I heard of the role of Lead Mentor. It was the Lead Mentor's role to connect students with anything they needed to enrich their experience. This position... this position was how I would make a difference for the program. I ran for the position and my cohort gave me their support and I was elected to the Council.

My first vision was to create a mentor program for the students in the GCSP. I would pair upper and lower classmen together to support and inspire each other. I had plans to make surveys for people who were interested in the mentor program to fill out and that was how I would pair people. But I soon realized that the majority of students in GCSP were freshman or sophomores and overall we were still a small program. I believed that there was a lot that we could learn from each other, but that a mentorship program may not be the best way to do that at that moment.

I offered my help with the portfolio nights that occurred once a semester. Portfolio nights were meant to provide students with resources so that they are better able to craft their own portfolio. The first portfolio night was scheduled to be in Spring 2018, about a year after I had started in the program. My role was to begin my portfolio and provide it as an example of student work. This was quite nerve racking for me. I was confident in the work I had completed but didn't know how I felt about sharing it with other students. At this point, my portfolio consisted of an introduction to the program and myself and one pillar. Standing up in front of my peers was very intimidating. My experiences and ways of thinking were put on the screen for everybody to see. I remember having a shaky voice and trying to remember to focus on having a brief explanation on why I set up my portfolio how I did and the theme that would bring it all together. I received a lot of positive feedback from my peers, one, for starting the portfolio and showing it as an example, and two, for it looking nice and being a good idea. This really motivated me, and I found that I wanted to be a part of the portfolio work moving forwards.

The next few portfolio sessions had been successful events, but I noticed that portfolios seemed to be an intimidating deliverable for many people. As a program we tried to leave the requirements for the portfolio as open ended as possible so that people could be creative and make it into a living, breathing, culmination of their career at Mines. But people continued to ask for templates, formats, word counts, and other requirements. I wondered if the structure that was often given to us as students for lab reports or essays was limiting how we were thinking about approaching an “abstract” concept like a portfolio. I knew that we had to give students some sort of guidance, so in preparation for the Fall 2019 portfolio night, I brought my concerns to Dr. Stephanie Claussen. I recommended the following:

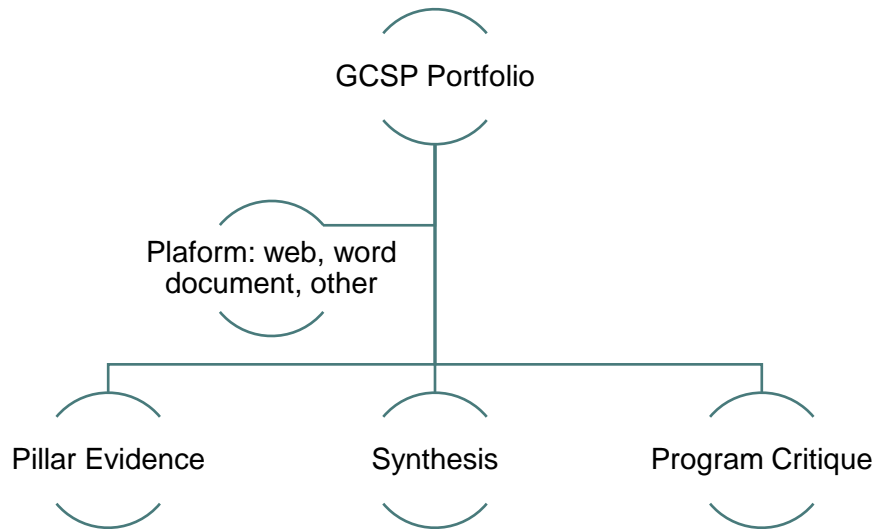


Figure 4: Suggested format for the GCSP portfolios.

I figured that this format would be beneficial for multiple reasons. Being able to break down the portfolio into three main components would make it seem less intimidating and hopefully let students view it as something very attainable. The platform “requirement” was put in as more of a place to start instead of a limitation. As a student I have found that having endless options makes starting very difficult. This would allow students to put pen to paper or fingers to keys and dive into the portfolio. The second part of my recommendation was that we needed a way to communicate this with students as soon as they entered the program. How could we give them this information and get them to read it? The answer I came up with was to put a welcome packet together. This packet would provide students with information on the program as a whole. The main topics I wanted to include were program requirements, faculty and council introductions, information on the GCGC, information on the portfolio, and ways to get involved with the program.

