Girls Into Tech Online Program:

Keeping Young Women Interested In STEM

An Interactive Qualifying Project Report
submitted to the faculty of
WORCESTER POLYTECHNIC INSTITUTE
in partial fulfillment of the requirements for the
degree of Bachelor of Science

by
Chloe Connolly
Renee Cullman
Konstantin Nikolaychuk

Date:
15th of December 2022

Project Center:
Santa Fe, New Mexico

Report Submitted to:

Dr. Shelly Gruenig
R4Creating, Be Greater Than Average

Professors Zoe Eddy and Melissa Belz
Worcester Polytechnic Institute

Abstract

Once girls reach middle school, their interest in science, technology, engineering, and math (STEM) decreases significantly. There is a critical need for educational STEM programs in New Mexico to help young girls retain interest. We helped the Girls into Tech program in their goal of sustaining STEM interest in middle school girls of NM. We conducted comparative analysis, observation, a survey, and interviews. Through these research methods we developed a model for an online STEM learning program to be integrated with the GIT curriculum. This outline consists of a yearlong calendar for exploring STEM careers. Each month, girls will learn about STEM careers through gamified learning modules, stories from female professionals, and an at home, hands-on activity.

Executive Summary

Goal and Objectives

Women today are disproportionately represented in STEM fields. When girls reach middle school, they lose interest in STEM. In order to get more girls into STEM, intervening at this stage is vital to retaining interest in these fields. In New Mexico, this issue is even more compounded by the inadequate state of its public education. Young girls of New Mexico are in need of greater support in their pursuance of STEM. Our sponsors, R4Creating and Be Greater Than Average, have created the Girls into Tech (GIT) program in order to do that exact thing. GIT is an independent, year-long STEM learning program for middle school girls. The GIT initiative includes monthly activities for all participants, peer and professional mentoring, and three courses, one introduction to STEM course and the others being open for participants to explore their own interests. Launched in the summer of 2022, Girls into Tech is a young program with room for growth. The goal of our project was to encourage middle school girls within New Mexico to engage in STEM by developing the foundations of an online component of the Girls Into Tech program. In order to properly achieve this goal, we identified four objectives:

1. Assess the contents of R4Creatings and Be Greater Than Average's Girls into Tech program.
2. Build a general overview of middle school aged girls in Pueblos and rural areas of New Mexico and their current engagement in STEM.
3. Determine strategies to improve STEM engagement in the GIT program by evaluating the effectiveness of existing programs.
4. Create the foundations of an effective online STEM learning program.

These helped orient our project by creating a clearer framework of how to achieve the goal of our venture. In order to achieve these objectives, a variety of methods were implemented.

Methods

We gathered data through interviews of teachers, GIT staff, students, professionals, program heads, and professors. These participants were asked about their experiences in STEM, and what they want or what they believe makes a successful program. Surveys were conducted on Worcester Polytechnic Institute students. WPI students were asked about their educational journey, and what roadblocks they encountered while pursuing STEM. Participant observation was conducted at GIT events and a Women In Tech event. Research was conducted on other existing programs with a focus on educating girls in STEM. From this data, we found the key aspects of successful programs.

Key Findings

While enacting our methods, we discovered four major aspects that are most commonly found in a successful STEM learning program. These main themes consist of:

1. Hands-on activities
2. Community
3. Mentors

4. Career exploration

Hands-on activities are vital for successful engagement in STEM for younger people. They do this by familiarizing the children with the topic and demystifying it for them. This leads to the children having more confidence with the topic and being less likely to avoid it. Community creates a support group for girls to succeed in STEM and provides peers in the field to connect with. This also gives the program participants greater confidence due to the support structure and peers in the same position, be it struggling or succeeding. Mentors help guide girls into the career path for STEM, as well as teach them valuable skills. They are also a role model for the mentee to look up to, showing them that the mentor's success is achievable for them. This leads to increased confidence as well, encouraging the mentee to pursue their path in stem and persist through any hardship. Career exploration teaches girls what opportunities they have as well as careers that they did not know existed. This allows them to find a career that fits them best and that they feel comfortable in.

Recommendations

Being in the early stage, Girls Into Tech is in need of overall development. Much of its development will take time, so what can be implemented in the near future that brings together the primary factors of an effective STEM learning program? Based on findings from our observation, comparative research, survey, and interviews, we recommend the following for an online portion of the Girls into Tech program.

Modules with information on STEM careers

Exposing young girls to as many careers as possible can help them find one that they are passionate about. With greater passion comes a better chance as a long term pursuant. For this reason, Girls Into Tech members would benefit from online modules that provide information on a wide range of STEM careers. Each month participants are to be presented with a STEM topic and three careers connected to that topic, each with its own informative module. Within these modules include a general overview of the career, an interactive portion, such as a quiz, and a story from a woman in the field. To create an engaging learning experience, a digital badge system would allow participants to receive a reward upon completion of a module. This system would motivate girls to complete the modules, and in turn make them explore a career which they might have previously been unaware of or dismissed.

Stories of female STEM Professionals from New Mexico

The inclusion of professional stories within the modules is to combat the lack of female representation in STEM that has discouraged many women from pursuing these fields. By including stories from female STEM professionals, specifically ones who grew up in New Mexico, girls will become more aware of their own capabilities as women. Information in this section speaks to the unique educational and professional journeys of these women with the goal of inspiring and building confidence. Stories have the opportunity to deepen participant understanding of a career, as well as spark interest in a new field. The presentation of diverse careers and journeys can also help young girls to understand the world of opportunities before them in the world of STEM. The process of collecting stories from professionals alone can be

beneficial to the Girls into Tech program. Connecting with more professionals will strengthen the Girls into Tech network. Doing so has the potential to open doors to greater opportunities for its participants and professional mentors.

Career-based activity

In addition to general information and stories, a hands-on activity can help young girls explore their interests and determine if a particular field is something they would enjoy pursuing. Each month, an at-home, hands-on activity connected to the career modules will be provided to GIT participants. The form of the career focused learning activities can vary but are all created with the goals of fun and accessibility. To support this portion of the program, a channel will be added to the Girls into Tech Discord server. This channel is dedicated to promoting completion of at-home projects by developing a community among members. Within this space, participants can ask questions and find support from peer mentors as they complete the activity. Like the learning module, participants will receive a digital badge upon completing the designated hands-on activity. This badge will both drive completion and develop the community as participants post about their achievements in the Discord.

The online and hands-on portion of this program being based at-home has an added benefit. Parental support has a large impact on a child's education. One of the best things a parent can do to support their child's pursuit of STEM is recognize their interest and then to listen. This at-home learning gives families the opportunity to engage with their child's learning, exposing the family to the topics and therefore, encouraging a support system.

By taking into account the themes of hands-on activities, mentorship, exploration, and community, we purpose an outline for an online STEM career exploration program. With its implementation, GIT will be setting itself and its girls up for success. An addition such as this presents a bright future to the Girls Into Tech program and the young girls of New Mexico.

Acknowledgments

We would like to thank those who provided guidance, support, and kindness. Without their help, this project would not be possible.

R4Creating and Be Greater Than Average

Dr. Shelly Gruenig

The Girls into Tech staff

Joanna Gillespie and Los Alamos National Laboratory

Gwen Warniment and the Legislative Education Study Committee of New Mexico

All of our interviewees

The WPI student survey participants

Our advisors, Professors Zoe Eddy and Melissa Belz

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Introduction

Women are victims of the leaky STEM pipeline. As they advance through their educational journey they fall through cracks. Between 5th and 8th grade is the most frequent time for girls to lose interest in scientific fields (*It's a Girls World*, n.d.; *Why Don't*, n.d., *New Study*, n.d.). These fissures are created by the sexist culture of STEM education. The result is a STEM environment that is dominated by men and discourages women from pursuing STEM careers. These factors result in a large gender discrepancy in STEM fields.

New Mexico's education system exacerbates these problems; fewer learning opportunities related to STEM results in reduced education opportunities for women. With its many rural communities, residents lack access to quality education, particularly for STEM subjects. Moreover, in indigenous communities, inequity and cultural difference lead to their exclusion in STEM education. Efforts to get the women of New Mexico into STEM involve many different methods of engagement, which may vary depending on the area and its resources.

One such effort is R4Creating's new program titled Girls Into Tech (GIT). The goal of GIT is to encourage middle school aged girls to engage with STEM. We have assisted in the research and development of this program's online component. This portion of the program will be beneficial to girls in rural and indigenous communities who want to learn about STEM. It will provide them with access to resources on STEM education and connect them with girls who share an interest in these subjects.

This new program will help rural and indigenous communities get access to quality STEM education. There is especially little research on STEM education in the New Mexico and Santa Fe areas. While looking for research articles on New Mexico public education, articles with relevant information were outdated. For example, the article Public Education in New Mexico contains information on relevant topics, but was written in 2005 (Mondragón & Stapleton, 2005). The exception to this issue would be the New Mexico Education board report published in 2022. Their information focuses on standardized test results, and how scores change over time in various subjects. In both the languages and STEM related subjects, scores declined, especially in low-income households and minority students (New Mexico Education, 2022). While New Mexico's education system is limited, additional programs can provide students with quality STEM learning.

The goal of this project was to get the girls of New Mexico interested in STEM by assisting with the creation of an online educational program. We worked with Girls Into Tech (GIT), a program recently launched by R4Creating and Be Greater Than Average. The primary goals of this program are to educate young women about STEM careers, engage them with STEM activities, and provide them the skills and support they need to pursue these fields.

We endeavored to understand the struggles of the community of middle school aged girls in New Mexico, as well as girls in STEM in general. In our background, we discuss STEM education in the United States and its deficiencies when it comes to the inclusion of women and other minority groups. Following this, information on gender and racial discrepancies in STEM and its effects on these fields will be covered. We transition into indigenous STEM education and inner city, rural, and urban STEM education. Here, we investigate the ways that different communities tackle education. Using this information, we identify STEM education techniques that are especially effective for members of minority communities. Following this background information, we present the goal and objectives of our project along with the methods being used to accomplish them. Finally, the gathered data will be analyzed and presented in our findings.

Background

STEM Education in the US

Compared to other countries, the U.S. is critically lacking in STEM education access and quality. The fields of science, technology, engineering, and math have become increasingly important to global strength. For the sake of the United States' economy and advancement, successful STEM education is vital to the United States. The 2019 Trends in International and Mathematics Science Study, an international study that tests 4th and 8th grade students in mathematical proficiency, found that the U.S. placed 15th out of 64 and 11th out of 46 respectively (Athanasia et al, 2022). Considering the past rankings of the U.S. in math and science, these numbers illustrate a downward trend. According to standardized testing in 2015, 38% of 4th grade students, 34% of 8th grade students, and 22% of 12th grade students could be considered proficient in science. In 2019, only 41% of 4th and 8th grade students and 21% of 12th grade students were considered proficient in mathematics (Athanasia et al, 2022). This minimal improvement of 4th and 8th grade scores and deterioration for 12th graders reflects the state of STEM education in the United States. Currently, "... [STEM] education in the U.S. is woefully inadequate, in both quantity and quality, and unequally available across social groups" (Xie et al., 2015). Finding ways to expose, teach, and engage students with the subjects of STEM is key to rectifying these educational downfalls. In person, in class, online, and after school programs are powerful techniques that can be used to increase engagement with these subjects.

After school programs that teach specific skills, such as mathematics, software, robotics, or game design programs simultaneously create STEM awareness while educating participants. One such program, known as FIRST LEGO League, is a hands-on[1], robotics program that greatly encourages teamwork and developing problem solving skills. Core values are the backbone of this program. In addition to teamwork and problem solving, FIRST emphasize exploration, respect, and real-world application (*About | FIRST LEGO League*, n.d.). Another successful program in the United States is Project Lead the Way (PLTW). PLTW offers for-credit for pre-k to 12th grade. The program focuses on hands-on, real-world activities and projects, prioritizing the understanding of the everyday and career applications of the concepts and skills learned in the class. Both programs highlight the real-world application of STEM learning and have a significant reason for doing so. Putting STEM into a career context for children greatly helps boost their interest in STEM (Connors-Kellgren, A. et al, 2016). The examination of successful STEM programs brings to light various methods that can be used in the development of new programs throughout the United States.

[1] Hands-on Learning: An activity where participants interact with science, technology, engineering, and math (STEM) subjects by actively participating or creating something that highlights a specific topic or idea.

Gender Discrepancies in STEM

STEM education has discrepancies across the United States. Women and people of color are not adequately represented in STEM education and subsequently the STEM workforce. In the professional world, STEM is disproportionately dominated by White men (Cech, 2022). Women only make up about 25-26% of the STEM workforce (Statista Research Department, n.d.). Straight White men in particular are more likely to feel social belonging, get respect from their peers, and earn rewards when working in STEM (Cech, 2022). These benefits make White men more likely to pursue STEM compared to other races and genders. Meanwhile, women and people of color fall out of the STEM pipeline, creating the existing disparity. Minorities often fall through the cracks during their educational journey, and it is here where significant action can lead to workforce equality. Gender discrepancy in STEM representation speaks to larger issues with US education

The gender discrepancy in STEM is the result of multiple factors, many of which connect to the culture of STEM workplaces and education. The culture of STEM can be sexist and exclusionary towards women and other marginalized groups (Campbell-Montalvo et al., 2022). Meanwhile, people who feel like they fit into the STEM community are more likely to pursue those fields. With a sense of belonging, their STEM interest retention increases, reducing the dropout rates from STEM subjects (Campbell-Montalvo et al., 2022). The opposite effect occurs for women, who generally feel as though they do not fit into the STEM community. STEM Students have reported sexism and stereotypical assumptions directed towards women, including but not limited to assumed lower intelligence in these fields (Campbell-Montalvo et al., 2022). Women can feel isolated and alone in STEM programs due to these harmful assumptions. Men claiming that women pick easy STEM majors and other derogatory stereotypes can also cause women to quit their pursuit of STEM (Campbell-Montalvo et al., 2022). The male centric culture of these fields is greatly discouraging to women, and in turn is detrimental to the state of STEM.

The number of women who drop out of STEM early has lasting effects on the field. Unfortunately, the effects of this gender disparity are often accepted by women. Female interviewees in higher STEM education would routinely report that they were one of the few girls in their field or class and that they are used to the disparity (Frederick et al., 2020). This type of acceptance and normality fuels stereotypes about the field. When students described a hypothetical STEM mentor or someone who works in a field, almost all men and women describe a man or use the pronouns he/him/his. This shapes the culture and perception of the field, not only to outsiders, but the people in STEM as well (Frederick et al., 2020). For women to push through these stereotypes and succeed in STEM they need support. Research conducted on women in college for STEM showed that encouragement from professors greatly contributed to their drive and willingness to continue to pursue the field (Brayboy, B. M. J. et al., 2018). Finding mentors not only helps educate girls about STEM but builds their confidence to pursue these fields and is key to regressing the gender disparity.

In addition to mentorship, there are a number of programs that strive to bring STEM education to girls and connect like-minded women for support. Astra Femina focuses on role models for young girls who are interested in the space fields of science. Whether they want to be an astronaut or an astronomer, young girls are exposed to women in the field, which can inspire them to pursue similar careers in the future. Other effective female driven STEM programs include

Girls Inc. Like Astra Femina, Girls inc. provides mentoring opportunities for girls getting into STEM. By doing so, the program hopes to provide support and build confidence. Girls inc. also includes learning programs centered on local communities, creating a more meaningful activity for participants. Opportunities to help one's community through engineering are also found in the Society of Women Engineers' SWENext Club. This club, which is available to all girls K-12, provides its members with the opportunity to participate in various STEM competitions, explore future careers and colleges, and gain leadership experience. Another club, the Science Club for Girls, is focused on providing learning opportunities and mentorship for women. One of its programs includes a free, 6-week virtual program with hands-on activities for girls K-8. These courses are then "co-led and taught by Junior Mentors in grades 8-12, and by adult volunteer mentors who study and work in STEM fields" (*Virtual Science Clubs*, n.d.). This structure simultaneously allows advanced club members to take on leadership roles and connects participants with STEM professionals. These programs provide the education and support that so many girls need to succeed in STEM. While gender discrepancies are a large factor in the greater issue, racial discrepancies are a comparably large issue.

Racial Discrepancies

It is not simply men who are prominent in STEM, but White men. Racial minorities are greatly underrepresented in the various fields of STEM. In 2021 the U.S. Bureau of Labor Statistics reported that 65.4% of computer and mathematical occupations are held by White people (U.S. Bureau of Labor Statistics, n.d.). Asians held 23.3% of STEM-related jobs, Black or African American held 8.5%, and Hispanic or Latino held 8.3%. A similar trend is found in architecture and engineering: Whites make up 77.0% of the workforce while Asians represent 14.6%, Hispanic or Latino 9.9%, and Black or African American 5.8%, (U.S. Bureau of Labor Statistics, n.d.). The discrepancies in these numbers are apparent, bringing the cause into question. The absences of American Indian and Alaska Native in these statistics alone demonstrate the prevalence of racial discrepancies in the fields of STEM. As previously mentioned, preconceived notions about what a person in STEM looks like, a White male, can hold back members of minority groups. Additionally, these work statistics can be traced back to education.

Most careers in STEM require some form of higher education that cannot be achieved without graduating from high school. It is in the high school dropout rates of various racial groups where further disparities can be observed. The dropout rate of Asian and White students is relatively low, "while 5.6% of Black, 7.7% of Hispanic, 8.0% of Pacific Islander, and 9.6% of American Indian/Alaskan Native students dropped out of high school" (COE - Public High School Graduation Rates, n.d.). Factors that cause these numbers include socioeconomic status and quality of education. Stereotypes, not only specific to STEM, also have a key role in student achievement. If a student or teacher has a negative bias pertaining to academic success, it can have a large impact on school performance and ultimate completion (Agrawal R. Ket al., 2016). The stereotype of ethnic minority students as intellectually inferior to White and Asian students leads some educators to have low academic expectations. Continuing to hold this view undermines student confidence and can lead to academic self-sabotage (Agrawal R. Ket al., 2016). Increasing teacher support and the confidence of minority students are vital to their success in education. It becomes especially important when a student is pursuing STEM. As they continue their STEM journey from high school and into college, it is crucial that this support persists.

College students from minority groups pursuing STEM reportedly, “compare themselves to the quantity of others, and felt like interlopers if there were not others like themselves in their program” (Campbell-Montalvo et al., 2022, p. 671). Providing students with representation in these fields yields a sense of belonging that can help retain students in STEM. Having a STEM mentor who shares common marginalized demographic identities with their mentees is one way of demonstrating inclusivity. For many college students, this type of mentorship along with other professional development and relationship-building opportunities can be found on campus with professional engineering organizations. Club organizations that are, “racially/ethnically-focused can encourage the establishment of connections with similar others as well as reduce feelings of isolation and promote persistence” (Campbell-Montalvo et al., 2022, p. 663).

Prior to college, programs directed towards racial discrepancies in STEM have a more structured approach. The Youth Sports Lab, a sports-based engineering program, was created with the goal to increase STEM engagement of underrepresented minority middle schoolers residing in Harlem, New York City. This 4-day summer camp is focused on bolstering their self-efficacy in STEM by combining it with other areas a child already holds high self-esteem, such as basketball (Marshall et al., 2021). The program found that by connecting existing interests with STEM, the fields become more familiar and gain significance. With this, participants strengthened their identity within STEM, giving them greater confidence to continue their relationship with the subjects. Such findings can be applied to encourage the engagement of gender, racial, and ethnic minorities with the various fields of STEM.

Indigenous Stem Education

The indigenous population of New Mexico is a significant minority underserved by current STEM education programs. The history of indigenous education in the United States is a tumultuous one driven by the intention of cultural assimilation (Brayboy, B. M. J. et al., 2018). Indigenous perspectives were excluded in education until relatively recently due to the persistence of the assimilationist curriculum. Current standards of education in the United States are still unable to fully take into account the fundamental values and practices of indigenous groups. This has created two worlds for Native students: one of cultural identity and one of higher education (Johnson et al., 2017). A lack of integration between these worlds has been detrimental to the success of Indigenous students, resulting in disproportionately lower rates of high school graduation and college matriculation (Wilcox, 2015). In recent years there has been a successful increase in the number of Native Americans receiving college degrees, however, they continue to be significantly underrepresented in STEM education and careers (Page-Reeves et al., 2019). When examining the number of STEM degrees awarded from 2009 to 2020 in the United States, as the figures for every race and ethnicity grew, those for American Indian/Alaska Native decreased by nearly 500 (Duffin, n.d.). Incongruence between the STEM curriculum and values of Native American students have often contributed to this lack of engagement. Finding ways to merge the world of STEM with student culture is key to increasing involvement.

The Funds of Knowledge and the iSTEM program strive to engage 3rd-8th grade Native American students with STEM by using activities, “related to real-world application specifically attuned to Native American culture and ways of learning as well as the context and geography” (Stevens, S. et al., 2016, 950). Infusing culture into education makes it responsive to the interests of students by connecting with their experience. When considering that Native American families tend to promote staying close to home and with the community, Funds of Knowledge discerned

that exposure to, “local STEM industries is critical for increasing Native American students’ interest and success in STEM fields and careers” (Stevens, S. et al., 2016, p. 949). Making STEM relevant to the real-world strengthens engagement, but increasing its cultural relevance makes it even more tangible.

The Reach For the Sky program combines adventure learning and indigenous culture to create an impactful experience for Indigenous students. Adventure learning is an interdisciplinary approach that uses experiential and inquiry-based learning where students actively solve real-world problems within their community (Miller, B. G. et al, 2012). It is grounded in the idea of using one's culture to create a more meaningful learning experience. For their online curriculum intended for indigenous education, Reach For the Sky used the game of snow snakes for its context. Snow snakes is a game that has been played within tribal communities for generations all over North America. Its use as a learning activity engages students in STEM education while creating a connection with tribal traditions. The use of an online environment was crucial to the experience as it allowed students to interact with their peers, educators, and other knowledgeable individuals. This open communication can help to develop understanding of a topic and motivate participants to continue their work. Involvement of the internet and other relevant media also gave students access to various streams of learning, aligning with the indigenous educational model which arises from the idea that knowledge can come from many places (Miller, B. G. et al, 2012). Consolidating STEM education with indigenous culture has the potential to promote learning while simultaneously enriching a student’s cultural identity.