I received a lot of positive feedback on these ideas and got the go ahead to move forwards with the welcome packet. I was able to produce a draft of the welcome packet by the end of the semester. But, my time as the Lead Mentor was coming to an end as elections are conducted at the end of the Fall semester. I handed off the work I had completed to Dr. Claussen and the new Lead Mentor and offered my help in the transition but knew that my term was over.

Creating the Connection

My time serving as Lead Mentor is very meaningful to me because it truly spanned my time at Mines. I spent three years in that position, and I like to think that even though it didn't start out as I thought it would, it evolved into something that truly did help the students of the program. Being able to show my work was very rewarding. But I believe the real impact I made was in the push to present the portfolio in three attainable components. In order to do this, I had to listen to the people around me, draw conclusions about the issues I was hearing, formulate a solution, and then present it to our program advisor in a way that showed we wouldn't lose the freedom that comes with a portfolio and would benefit students. I am truly proud of the work I completed in this position. I didn't directly serve people in the way that community service is often thought of, but I left the program better off than when I first joined. I also learned a lot about what it means to be a conduit for people. Being in a leadership role doesn't only mean making decisions, it means trying to figure out the best way to help the people you are serving.

Entrepreneurship Pillar

Introduction

Entrepreneurship is often viewed as a way to move the world forward. It's how an idea becomes something more. I had never experienced what it meant to take an idea past being only an idea. In classes we had talked about it in terms of costs of materials and feasibility in a specific market, but it was just that... talk.

The Global Grand Challenges Summit (GGCS) is hosted every other year in rotation by the National Academy of Engineering (NAE), Royal Academy of Engineering (RAE), and the Chinese Academy of Engineering (CAE). There is often a design competition that students can compete in that, if successful, will provide the participating students with funding to attend this summit. I was very fortunate to attend the GGCS hosted by the NAE in Washington D.C. in Summer 2017 and see some of the work done by students. When the announcement for the GGCS in London scheduled for Fall 2019 was released along with the student competition, I knew I had to be a part of the students who were working towards making a difference. Thus began my work in an entrepreneurship/innovation competition surrounding the topics of artificial intelligence and world sustainability.

The Bird with the Mask

I began gathering people who were interested in the competition. Starting out we had no idea what the topic would be, just that there would be a competition and that a select few winning teams would be sent to London, England for the summit. This wasn't much to go on, but a group formed and we were prepared to start work whenever we received information. In late Fall 2018 we were sent the following:

Humanity is facing unprecedented challenges from a population growing to 10 billion by 2050, and accelerating degradation of the planet and its resources. At the same time, exponential technological changes are making the world smarter, faster and more connected, but with unanticipated consequences. Engineers are crucial to the international effort to address these rapidly evolving, unpredictable challenges. We need to embed collaboration, diversity, and global responsibility into the solutions we create, transforming the way engineers work, think, and are taught. Engineers have the power to help make a better world for the citizens of 2050, but only if we transform engineering and embrace that responsibility today.

The two parallel themes for the Summit are:

- *Can we sustain 10 billion people?*
- *Will AI and other transformational technologies change humanity for the better?*

We weren't given any details on the competition, but we knew what the themes were, and we got to work. Initial brainstorming led us to focus on the first theme: sustaining 10 billion people. At the start of the Spring 2019 semester, our team reconvened. Our first order of business was to elect a team leader. I was nominated due to my experiences in the previous GGCS and my interest in forming the team. I was honored to say the least and vowed to myself that I would learn to be a good leader. We all made the spoken commitment to this project that would end up taking more of our time than any of us thought.

Over the coming months we narrowed down our topic to tackling air pollution. Under the logic that everyone on our planet will continue to need to breathe this seemed like a good idea. Furthermore, all of us felt that we had been hearing of more and more air pollution events that have taken place across the world. Two of the main events were the wildfires in California and the increased dust in some Asian countries. The focus of our project was protecting people from particulate matter air pollution. One way of doing this is through face masks, but we were aware of the stigma that surrounds face masks. Common descriptors we found were weird, sick, and even dangerous. This led to the creation of Canary. Canary is a patentable method of inserting replaceable PM 2.5 filters into clothing. By combining masks with everyday clothing, we would normalize the use of masks and therefore decrease the stigma surrounding them.



Figure 5: Canary - The Bird with the Mask

We dove into the work surrounding Canary. We conducted user interviews, created a business model, drafted a timeline for our newfound company, and continued work with our prototype. In no time at all it was time to submit our presentation and prepare to fly to Irvine, CA where we would compete against all of the other teams in the western region. Below is the timeline of the competition.