Inner-City, Rural Urban STEM Education

Schools in underserved communities often fail to properly educate students and nurture their academic interests. There are four so-called paths that have been shown to influence a student’s performance, be it leading them to failure or success. Rational, emotional, organizational, and family paths can be used by leadership figures in the school to improve a student’s performance (Liu, et al., 2021). Many underserved schools manage these paths improperly, leaving the academic interests of students undeveloped. Members of underserved communities often contend with racial prejudice in addition to improper education. It has been shown in urban and inner-city environments that minorities avoid STEM and related activities for the fear of “acting White” (Drazan et al., 2016). Strategies that have proven to be effective in breaking these prejudices utilize activities that are culturally relevant to its participants.

One of these activities is a do-it-yourself project in which a group of inner-city students made a vertical jump measurement platform. This study used low-cost items that would be readily available to the urban community (Drazan et al., 2016). Participating students collaborated with peers and engaged with their community to construct the platform. Following the initial creation, students from the study continued pursuing their individual STEM projects with support from mentors. While support was vital to the success of this study, the socially relevant subject matter was another key component to this project. The subject of a vertical jump measurement platform engaged students in a way they were comfortable with and excited about (Drazan et al., 2016).

Other methods have been used to encourage students from underserved areas to engage in STEM. One of these methods is micro-credentials, or digital badges. These online certificates can be used in conjunction with online learning programs to provide participants with a concrete goal and proof of achievement. Digital badges can effectively provide presentable proof of education for anything that does not require hands-on experience to anyone with an internet connection

(Tinsley et al., 2022). Online programs in general can give students living in remote areas access to quality STEM education. During the pandemic, the Digital Youth Divas (DYD) program became vital to preserving the female STEM community. Fun online resources and video calls were used to create interactive learning experiences for DYD participants. Video calls were further used to encourage peer and mentor connections. The DYD program also strives to obtain parent involvement in order to create the best environment for their STEM journey (Thompson et al., 2021). Utilizing the internet to produce STEM education programs means creating an opportunity to gain knowledge, experiences, and support that might otherwise be inaccessible.

STEM Techniques Summary

Programs inside and outside of school provide structured learning experiences that promote STEM. Orienting such programs to promote a connection between STEM and relevant, real-world situations contribute to increased engagement (Stevens, S. et al., 2016). The introduction of positive figures and mentoring have proven to be effective techniques that inspire and sustain interest in STEM (Campbell-Montalvo et al., 2022). This is especially impactful for females and members of minority groups. The use of an online platform provides unique educational opportunities for STEM education. Utilizing the internet can give program participants the opportunity to communicate with mentors, professionals, and each other. Such an environment encourages learning and exposes students to new ideas and perspectives that expand their knowledge (Thompson et al., 2021). Online learning in the form of digital badges is another web-based strategy that provides encouragement for students to complete their learning (Tinsley et al., 2022). The effective implementation of these education practices could be the key to eliminating the discrepancies found in STEM.

One existing program is R4Creatings, Girls into Tech program. They are currently working to create more engagement for girls in STEM by hosting events, workshops, and competing in robotics competitions. The goal of this project is to assist R4Creating and the Be Greater than Average with their Girls Into Tech (GIT) program. The GIT program's mission is to increase participation and engagement in STEM for 5-8th grade girls living in remote areas of New Mexico. They offer various learning programs and workshops on STEM related subjects. Additionally, a developing mentorship component and discord server allow for support and continued communication. The current goal of GIT is to expand its online component to better connect the girls of New Mexico, especially those in rural and tribal communities, with STEM. The primary focus of our undertaking is to contribute to the online portion of the program, by presenting numerous STEM career paths girls can pursue.

Methods

The goal of our project was to encourage middle school girls within New Mexico to engage in STEM fields by developing the foundations of the online component of R4Creating and Be Greater than Average's Girls Into Tech program. To properly achieve this goal, we identified four objectives:

1. Assess the contents of R4Creatings and Be Greater Than Average's Girls into Tech program.
2. Build a general overview of middle school aged girls in Pueblos and rural areas of New Mexico and their current engagement in STEM.
3. Determine strategies to improve STEM engagement in the GIT program by evaluating the effectiveness of existing programs.
4. Create the foundations of an effective online STEM learning program.

These objectives helped to orient our project by creating a clearer framework of how to advance the progress of this project. In order to achieve these objectives, a variety of methods were implemented.

Objective 1: Assess the contents of R4Creatings and Be Greater Than Average's Girls into Tech program.

We could not make an effective addition to a program if we do not fully comprehend the initiative. For this reason, our first objective was to gain a better understanding of the GIT program: this included researching its current state, educational practices, and future goals. It was important for us to achieve this objective before beginning our work on the digital program. Although, coming into this project, we had a general understanding of the GIT initiative, more information was needed to create a product that fully aligned with the developing program. This was accomplished by exploring the various practices of GIT and the people who work to achieve its goal of spreading STEM education. There were several methods that generated the information needed to realize this objective.

To achieve this objective, we engaged in active participation, interviews and observation. Actively participating in events hosted by R4Creating, and general women in tech events, allowed us to gain a more comprehensive understanding of the goals of the GIT program. These events provided us with firsthand knowledge of the program itself and the experience of its participants. Using this understanding, we made more relevant and valuable decisions in our own work.

We conducted interviews with GIT staff and a girl who participated in the program (see Appendix A, B). These groups, each with their unique perspective of GIT, gave us a well-rounded view of the initiative. Interviews were structured, semi-structured, and unstructured depending on the person. We used Structured interviews when we needed to collect and compare specific information. In other circumstances we used semi-structured and unstructured interviews to build deeper connections and allow opportunities to gain information to which we were previously unaware.

The final method to achieve a better understanding of the GIT program was through unobtrusive and participatory observation in program activity. The GIT program allows participants the chance to connect both online through Discord and in person. Although our focus is online, the in-person parts of the program are still important, as it builds peer community and gives more opportunities to connect with mentors. Becoming familiar with both the online and offline activities of GIT helped us to better understand the program, allowing us to make an appropriate contribution.

Objective 2: Build a general overview of middle school aged girls in pueblos and rural areas of New Mexico and their current engagement in STEM.

While we learned of the R4Creating and Be Greater Than Average's program, we wanted to familiarize ourselves with other stakeholders and their motivations. We wanted to understand why the community has such low STEM rates for women. Finding out what services they needed in an online program helped us create a STEM program for this specific community.

To understand our demographic of girls in New Mexico, especially in rural areas, we interviewed and unobtrusively observed. As with Objective 1, we conducted structured and unstructured interviews with GIT staff. We wanted to hear their insight on what girls need for STEM education, as well as what can be improved in the program. This helped us understand what the girls needed in a STEM program. We used this data to develop ideas for the program with the needs of girls in mind.

We interviewed a student along with various professors and teachers (see Appendix B, C). From the girls, we wanted to find out what initially interested them in STEM and continues to keep them engaged. Although professors, public school teachers, and charter schoolteachers are not directly connected with the GIT program, we interviewed them about the strategies they integrate into their teaching to promote female interest in the fields of STEM. We also asked them about what they wish their class had and what the state of STEM education in their school system is like. This was done to better understand what is lacking in the classroom, as well as the state of STEM education in New Mexico. We took this information and developed tactics to create a successful GIT program. This gave us insight to specific strategies that we might not know about, as well as first-hand accounts of the efficacy of certain strategies.

Objective 3: Determine strategies to improve STEM engagement in the GIT program by evaluating the effectiveness of existing programs.

Once we began to understand the program and the concerned parties, we needed to understand what strategies could be used to improve and sustain participant engagement. Bolstering interest in STEM is the primary purpose of the GIT program, making this a vital step in our project's success. To uncover the best way to achieve this, we had to consider the wants and needs of the participants as well as expert insight. Together, these perspectives informed us on how to effectively increase interest in STEM for middle school aged girls.

We researched existing programs, conducted a survey, and carried out interviews. Online research into STEM programs was our first step. By examining the educational practices and program features of 26 STEM programs that were most commonly utilized, we discerned various methods of engagement to consider for our own program (see Appendix D). Facts gathered from this preliminary online research additionally helped us to create more intentional questions to collect more pertinent information on STEM education strategies. These questions were used for our survey with college STEM students and interviews with GIT staff and other program heads (see Appendix E).

	Mentorship	Hands-on Activities	Community	Representation	Career Exploration	Competitions	Long Term
Girls Inc.	☑	☑	☑	☑	☐	☐	☐
Teck Trek NM	☐	☑	☑	☑	☑	☐	☐
Society of Women Engineers	☑	☐	☑	☑	☑	☑	☑
Project Lead the Way	☐	☑	☐	☐	☑	☐	☐
Girls Talk Math	☐	☑	☑	☑	☐	☐	☐
Girls Who Code	☐	☑	☐	☑	☑	☐	☐
FIRST	☑	☑	☑	☐	☑	☑	☐
STEM Connector	☑	☐	☐	☑	☐	☐	☐
Girls World	☑	☑	☑	☑	☑	☐	☑
Million Girls Moonshot	☑	☑	☐	☑	☐	☐	☐

Figure 1. 10 out of the 26 STEM programs researched (see Appendix D).

We created a Google Form that was sent out to college students from WPI to gather basic information on students pursuing a career in STEM so that we might better understand what sparks and sustains interest in those fields. With its 23 responses, the survey informed us of various factors that get STEM students initially engaged, what support structures they had during their pursuance, if they lost confidence in their STEM abilities and how they regained it, along with the largest barriers they face in their educational journey. Using these responses, we further determined what helps and hinders STEM interested students as they pursue these fields. This allowed us to better ascertain what would drive participation in a STEM program.

To gather information focused on existing programs we conducted interviews with 6 program instructors to learn about their perspectives on STEM education. These interviewees, many of whom are ex-professionals and college professors, are involved with programs such as Girls Inc., AAUW Tech Trek, New Mexico Network for Women in Science and Engineering, Girls Talk Math, Girls Who Code, Association for Women in Mathematics, and 500 Women Scientists. Questions pertaining to what makes their program(s) successful, where they see room for improvement, and what educational methods were the most engaging provided us with the most valuable information.

Additional interviews with two STEM teachers based in New Mexico gave us further insight into deficiencies of public education and what aspects of a program could help to fill those gaps. An interview conducted with a current Girls into Tech participant who participated in other STEM programs gave us another perspective on what participants themselves find engaging. The information we received from these various perspectives were instrumental in the creation of an effective educational tool.

Objective 4: Create the foundations of an effective online STEM learning program.

As we learned about the GIT program as a whole, the stakeholders involved, and the best ways to educate participants, we formed a strategy for the optimal engagement of middle school-aged girls with STEM. Using this strategy, we designed the foundations of an online STEM learning program. We did so by analyzing the data gathered from the online research, interviews, survey, and participant observation to thoroughly understand what participants want and need in a STEM program.

Through interviews with GIT staff and a participant we were able to discern in what ways the Girls into Tech program could be improved. Speaking with a member from the Department of Education and two New Mexico based teachers, we developed our understanding of the state's current STEM education practices. By researching STEM programs online and through interviews

we determined various strategies that can contribute to an effective STEM education. By uncovering the gaps and educating ourselves on the various ways to fill them, we have proposed an online learning program for GIT. The next section details our findings and recommendation to the Girls into Tech program.

Findings

For an online STEM learning program to be successful, it must engage girls in STEM and maintain their interest. To determine how to do this, we developed an understanding of the Girls Into Tech (GIT) program along with the relationship middle-school aged girls (about 10 to 14 years old) of New Mexico have with STEM education. To determine successful STEM learning strategies we researched current STEM programs and interviewed GIT staff, a program participant, teachers, professors, program heads, and STEM professionals (see Appendix A, B, C, F, G). Results provided information on the state of New Mexico's STEM education and how a program like GIT could provide additional support. An investigation into the Girls Into Tech program itself brought to light its engagement strategies, support system, and places where the program could be improved. To fill those gaps, we discovered that a strong STEM program includes hands-on activities, a strong community, mentors for support and guidance, along with opportunities to explore careers. Below we present our findings on the GIT program and strategies for successful STEM programs in New Mexico.

New Mexico Education

It is clear that something significant is lacking in New Mexico STEM education and it was our goal to figure out what that is. It is especially true for STEM, specifically girls trying to get into STEM. The standardized test results put New Mexico firmly in the bottom five spots nation-wide. For instance, New Mexico was ranked 53rd in math proficiency among the 50 states and 3 of the United States territories tested this year. The lack of science education is also easily visible. As Dr. Shelly Gruenig mentioned during a discussion, there is “very little” in the way of science education for New Mexico students. Compounded with the general gender inequality and discrimination throughout the US, females have an extremely difficult time getting into STEM.

Based on the interviews we conducted, careers in STEM have not been much better. Several of the female STEM professionals we interviewed said that they had to struggle to access education in the field, and, once they received that education, they had to face considerable discrimination throughout their career. One of our interviewees stated that she was discriminated against at work while setting up a computer for a man. When she arrived to carry out her task, the male department head asked what she was doing. Upon saying that she was there to set up the computer, he replied, “but you’re a woman?” (STEM professional, personal communication, 2022). This comment implied that the interviewee did not have the knowledge to complete this task and therefore did not belong.

Our sponsor revealed another challenge that girls in New Mexico face when getting into STEM is the fact that in some cultures in more rural areas, leaving the community after high school is extremely uncommon. This prevents the girls from getting a higher education in general, let

alone in STEM, which is perceived as unnecessary in the environment they live in. This was further enforced during our interview with a member from the math and science bureau of New Mexico's Public Education Department. When discussing reasons for the lack of engineering courses in schools, one factor was that, “the community may not feel that that subject is a priority.” This is quite unfortunate for students who are interested in pursuing an education in STEM. In these situations educational programs like Girls Into Tech can become a resource for additional support.

State of GIT

The GIT program has multiple goals that it attempts to achieve using several methods. It aims to engage middle school-aged girls in STEM, provide them with an avenue to maintain their interest, as well as create a support system that they can lean on when needed. Engaged, in this context, means that the participants are interested, pay attention to the topic, absorb information given to them, and seek out further knowledge. GIT employs several strategies to build engagement among its participants.

Engagement Strategies

GIT engages girls in the program through various activities such as providing courses on certain STEM topics, speakers, and hands-on activities. Members are required to take a general engineering course hosted by GIT to become more informed of the possibilities of various fields. They are also required to choose another class and can participate in clubs focused on various STEM topics.

Guest speakers are also invited to talk about their experience in their field and about what they do in general. When a female prosthetist came to speak with GIT participants, program heads reported incredibly high engagement (Alessandra, Omdahl, Solecki, Gruenig, personal communication, 2022). The talk exposed them to a new and interesting career and also, “gave them something to aspire to” (Alessandra, personal communication, 2022). In addition to these options, there are also hands-on activities that the girls can participate in. Most of these hands-on activities are done in groups to create bonds between the girls.

Additionally, there is a monthly activity held by Be Greater Than Average/R4 Creating where many participants of the program take part. The Hyperspace Connect event was an example of these activities. During the event students in middle and high school have the opportunity to connect with professional mentors from a wide variety of businesses supporting the Aerospace industry (Gruenig, personal communication, 2022). When asked about their favorite parts of the GIT program a current participant cited these types of conferences as not only fun, but a valuable opportunity.

Finally, one of the main ways that GIT maintains participant interest is through the length of the program. The program is a yearlong from the point of signing up, allowing them to participate in all of the monthly activities planned throughout the year. The length of the program allows continuous engagement for extended periods of time as well as support for the participants.

Support System

The GIT program has a support system in place for the girls to encourage them to maintain their confidence, interest, and allow them to seek out help when they need it. There are a few ways that they provide this support to the girls. One example is that the staff, who are mostly volunteers

who are former educators and STEM professionals, are easily accessible to support the girls. To do this, the GIT staff are available on site and through email and other messaging services. This allows the girls to ask them questions and for advice at most times during the day.

Another leg of the support system is networking with the guest speakers and at various events that take place with the girls. Many of the professionals that the girls meet are open to answering questions they have and potentially helping them in the future. The guest speakers give the girls a successful STEM role model that they can look up to and understand that such success is an attainable goal for them. The guest speakers also allow the girls to see possibilities in fields that they did not know existed. One of these guest speakers was a mechanical engineer that made prosthetics. Prior to hearing what the guest speaker had to say, the girls had little interest in mechanical engineering. Afterwards, the girls were excited to learn about mechanical engineering because they realized that they could help people and other living beings with it.

A method of providing support that is intrinsic to the program is simply the fact that bringing together so many like-minded people of a similar age allows them to look upon each other for help. This also solves one of the main problems that females face when they try to get into STEM – the lack of women currently in, as well as going into, STEM. This leads them to feeling lonely, like they do not belong, or that they feel as though they have nobody to relate to (Campbell-Montalvo et al., 2022). Putting them into a supportive environment circumvents this problem by giving them people to relate to and a community they feel they belong to.

The final method of support in place at GIT is that they have a discord server with all of the current and past participants, staff, and mentors. This allows participants to easily communicate with each other as well as older girls who have participated in the program. This sets up a network where they can communicate with more experienced girls and those that are further ahead in their education. Our sponsor's hope for the discord server is that in a number of years, the girls who went through this program and entered the workforce can come back and help mentor and support the girls in the program. Something similar happened with the robotics program that is run by R4 Creating, where past participants came back to pay it forward to current participants.

Gaps In the Program

While GIT is set up to perform well and get more girls into STEM, there are a few gaps in the program that we have identified. One such gap is their mentoring program. The GIT staff have already identified mentoring as a crucial aspect to their success. However, they lack the mentoring figures to properly put it in place. The only mentors currently in the program are the staff and a single peer mentor currently in high school. This limits their mentoring ability to their professions and fields they have a solid understanding of, hindering the breadth of the mentoring. Another factor that hinders their mentoring ability is that they have only a small number of mentors managing all of the participants who want or need mentoring.

Another gap in the program is their lack of an online learning platform, even though GIT staff has recognized this as a priority. The lack of an online platform limits GIT staff's ability to reach girls in more remote or simply distant areas. GIT program head, Karena Omdahl stated, "distance is an issue, which is why we're trying to build discord (an online communications platform) but even then, trying to engage over a remote platform…is not always easy because, …really to engage it's got to be hands-on." For context, the population density of New Mexico is 17.5 people per square mile, the sixth lowest in the United States (*U.S. Census Bureau QuickFacts*, n.d.). Because New Mexico is "so spread out" (Omdahl, personal communication, 2022), an online

program would provide GIT with an avenue for expansion and the ability to have more consistent engagement and activities.

The final gap we have identified is the lack of advertisement and outreach. This gap is less of an issue than either of the previous ones, but it has the potential to seriously hinder the program's future. Currently, there is only one method of spreading awareness of the program, which is through word of mouth. While GIT has a website, the website currently has little information on the contents of the program. It is also severely overshadowed by the similarly named world-wide program known as Girls in Tech, making it difficult to find even if you know what you are looking for. While it is a necessity to advertise, it is understandable why they would want to hold off on expanding for now. They currently only have a handful of staff members who are already overworked and no way to engage a large number of girls, let alone remotely.

Strategies of Successful Programs

We found that there are many aspects to what makes a successful program. While interviewing children on what they want was highly effective to understand their needs, interviewing adults who run programs and staff programs aimed at educating girls in STEM was also highly effective. Adults can give insight because they observe and teach for much more time than we could have in our time frame. While interviewing people whose jobs it is to get girls interested in STEM, four main topics for a successful program emerged: hands-on activities, mentoring, community, and exploration are the key aspects to learn about and keep girls interested in STEM topics.

1. Hands-on Activities

Activities that the girls can interact with and get a grasp of in-person are the most engaging way to teach. All of the 10 program heads, professors, and teachers who we interviewed cited hands-on activities as an incredibly effective, if not the most effective, method for STEM education. One program head said being able to engage program participants effectively creates more growth for their interest in the subjects. It lets them figure out problems and topics and can allow them to develop important STEM skills including problem solving and creativity. GIT staff member, Karena Omdahl, when asked about hands-on activities, said "Hands-on is the way you're going to get someone engaged because what it does is it removes the mystery. Mystery is what keeps a lot of people from doing something." A hands-on method is more effective, as opposed to lectures, when it comes to learning STEM topics such as designing and manufacturing or how to use various STEM equipment. When working in a group, hands-on learning encourages collaboration and sharing of ideas, while creating bonds between the girls that have the potential to last throughout their lifetime and help increase their love of STEM. All of our interviewees, except for one professional who was also an outlier in nearly all aspects, helped solidify the idea of hands-on activities working the best for engagement.

2. Community

Strong community creates bonds that can help shape interest in STEM. Within the female STEM community, representation is incredibly important. A female respondent from our survey of WPI students cited a lack of women in STEM as the cause of them losing confidence in their abilities. In multiple interviews from teachers and program heads it was stated that girls are

generally more interested in health careers. Further explanation tied this to the high number of female professionals currently present in these fields of STEM. This demonstrates how impactful representation can be on a girl's pursuit of a specific interest or career. During our analysis of online programs, we found that several utilize representation as a part of promoting STEM to girls. One such method of doing so is by sharing the stories of real-life female professionals working in STEM. Examples of utilizing professional stories to support career exploration can be found in the Society of Women Engineers STEM Pathways modules, the Discover Engineering program's STEM careers, and the Career Girls website. All of these resources relay the educational and work experiences of STEM professionals. They provide girls with representation and role models, making it easier for young girls to see themselves in those positions (*Our Impact - Imagination Index | Career Girls*, 2020).

Community on a more personalized scale is as important for sustaining female interest in STEM. We talked to three professors about their educational journey and found that shared experience, whether that be through a shared interest or struggle, a support group, or seeing peers take part in an interesting venture, helps tremendously in keeping girls interested in the STEM field. All of the teachers, professors, and professionals had some sort of community to help them go through their education. According to the GIT staff as well as other program heads, and teachers in STEM fields, creating supportive spaces is crucial to keep girls in STEM. Karena Omdahl, commented on this by saying "Most girls like [social engagement] and it helps build their confidence." This can be done through helping one another with work, a shared experience of struggle, and simply knowing that you're not alone (Bernardi; program head, personal communication, 2022). Community can create new mentors as time passes and older kids from the community become a guiding force in helping younger girls in STEM. Shared community can also help them develop communication skills, which are vital to the professional world of STEM, since people need to share ideas with others. Three GIT staff members, who were all former STEM professionals or educators, stated their hopes that the program will develop a strong community of young women and connections to professionals. This sentiment of community was also echoed by another program head, which emphasized the importance of girls meeting other girls like them.