Intense work started in late January when the call for proposals was announced. It was less than three of months of hard, dedicated work to put together our idea and business model.



Figure 6: Entrepreneurship and innovation competition timeline.

On the day of the competition I knew we put our best foot forward and gave the presentation everything we had. We didn't end up moving on in the competition, but I couldn't have been more proud of my team. The teams who moved on had been together for well over a year and had competed in previous competitions together. My team was together for only a few months and the work we completed during this time was incredible. Entrepreneurship takes hard work and dedication. I learned that as an innovator and entrepreneur you will fail many times. You will have your ideas ripped apart and feel just as torn yourself only to put it all back together stronger. Entrepreneurship requires perseverance.

The Canary team continued work on Canary over the summer and into the Fall 2019 semester. Due to time constraints, graduating members, and the fact that we were still in college the Canary team ended its pursuit of a business. But I know that this group of people will always be my team.



Figure 7: The Canary team (from left to right): Daniel Personius, Evan Mele, Sarah Ingram, Andy Bei, Michael Thuis, and Tricia Robinson

Creating the Connection

Working with the Canary team was unlike any experience I'd ever had. I have worked on many group projects during my time at Mines, but never a group so passionate and dedicated to changing the world for the better. I am able to reflect on this experience and see that I came into my own as a

leader throughout this project. In the past I had frozen in the face of decisions and delegating tasks, but being put in a leading position forced me to make these decisions. I learned that I likely won't ever be 100% sure on a decision I make and that's okay! It forced me to become confident in my professional communication abilities and also made me realize the importance of communication. It was important not only within our team, but with our advisors and the competition organizers as well. I also had to learn to trust my teammates with the work they committed to, but by far the hardest lesson to learn was that I can't do everything, and I had to learn to recognize my limitations and ask for help when I needed it.

Entrepreneurs will forever have my respect. The work they do is hard, demanding, tedious, and often seems unrewarding. But they are critical, and their work helps to move our world forwards. This competition and experience helped me understand that I will not be pursuing a career in entrepreneurship any time soon. But should I choose to in the future I will be far better prepared than I would be otherwise.

Global Dimension Pillar

Introduction

While Canary was not selected to go to London and present our pitch in front of cohorts from across the world, I found my way to the GGCS another way. Mines was given the opportunity so send a scholar to London and I was selected due to the work I put forth as the team leader of Canary. I was elated to say the least when I found out. I had never been out of the country before and I could only imagine what was in store across the great Atlantic Ocean.

The summit was broken into two parts: the student collaboration and the official summit. The student collaboration took students from around the world and broke them into multicultural groups that would aim to solve one of the two themes of the summit and create a business plan to implement the solution. The global summit would bring together industry experts and academics for presentations, panels, and discussions on the future of our planet with a focus on the summit themes.

The summit's themes were:

- Can we sustain 10 billion people?
- Will AI and other transformational technologies change humanity for the better?

The World Through a Different Set of Eyes

Student Collaboration

I was fortunate to attend the summit with a team member of Canary, Daniel Personius. As soon we arrived at the conference we were thrust into activities and trainings that would prepare us for the upcoming competition. We looked at resource distribution, who in the world had power to cause change (spoiler: all of us), how to make our ideas heard, the future of artificial intelligence (AI) and

many other budding topics. We were soon split into our multi-nationality teams and let loose for a 24-hour innovation and entrepreneurship challenge. My team decided to focus on combining artificial intelligence with advancing personalized learning, a topic that I had become very passionate about. Our method looked to use artificial intelligence as a way of compiling schoolwork that would be tailored to students' different learning styles. An example of this would be a topic such as the founding of the United States. The program would compile different ways of learning about the topic including videos, articles, interactive games, podcasts, etc. This would then allow the teacher to review the results and select options for the students. This would decrease the time that the teacher would need to prepare lessons and therefore allow them more precious time to tailor it to their students' specific needs. The following poster was created to show our idea.