3. Mentors

Mentors are critical to a successful program. Without mentors, children have nobody to look up to, or anyone to guide them to better understand the STEM field. Mentors help show kids what they can pursue and accomplish within their fields. They are a critical form of support during a child's STEM journey. Mentors can be many types of people: teachers, more experienced peers, parents, and professionals all help create an environment where girls can feel validated in STEM. In the existing GIT program, many of the staff found that having the opportunity to meet people in the field who are women, and share their stories, greatly influenced girls.

According to two GIT staff, having the opportunity to ask professionals questions helps girls understand what they do, and gives them opportunities to hear what the professional field is actually like. While interviewing three GIT staff, as well as four other program heads, we found that mentoring others can help women get opportunities they would not have otherwise, while teaching them valuable skills in the STEM field. Several STEM professionals that we interviewed echoed this saying that throughout their experience, mentors in their lives were a great help in encouraging them to stay in STEM and getting opportunities they otherwise would not. A guiding force in their STEM journey helps them gain experience and fosters their education.

4. Career Exploration

Exploration of different career paths helps women find out what options they can pursue, and even exposes them to opportunities they did not know existed. Discovering a strong interest within STEM can drive pursuance and lead to a longer lasting involvement. When WPI students were asked what helped them regain confidence in their STEM abilities, one of the three top responses was to redirect their educational pursuits towards a STEM topic that they were passionate about. When students find something that truly interests them, "they're going to perform" (Alessandra, personal correspondence, 2022). This can be related to one of the other three top responses: successful competition. When students are able to complete a difficult task, it proves that they are capable, building their confidence. With greater passion comes greater motivation to complete a task, and intern can lead to increased confidence in STEM abilities. This increase in confidence is key to maintaining girls in STEM.

Meeting professionals further supports this exploration. Introduction to working STEM experts gives girls the opportunity to hear personal stories and learn how engineering can help people. Through interviews with professors and program heads, as well as GIT staff, understanding that STEM can help people greatly increases female interest in STEM, making this the reason many women go into medical fields. While talking to GIT staff, we learned from all of them that when girls were given the opportunity to learn more in depth about a field and how they can help people, they become more interested in that particular field.

For example, through an interview with GIT staff, we learned that a computer scientist spoke at an event. When the girls were asked about their thoughts on the professional's field before the professional spoke to them, they responded with little enthusiasm. However, after the professional told them about how she learned computer programming to develop software to help her friend with diabetes keep track of their blood sugar, and continued down the CS path, the girls were enthusiastic to take a deeper dive into programming. Kim Alessandra, a GIT staff member said "They gave them something to aspire to". Throughout our interviews with GIT staff and professionals, we found that girls are much more likely to become interested in something when they know it can help a person or animal.

Interconnectivity

An important thing about these four topics is that they are interconnected. All of the important aspects of a successful program work together. Being able to complete hands-on activities related to a career gives girls great insight into whether that field is something they would enjoy doing more work in and can increase confidence in their STEM abilities. Working on these activities can also grow a community, which can be made up of mentors that help the girls explore their options in life. It is also cyclical in nature, as girls in the community can grow up and become mentors that help younger women explore their options for careers, and let them grow as they did. As students grow, they can also take that support system through their peers and continue to have that support throughout their professional careers. One program head in particular talked about how every aspect of her program is a foundation to create the overall successful program. This can also stop people from dropping out of the field later in their lives, which means overtime there will be more women holding jobs in STEM. This was one of the main points from the Women In Tech event we attended and was a common theme throughout the discussions and talks.

Considerations

We would like to acknowledge the focus on discrepancies between males and females in STEM. Middle school students who identify as non-binary are also in need of support and mentoring in the pursuit of STEM. As an underrepresented group, steps must be taken to promote STEM engagement for those who do not identify as male or female. The attention of Girls into Tech is centered on female identifying students, which is the reason for our similar focus.

Additionally, we recognize faults in our investigation. During the researching process there was a lack of information on New Mexico's STEM education. To learn more on this matter, interviews were conducted with a member of the Math and Science Bureau from the Public Education Department of New Mexico and two teachers based in the state. We gained a great deal of useful information from these interviews, but there was room for further exploration into New Mexico's STEM education.

There was also a lack of information gathered from children. One child interview was conducted with a member of Girls into Tech. During this discussion we got to see the GIT program from a new perspective and began to understand what participants wanted from the initiative. More interviews with GIT participants would have allowed us to deepen this understanding. Time constraints prevented us from collecting as much material as we had intended, including surveying a broader base of colleges. Despite these limitations, we have formed a recommendation that will strengthen the impact of the Girls into Tech program.

Recommendations: Outline for GIT Online Program

The Girls Into Tech program offers opportunities for hands-on learning: it has a community along with a mentorship program, and STEM professionals speak to girls about their fields. These are integral parts to a successful STEM initiative. What the program needs is more. Girls Into Tech is in its early stage, making the need for overall development expected. Much of this development will take time, so what can be implemented in the near future that brings together the primary factors of an effective STEM learning program? Based on findings from our observation, research, survey, and interviews, we recommend the following for an online portion of the Girls into Tech program. A summary of this outline is as follows with more detail below:

1. *Modules with information on STEM careers*. GIT should create an online platform containing information on a wide range of careers. Based on a year-long calendar, each month participants are to be presented with a STEM topic and multiple careers within that field (see Appendix H). This information must be presented in an engaging manner in the form of a module with a digital badge awarded upon completion. An example has been developed and is presented in Appendix I.
2. *Stories of female STEM Professionals from New Mexico*. Personal stories are to be a key part of the STEM careers module. These come from a diverse range of female STEM professionals who grew up in New Mexico. Information in this section speaks to the unique educational and professional journeys of these women with the goal of inspiring and building confidence. A story example has been developed and is presented in Appendix J.

3. *Career-based activity*. An engaging, hands-on activity is to be designed to accompany the career exploration modules and are connected to the STEM career field theme of the month. The existing Girls into Tech Discord server is to be a place where participants can ask questions and find support as they complete the activity. Upon completion, participants will receive a digital badge. Materials for the hands-on activity are to be provided by Girls into Tech. An example activity has been developed and is presented in Appendix K.

Modules With Information on STEM Careers

Science, technology, engineering, and math can be found all around us. These fields are wide reaching, each containing fascinating, niche career paths. It is important to expose young girls to as many of these careers as possible so that they might find one that they are passionate about. Finding such an interest can drive pursuance and lead to a longer lasting involvement in STEM, as found from the survey results and interviews with GIT program heads. Providing information to Girls Into Tech members on various careers could be very beneficial to their interest and persistence in STEM.

Presenting the information as an online module is one way of doing this. An example can be found on the Society of Women Engineers (SWE) website. SWE provides information on careers through a course module, where each section provides easy to digest information along with a quiz, stories of people in the field, additional resources, and a final message that the course has been completed (see Appendix L). The resource designed for Girls Into Tech looked to this example as a guide. While SWE's courses are informative and short, further 'gamifying' the learning experience could be beneficial. One way of doing this is a badge system.

Instead of getting a message that something is complete, a user instead would receive a badge dedicated to the completion of a specific task. As a participant learns about a career by engaging with the interface, answering questions, etc., the platform keeps track of their progress. The inclusion of a progress as a visual to further drive completion for the user (Conrad et al., 2010). Once participants have completed all of the in-module interactions and activities they will receive a completion badge (see Appendix M, N). Receiving this badge alone can create a sense of accomplishment (Kruse, n.d.). A badge system adds value to learning, prompting participants to fully embrace career exploration, because they will be more compelled to learn about a career they were previously uninterested in in order to receive a completion badge (Kruse, n.d.). An even greater incentive can be added, with a prize given to girls who receive every career exploration badge for that year. This badge system can act as a progress checker, not just for a single module, but for the online program as a whole.

Stories of Female Stem Professionals From New Mexico

As previously mentioned, the lack of female representation in the fields of STEM has discouraged many women from pursuing these careers (Campbell-Montalvo et al., 2022, Burch, Arnold). Not seeing themselves reflected in these roles can reduce confidence in their own STEM abilities. By including stories from female STEM professionals into the online learning program, girls will become more aware of their own capabilities.

These stories from female professionals should be a featured portion of the career exploration online learning modules. Professional stories found in the Society of Women Engineers STEM Pathways modules, the Discover Engineering program's STEM careers, and the Career Girls website are the primary sources of influence. To increase impact for the Girls into Tech program, one commonality between the women should be that they all came from New

Mexico. Ideally, the professionals would have grown up in various locations within the state, both rural and urban. This would further allow GIT participants to find someone they can relate to, and as a result, realize what they can accomplish.

In addition to representation, stories have the opportunity to deepen the participants' understanding of a career. The information provided in the other portions of the learning module would be relatively easy to unearth on the internet, but an individual's story is unique. They have the ability to provide information on a specific experience or career that is not often heard about. Under the umbrella of engineering, there are dozens of branches. These stories allow people to learn the specifics, and therefore gain a better idea of what careers are available. Girls Into Tech has had guest speakers explain their careers to participants with great success, but this success in sparking interest in a new field lends itself to expansion. Even if a girl is not interested in a particular field, exposure to different stories can help them to realize that there are many paths within a branch of STEM. While the more personal nature of stories has great potential to spark interest in a field, the presentation of diverse careers and journeys can also help young girls to understand the world of opportunities before them in the world of STEM.

The process of collecting these stories alone can be beneficial to the GIT program. Connecting with more professionals will strengthen the Girls into Tech network. Many of these professionals could become future mentors for girls in the program. By focusing on women from New Mexico, a sense of connection between the participants and professionals would likely be a two-way street. In the Girls Into Tech presentation room at the University of New Mexico's Women in Tech event, when asked who wanted to be a mentor, approximately one third of the room's 20 attendees present raised their hand. There are STEM professionals in New Mexico who are willing to be mentors, and the process of reaching out to gather stories will help Girls into Tech find them. In addition to connecting with mentors, searching for a wide range of professionals can open the door to student opportunities in various fields. Whether it is an event or internships, creating this portion of the online program has the potential to uncover greater opportunities for the young girls of GIT.

Career-based Activity

In addition to general information and stories, career exploration can be taken further with the inclusion of a hands-on activity. Pairing career learning with experiential learning can help young girls explore their interests by completing a fun task that is related to their field of fascination. The inclusion of a hands-on activity also makes for more engaging and effective learning. Being able to perform a task that is related to a career could give girls great insight into whether that field is something they would enjoy doing more work in. They don't just discover something they might like; they can actually do it. This leads to a deeper learning experience.

What these hands-on career focused learning activities look like can vary. Because the girls using the online platform will have access to a device and the internet, free online activities can be used. The internet is filled with online activities that can be connected to various STEM careers. Additionally providing activity plans for physical, at-home projects can further captivate GIT participants (Bird, personal communication, 2022). These activities should be created with the goals of fun and accessibility. Accessibility in this case means creating activities for which the GIT program would be able to provide and distribute materials. With the goal of reaching out to more girls in rural communities, distribution of materials to these participants could be difficult. It is for this reason the program has one hands-on activity per month rather than providing a distinct activity for each individual career module. Providing every girl with the same materials kit every

month is a more attainable task in terms of cost and transportation. Although the logistics of this program component is not without demand, having a tangible activity for girls to perform is vital to achieving an effective learning experience (Omdahl, personal communication, 2022).

Partnered with the monthly activities is a channel on the existing Girls into Tech Discord server. This channel is to be a place dedicated to promoting completion by developing a community. As girls work on their at-home projects they have a place to discuss, ask questions, and give encouragement. Support found here can help prompt girls to complete the activity and get help in order to work through any bumps in the road. This channel is also a space with great potential to establish and foster peer mentor relationships. As girls work through the project, a peer mentor can help to answer any question they may post in the channel. The developing Discord platform is also one way of reaching more of New Mexico's' spread out population, but it lacks the vital hands-on component of STEM education (Omdahl, personal communication, 2022). Combining the Discord channel with the at home activities process will close this gap. Once participants have managed to complete their activity, they will post evidence of their product on Discord. Upon doing so, they will receive a badge. Additionally, posting the accomplishment in the channel opens the door to congratulations and encouragement from peers. The same can be done with the digital badges received upon finishing a career exploration module. The outcomes following the completion of the designated hands-on activity or module will drive engagement and prompt continued learning.

An additional benefit to this particular recommendation is parental involvement. Creating something at home opens the door to parents becoming more involved with what their child is doing and their interest. Whether it is asking for help or presenting the final product, an at home project has the potential to encourage parents to become a vital source of support. When asked about the importance of parental support in a child's education, the GIT director and personnel used words such as "hugely important" (Omdahl, personal communication, 2022) and "crucial" (Solecki, personal communication, 2022). A STEM professional and parent said that the best thing a parent can do for their child is first recognize the interest and then to listen or pretend to listen. Providing at-home activities is a promising way to create this dynamic. As the parent(s) are able to learn more about their child's interests, they become more aware of how to foster their interest in STEM.

Conclusion

Whether it is a lack of representation, self-confidence, support, or access, women are underrepresented in the fields of STEM. Science, technology, engineering, and mathematics are the future. If these fields lack female representation, what does that say about the world that lies ahead? Everyone has their own unique experiences and stories, and diversity of perspectives is what drives innovation. There is a lack of valuable female perspectives in STEM. When young girls look for examples of what they can accomplish, they do not see themselves in the fields of STEM. It is important that we do not allow young minds to limit themselves based on what they perceive their limits are. Young girls need to see that there are people like them who are successfully pursuing STEM. That girls their age are also passionate about the same subjects. That there is no STEM career for themselves.

The goal of the Girls Into Tech program is to support middle school girls of New Mexico with their interest in STEM and help them to build confidence so that they will pursue their passion. The research done for this project was conducted with the goal of finding the best way for the GIT

program to achieve its objective. Our findings uncovered the importance of four main themes in a successful STEM journey: engagement through hands-on activities, supportive community, effective mentorship, and the opportunity to explore the numerous facets of STEM. By focusing program development on these topics, GIT will be setting itself and its girls up for success. Our proposal takes into account the themes of hands-on activities, mentorship, exploration, and community. With such an addition, the Girls Into Tech program presents a bright future to the young girls of New Mexico.

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Appendix A: Interview Questions for GIT Staff

GIT Staff include the workers that help create and manage the GIT program, as well as Be Greater than Average.

"We are a group of students from Worcester Polytechnic Institute in MA. We are doing research to help develop R4Creating's Girls Into Tech program. For this interview, we wanted to ask you about your involvement in the GIT program, as well as the GIT program as it stands. The interview will be about 30-45 minutes. Your name will be kept confidential unless you give us permission to use it. This interview is voluntary. You may skip any questions that you do not wish to answer. You may also stop at any time. This research will be available to the public via the WPI Library. Please feel free to ask any questions you have about this research at any time. You may also contact our research advisors, Prof. Zoe Eddy and Melisa Belz, at zeddy@wpi.edu and mbelz@wpi.edu, or our group at gr-SF22-GIT@wpi.edu, with any questions you have about this process. We would like to record our conversation only for our note taking. Is it ok to record just the sound?"

1. What is your role in the GIT program?
2. How would you define STEM?
3. Why is STEM important to you?
4. What are the main reasons why you think this program is important?
5. What parts of the program are the most effective at engaging GIT participants?
6. What parts of the program could be improved?
7. What does the program not include that would be beneficial to its goal?
8. What is your goal with the GIT program?
9. Where do you see Girls Into Tech going in the future?
10. What engages specifically female students in the classroom?
11. How much influence do parents have on their kids' educational success?
12. What advice would you give to children interested in entering or pursuing STEM?

Appendix B: Interview Questions for Students

Students are children participating in 5-8th grade, as well as children who participated in the GIT program.

"We are a group of college students from Massachusetts doing research to help Shelly Gruenig develop the Girls Into Tech program. For this interview, we wanted to talk to you about your experience with the Girls into Tech program and your interest in the subjects of science, technology, engineering, and math. We expect this interview to last about 40 minutes. This interview is voluntary and you may skip any questions that you do not wish to answer. You can also stop at any time. Your name will be kept confidential. Please feel free to ask any questions you have about this research at any time. Your parents may contact us or our research advisors with any questions that you or they might have."

1. What grade are you in?
2. What subjects in school are your favorite and why?
3. Why do you like science, technology, engineering or math (STEM) subjects?
4. What part of STEM are you most interested in?
5. What or who got you interested in STEM?
6. What do you like the most about the Girls into tech program?
7. Is there anything you wish would be added to the program?
8. Is there something that the GIT program has now that you think could be improved?
9. Have you participated in any other STEM programs inside or outside of school? Could you describe them?
10. How do you feel about your capabilities in STEM?
11. Are there STEM subjects that you find are more difficult to learn about than others?
12. In what ways do you learn best?
13. What motivates you to learn?
14. Has online education affected your ability to learn and if so, how?

Appendix C: Interview Questions for Professors and Teachers

Professors include teachers and researchers at Worcester Polytechnic Institute. All of the professors had a college education, as well as worked in or headed their own STEM education programs.

"We are a group of students from WPI doing research to help develop R4Creating's Girls Into Tech program. For this interview, we wanted to ask you about your involvement in [STEM program], your experiences growing up being a woman in STEM, and your experience in the STEM workforce. The interview is expected to last about 40 minutes. Your name will be kept confidential unless you give us permission to use it. This interview is voluntary. You may skip any questions that you do not wish to answer. You may also stop at any time. This research will be available to the public via the WPI Library. Please feel free to ask any questions you have about this research at any time. You may also contact our research advisors, Prof. Zoe Eddy and Melisa Belz, at zeddy@wpi.edu and mbelz@wpi.edu, or our group at gr-SF22-GIT@wpi.edu, with any questions you have about this process. We would like to record our conversation only for our note taking. Is it ok to record just the sound?"

1. What do you do?
2. What was your educational journey like?
3. What or who got you interested in STEM?
4. Why is STEM important to you?
5. Did you ever lose confidence in your STEM abilities? If so, what helped you regain it?
6. In what places did you find support while pursuing STEM?
7. Throughout your educational and professional journey, what times, if any, did you feel like you didn't belong?
8. Have you experienced gender discrimination during your educational or professional career? If you are comfortable, could you elaborate?
9. Were there any other barriers that hindered your interest in STEM? Lack of opportunity, financial barriers, etc.
10. In the past, what STEM related things did you want to do or learn but lacked access to?
11. What are some advancements or topics in the STEM fields that you believe would be of interest to middle schoolers?
12. What would you do differently if you could start over in terms of your STEM career?
13. What are some of the skills you find yourself using in your career?
14. What advice would you give to children interested in entering STEM?

Appendix D: STEM Program Research

List of 26 existing STEM programs. Based on their websites, we determined the methods of STEM education they implemented.

	Mentorship	Hands-on Activities	Community	Representation	Career Exploration	Competitions	Long Term
Girls Inc.	☑	☑	☑	☑	☐	☐	☐
Teck Trek NM	☐	☑	☑	☑	☑	☐	☐
Society of Women Engineers	☑	☐	☑	☑	☑	☑	☑
Project Lead the Way	☐	☑	☐	☐	☑	☐	☐
Girls Talk Math	☐	☑	☑	☑	☐	☐	☐
Girls Who Code	☐	☑	☐	☑	☑	☐	☐
FIRST	☑	☑	☑	☐	☑	☑	☐
STEM Connector	☑	☐	☐	☑	☐	☐	☐
Girls World	☑	☑	☑	☑	☑	☐	☑
Million Girls Moonshot	☑	☑	☐	☑	☐	☐	☐
Code Path	☑	☑	☑	☑	☑	☐	☐
Million Women Mentors	☑	☐	☐	☑	☑	☐	☐
National Sociaty of Black Engineers	☑	☐	☐	☑	☐	☑	☐
Code.org	☑	☑	☑	☑	☑	☐	☐
Eva Longoria Foundation	☑	☑	☑	☐	☐	☐	☐
Girlstart	☐	☑	☑	☑	☑	☐	☑
GoldieBlox	☐	☑	☐	☑	☐	☐	☐
American Indian Science and Engineering Society	☑	☑	☑	☑	☑	☑	☐
Challenger Center	☐	☑	☑	☑	☑	☐	☐
STEP UP	☐	☐	☐	☑	☑	☐	☐
Science Club for Girls	☑	☑	☐	☐	☑	☐	☐
Discover Engineering	☑	☑	☐	☑	☑	☐	☐
Teen Science Cafe	☐	☑	☑	☑	☑	☐	☐
Destination Imagination	☐	☑	☑	☐	☐	☑	☐
National Center for Women and Information Technology	☑	☑	☑	☑	☐	☐	☑

Appendix E: Survey Questions

This survey was sent out to current Worcester Polytechnic Students. Respondents were male, female, and non-binary participants all studying STEM.

1. What was your educational journey like before college? (i.e., Educational interests, clubs, extracurricular activities, learning programs, tutoring, etc.)
2. What was your educational journey like during college? (i.e., Educational interests, clubs, extracurricular activities, learning programs, tutoring, etc.)
3. What got you involved in STEM? Was there something specific that sparked your interest?
4. What support structures have you experienced in your pursuance of STEM? In what ways did they help you?
5. Did you ever lose confidence in your STEM abilities? If so, what helped you regain it?
6. What barriers have you faced while pursuing STEM? (i.e., lack of opportunity, financial barriers, inadequate support, etc.). Please expand on this if you feel comfortable doing so.
7. What is your year of college graduation?
8. What is your gender identity?
9. What is your major

Appendix F: Interview Questions for Program Heads

Program heads include people that founded or run similar STEM programs targeted at young girls, which focus on education and hands-on activities.

"We are a group of students from WPI doing research to help develop R4Creating's Girls Into Tech program. For this interview, we wanted to ask you about your involvement in [Program]

The interview is expected to last about 40 minutes. Your name will be kept confidential unless you give us permission to use it. This interview is voluntary. You may skip any questions that you do not wish to answer. You may also stop at any time. This research will be available to the public via the WPI Library. Please feel free to ask any questions you have about this research at any time. You may also contact our research advisors, Prof. Zoe Eddy and Melisa Belz, at zeddy@wpi.edu and mbelz@wpi.edu, or our group at gr-SF22-GIT@wpi.edu, with any questions you have about this process. We would like to record our conversation only for our note taking. Is it ok to record just the sound?"

1. Could you tell us about your role in the _____program?
2. What is your goal with the _____ program?
3. What are the main reasons why this program is important?
4. What parts of the program are the most effective at engaging its female participants?
5. What does _____to engage specifically with the girls of Santa Fe?
6. What parts of the program could be improved?
7. What does the program not include that would be beneficial to its goal?
8. Where do you see _____ going in the future?
9. What advice would you give to children interested in entering or pursuing STEM?