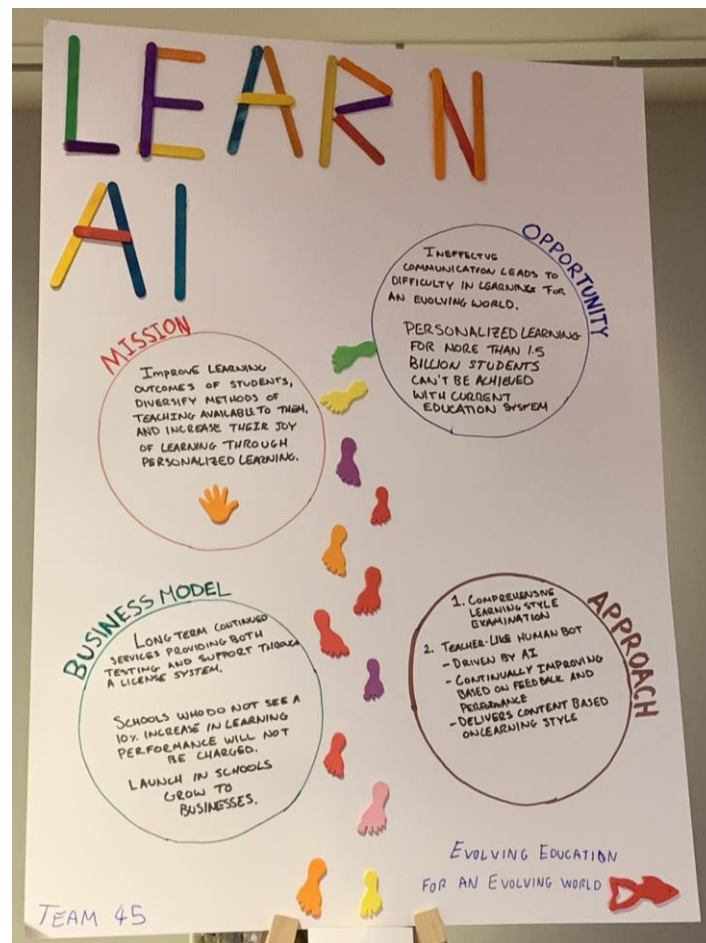


Figure 8: Poster created for the student collaboration competition in London.

What isn't shown in the poster is hours of frustration of trying to communicate on a multi-nationality team. While most of our group spoke English very well, we had one student member and our faculty advisor that weren't as fluent. I had expected some sort of language barrier but realized I was not prepared to deal with it. My team was wonderful but continued to leave this member of the team behind. By the point he had something to contribute to the conversation, the topic had moved on and decisions had been made. It was very difficult to contribute to the current conversation as well as try to keep him up to speed with what was going on. At the end of the day I was exhausted. I had never wanted so badly to be bilingual and it gave me a respect for people who can speak more than one

language. Regardless of the difficulty this posed, having a multi-nationality team was so valuable to our project. It provided perspectives that I never would have thought of.

The student collaboration was ended with a gallery walkthrough that allowed us to showcase our idea. During this walkthrough we were able to pitch our ideas to stakeholders. This was part of the fun of the competition and could give you a leg up but was really meant to practice interacting with stakeholders and learning to tailor the conversation to what it needed to be depending on the stakeholder. This was an experience that I will never forget and I'm thankful that I had the team I did.

Global Summit

Following the completion of the student collaboration, the global summit ensued. I don't think I had ever been in a room with so many of the world's changemakers. It was extremely overwhelming, but also empowering. The global summit was extensive. There were talks on ethical AI, transformational technologies, increasing the world's resilience, and developing cities of the future. These talks were inspirational, but the moment that I will always remember from the summit was sitting down and having a conversation with Dr. Jean Venables.

Dr. Venables is a highly esteemed civil engineer. She worked in flood risk management for many years and was the president of the Institution of Civil Engineers (2008-2009). I was honored to be able to have a conversation with her. At this point, I felt like there was such a push for engineers to become entrepreneurs and was beginning to feel like this was the only way we could make a difference in the everchanging world around us. I also knew that I did not want to be an entrepreneur. This is what I asked Dr. Venables about: How do I make a difference without becoming an entrepreneur? Her answer inspired me.

She told me of her work she'd done on flood prevention while working with the Regional Flood Defence Committee of the Environment Agency in the United Kingdom. This was a woman who had truly made a difference. Later in life she and her husband started a consulting company and she expressed her love for the work. She encouraged me to explore all my options and to never truly eliminate something from my horizons. I remember her saying that even if it isn't the right thing for me right now, it could be later. Thank you, Dr. Venables, for showing me how there are so many ways to make a difference in the world.