Appendix G: Interview Questions for Professionals

Professionals include women that are working or have worked STEM jobs. This does not mean they inherently have a degree in STEM, but they have experience in the professional world and the STEM workplace.

"We are a group of students from Worcester Polytechnic Institute. We are doing research to help develop R4Creating's Girls Into Tech program. For this interview, we wanted to ask you about your experiences growing up being a woman interested in STEM, and your experience in the STEM workplace, as well as being a parent. The interview will be about 30-45 minutes. Your name will be kept confidential unless you give us permission to use it. This interview is voluntary. You may skip any questions that you do not wish to answer. You may also stop at any time. This research will be available to the public via the WPI Library. Please feel free to ask any questions you have about this research at any time. You may also contact our research advisors, Prof. Zoe Eddy and Melisa Belz, at zeddy@wpi.edu and mbelz@wpi.edu, or our group at gr-SF22-GIT@wpi.edu, with any questions you have about this process. We would like to record our conversation only for our note taking. Is it ok to record just the sound?"

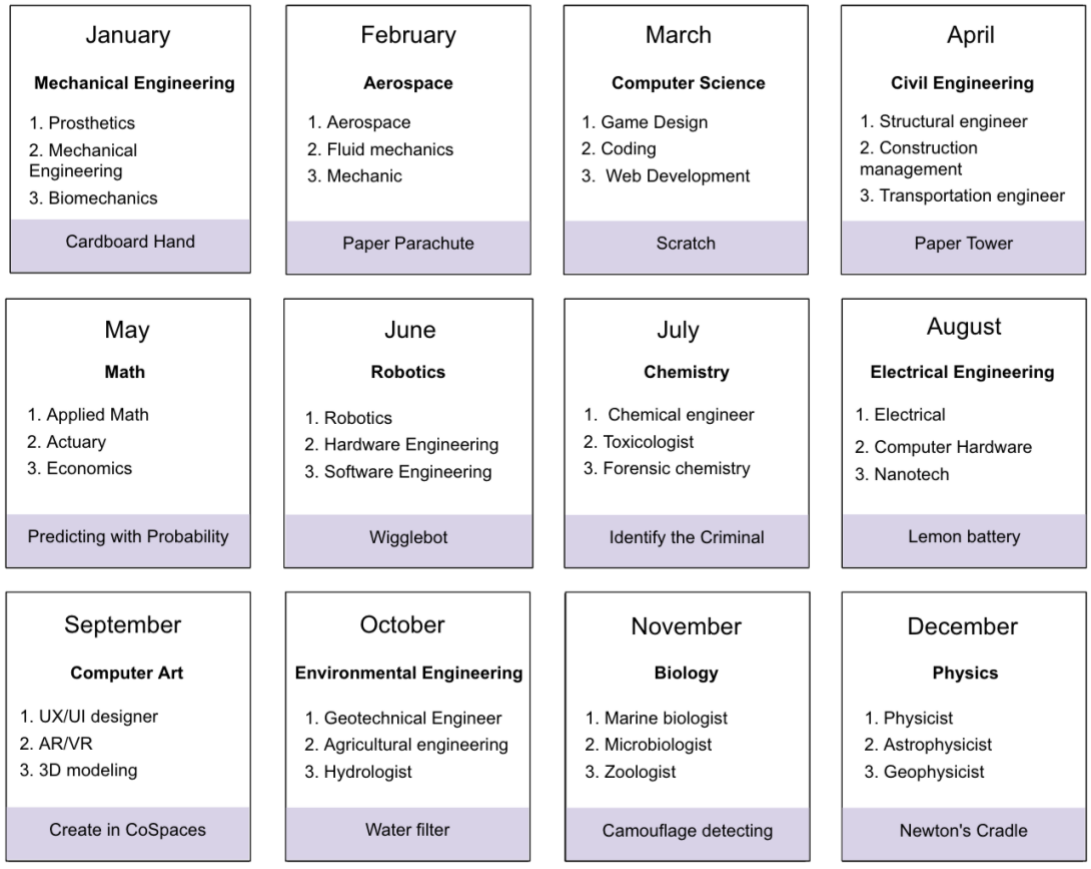
1. What do you do?
2. What was your educational journey like?
3. What or who got you interested in STEM?
4. Why is STEM important to you?
5. Did you ever lose confidence in your STEM abilities? If so, what helped you regain it?
6. In what places did you find support while pursuing STEM?
7. Throughout your educational and professional journey, what times, if any, did you feel like you didn't belong?
8. Were there any barriers that hindered your interest in STEM? Lack of opportunity, financial barriers, inadequate support, etc.
9. What are some of the skills you find yourself using in your career?
10. What advice would you give to children interested in entering STEM?

Professional/Parent

11. What's the best thing a parent can do if their child is interested in STEM?
12. What challenges do you see kids today facing when it comes to STEM access?

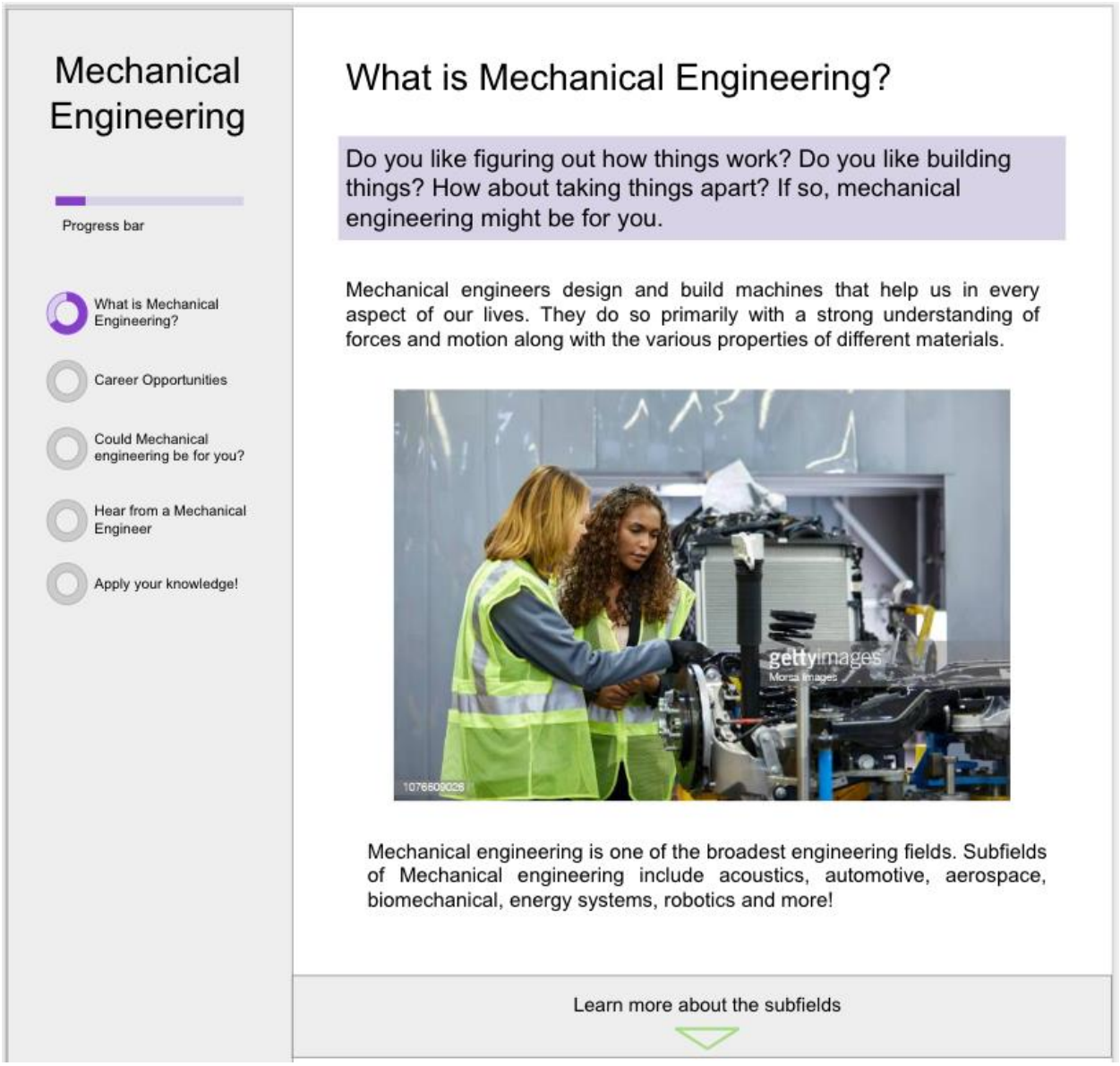
Appendix H: Example Calendar for Program

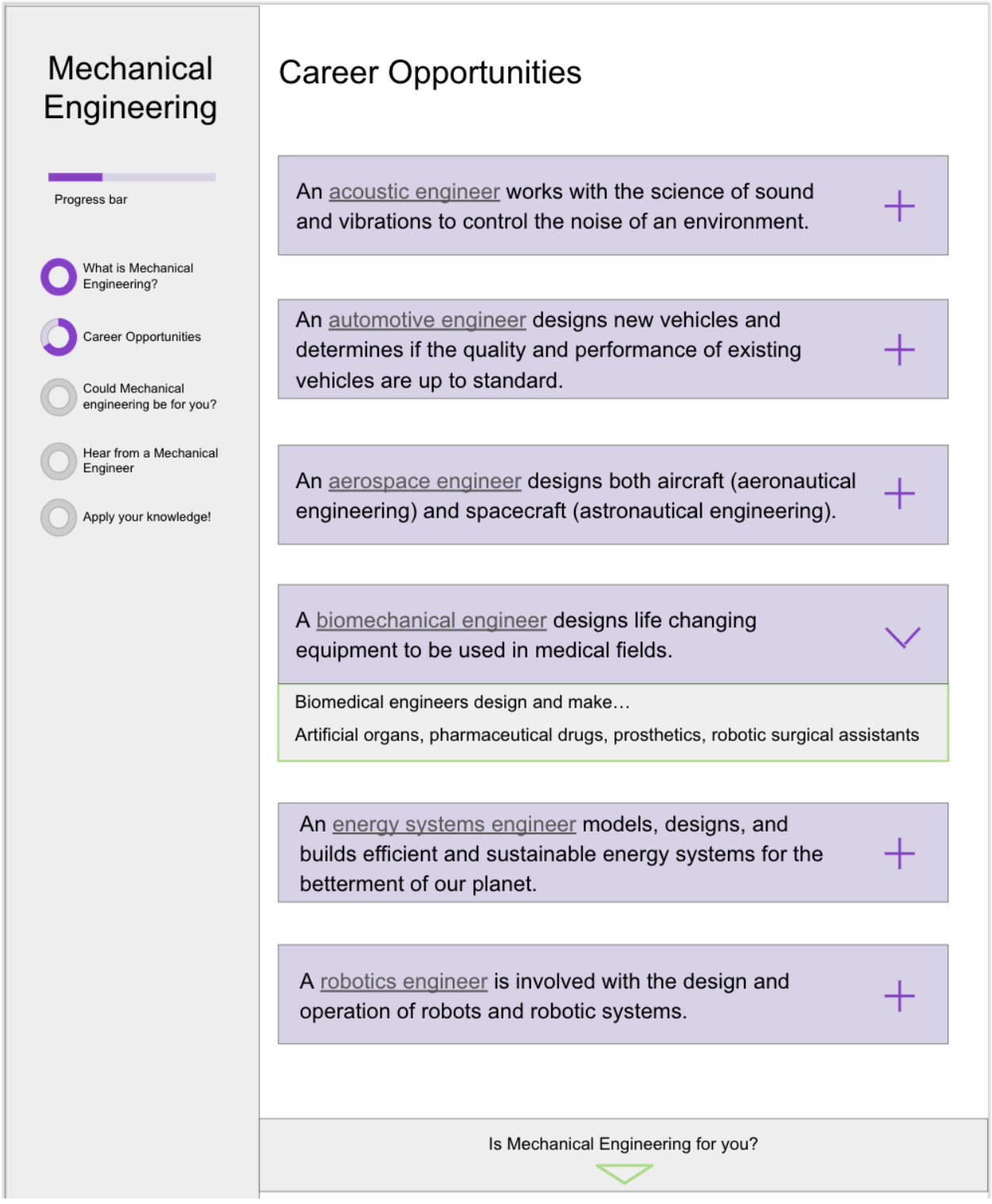
Organizational calendar of the online career exploration program. Each month is assigned a theme, three STEM careers that correspond to the theme, and a hands-on learning activity that connects to the careers.