Creating the Connection

I learned a lot from both the student collaboration and the global summit. Between the numerous presentations by student groups, intense trainings, and panels and discussions I learned what could be possible for the world. Some of these talks scared me, but more so they gave me hope. I wish I could say that there was a single panel or speaker that changed my view and inspired me to move forwards in my career as a change maker, but there really wasn't. The interactions I value most are the ones that happened outside of the conference proceedings. The conversations I had with other students and the bonds we created in such a short period of time are the pieces that I cherish today: a group chat of students from across the world, checking in on each other in the midst of the COVID-19 outbreak; my friend Marcia who I still talk to on a regular basis; my roommate from the dorms that we stayed in at Imperial College who texted me to say that she heard a song that made her think of me; a friend from Maryland who met me for coffee on his way through Denver just to catch up and

say hello. We are the next generation of changemakers. Policies, inventions, world agreements, and international programs can only go so far. It is the connections made during times like these that show us just how similar we are at heart. They show us how successful we can be when we acknowledge the differences we have and use them to find common ground. Differences shouldn't be seen as a barrier, but an opportunity for growth.

Thanks Marcia, Randy, Lauren, Michael, and Daniel for teaching me that the world is a crazy place and together we can really make a difference.



Figure 9: Photo of Randy Deinlein and Sarah Ingram at the GGCS.



Figure 10: Photo of Marcia Pryce and Sarah Ingram at the GGCS.

Program Critique

GCSP has been amazing to me. I've had the honor of attending two global summits, an annual GCSP meeting with the NAE, and the western E&I competition where I competed with Canary. It has provided me with a lot of eye-opening experiences, but I also feel like in some areas it has left me wanting. Through a couple of my pillars I discovered that I will not be an acting entrepreneur in the near future. There is such a push within the engineering academies to encourage entrepreneurship that it feels that is the **ONLY** way to make a difference in the world. I encourage entrepreneurial endeavors and believe they are crucial to our world moving forwards and healing, but I don't think they are the only groups that are needed. We will need scientists, policy makers, teachers, and

advocates in industry to name just a few. Moving forwards, I think that there needs to be a greater push to support students with other aspirations since they are just as important to the causes we are all working towards. The effect of this manifested in me trying to decide on whether or not I should go into industry following my undergraduate studies. I had been offered a position in the energy industry and didn't know if I should be a part of this. I thought back to my time at these conferences and all of the talk of "down with oil and gas" and wondered what it said about me as a person that I was considering this field. I came to the conclusion that the industry you work for does not define who you are as a person. The world is changing, and industry will have to change with it. I can be an advocate for change while working in this industry. My position is allowing me to directly affect the safety of the industry and I am proud I made the decision to enter this career path.

Connecting the Connections

It was hard to see everything that I have accomplished before laying it out in a format like this. I can say beyond doubt that I couldn't be more proud of the work that I have completed during my time in the Grand Challenges Scholar Program. It's difficult to link all of these pillars together besides the fact that everything that each pillar has taught me will make me a better engineer. They are distinct for a reason. Although what I have realized is that in each and every one of these pillars, I have been encouraged to pursue what I wanted and what I thought was right. Mentoring the EGC class was my idea, creating the STEAM vent fell under my lead, pushing for redefinition of the portfolio and a welcome letter, taking the lead on a startup with Canary, and last but not least making my own way in London at the Global Grand Challenges Summit. None of these experiences had direct paths for me to follow and I was responsible for making them happen. I was responsible for creating connections with programs and people.

This program is empowering. I didn't necessarily realize this while I was completing it but laid out before me and reflecting on it, I feel truly empowered.

I have accomplished these things and so many others that didn't make it into my portfolio. From traveling to speaking at events and recruiting new members. My advice for students coming into the program is to see the pillars as a guide and not as limitations. This program is amazing because of the freedom it gives to pursue what you are interested in. GCSP is about self-discovery, growth, and empowerment and I truly hope that students can continue to experience this.

Thank You

Last but not least I wanted to take a moment to thank the people who have gotten me here. Due to COVID-19 I likely won't get to see many of you in person to thank you for all the support you've given me.

Stephanie, you are one of the most amazing people I have ever met. Your kindness and care for the students in this program warms my heart. You've encouraged me to travel, lead, take risks, and explore the unknown. Thank you for being such an amazing mentor and friend to me.

Melanie, my boldness started in your class and has stayed with me since. Your will and passion to teach is inspiring and I hope you never stop. Thanks for believing in me every step of the way and always being a friendly face on campus.

Toni, you inspire me. Everything I hear from you is filled with poise and passion, two things that I feel like don't always go together. Thank you for being spectacular.

Canary, you guys are amazing. Thanks for being the best team ever and always having my back.

Mom, Dad, and Aaron you guys have supported me through all the travel, stress, and accomplishments I have made. I couldn't have asked for a more amazing family. Thanks for all the love you give.