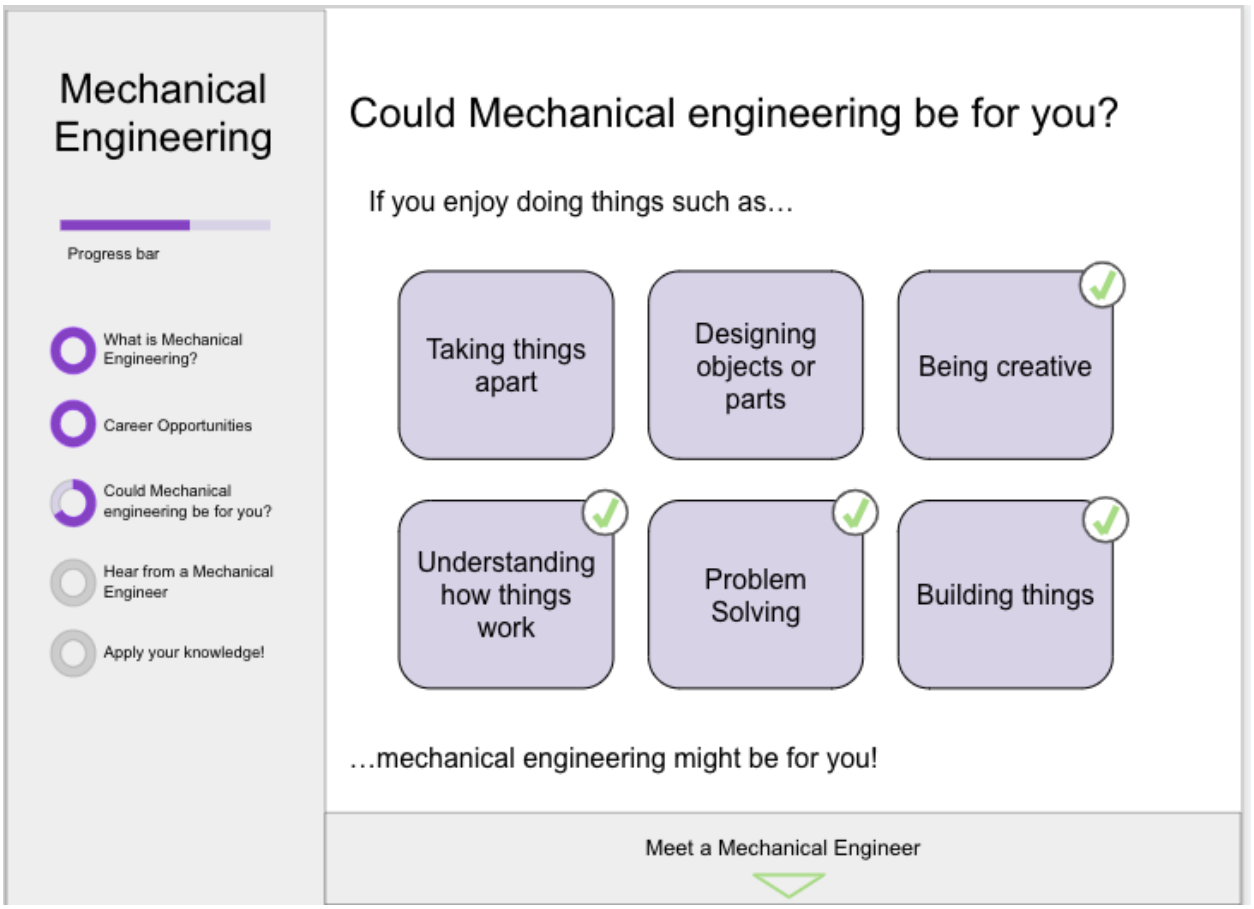


Appendix I: Career Learning Module

Module to learn about the field of mechanical engineering. Three modules such as these will be presented to GIT participants each month to inform them on STEM career paths.




Mechanical Engineering
Progress bar
What is Mechanical Engineering?
Career Opportunities
Could Mechanical engineering be for you?
Hear from a Mechanical Engineer
Apply your knowledge!
Career Opportunities
An acoustic engineer works with the science of sound and vibrations to control the noise of an environment.
An automotive engineer designs new vehicles and determines if the quality and performance of existing vehicles are up to standard.
An aerospace engineer designs both aircraft (aeronautical engineering) and spacecraft (astronautical engineering).
A biomechanical engineer designs life changing equipment to be used in medical fields.
Biomedical engineers design and make…
Artificial organs, pharmaceutical drugs, prosthetics, robotic surgical assistants
An energy systems engineer models, designs, and builds efficient and sustainable energy systems for the betterment of our planet.
A robotics engineer is involved with the design and operation of robots and robotic systems.
Is Mechanical Engineering for you?


Mechanical Engineering
Progress bar
What is Mechanical Engineering?
Career Opportunities
Could Mechanical engineering be for you?
Hear from a Mechanical Engineer
Apply your knowledge!
Could Mechanical engineering be for you?
If you enjoy doing things such as…
Taking things apart
Designing objects or parts
Being creative
Understanding how things work
Problem Solving
Building things
…mechanical engineering might be for you!
Meet a Mechanical Engineer

Mechanical Engineering

Progress bar

- What is Mechanical Engineering?
- Career Opportunities
- Could Mechanical engineering be for you?
- Hear from a Mechanical Engineer
- Apply your knowledge!

Hear from a Mechanical Engineer

Ruse McLair*

Mechanical Engineer

Background and Education

I grew up in Truth or Consequences, New Mexico. In Highschool I became fascinated in tinkering with old junk in my dad's garage. I went to the University of New Mexico, and became a mechanical engineer after learning about the major and its career possibilities. Classes were tough, but we got to work on so many interesting projects. One of my professors told me about Ponnico inc., I applied for a job and have been working there for 15 years.

" If you put your mind to it, you will eventually succeed"

What She Does

I started out in my career designing nuclear reactors. I would design the parts of the reactor that hold the uranium rods, which is very critical to the success of a nuclear power plant. I have done other things over the years but I continue to work with renewable power. I really wanted to go into renewable energy in some way, as I really care about the environment. I hope that my work in this field can help the environment heal from climate change.

Interesting Work

I worked on designing safe ways to store radioactive waste from these power plants, which comes with a lot of challenges, but that's what makes it interesting. Ultimately, my work helped store those hazardous materials safely, making sure the radiation would not be able to cause harm to others.

*Ruse McLair is not real STEM professional

See What You've Learned

Mechanical Engineering

Progress bar

- What is Mechanical Engineering?
- Career Opportunities
- Could Mechanical engineering be for you?
- Hear from a Mechanical Engineer
- Apply your knowledge!

Apply your knowledge!

Which of these items would a mechanical engineer ***not*** work on?

There are many movie props that mechanical engineers have designed and build for the big screen. For and example, just look to the famous animatronic, E.T.

Which of these items would a mechanical engineer ***not*** work on?

A computer's motherboard falls under the discipline of electrical engineering. There is overlap between mechanical and electrical engineering, but ultimately they are two distinct fields

Mechanical engineers impact our lives in many ways. The work they do makes all of our lives easier and safer.

Complete Exploration

Appendix J: Professional Story Example

Example of a female professional working in STEM. This particular individual does not exist.

Ruse McLair*

Mechanical Engineer

Background and Education

I grew up in Truth or Consequences, New Mexico. In Highschool I became fascinated in tinkering with old junk in my dad's garage. I went to the University of New Mexico, and became a mechanical engineer after learning about the major and its career possibilities. Classes were tough, but we got to work on so many interesting projects. One of my professors told me about Ponnico inc., I applied for a job and have been working there for 15 years.

> " If you put your mind to it, you will eventually succeed"

What She Does

I started out in my career designing nuclear reactors. I would design the parts of the reactor that hold the uranium rods, which is very critical to the success of a nuclear power plant. I have done other things over the years but I continue to work with renewable power. I really wanted to go into renewable energy in some way, as I really care about the environment. I hope that my work in this field can help the environment heal from climate change.

Interesting Work

I worked on designing safe ways to store radioactive waste from these power plants, which comes with a lot of challenges, but that's what makes it interesting. Ultimately, my work helped store those hazardous materials safely, making sure the radiation would not be able to cause harm to others.

*Ruse McLair is not real STEM professional

Appendix K: Hands-on Activity Example

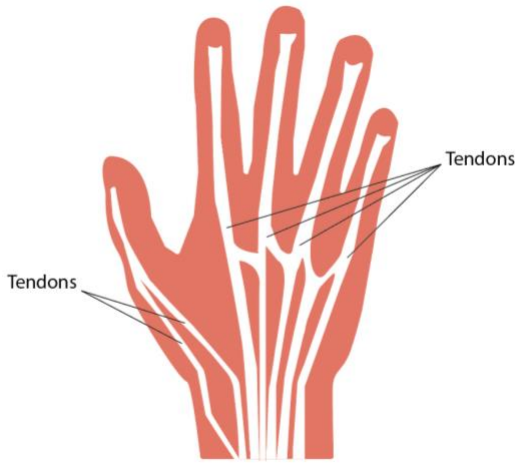
Example of an at home, hands-on activity related to the monthly career learning modules. This module is under the theme of mechanical engineering.

The Mechanics of our Hands

For this activity you will be examining the mechanics of a highly complex machine you see every day: your hand! Together, the tendons, bones, ligaments, and muscles in our hands work together in incredible ways that allows us to perform tasks that range from playing the guitar to picking our nose!

Materials:

1. Cardboard tubes
2. Standard sizes straws
3. Jumbo sized straws
4. Cardstock
5. String
6. Tape
7. Scissors
8. A ruler



Your goal:

Using the provided materials, create a hand with fingers that will bend when its 'tendons' are pulled.

Constraints:

-Use only the materials provided
-The hand must have four fingers and a thumb
-The hand does not need to be the size of a normal hand

Background information:

Did you know that our fingers and thumbs don't have muscles in them? In order for our fingers to move, the muscles in our hand, with the help of ligaments, pull on the tendons in our fingers. To see this interconnectedness in action, place your palm face up and firmly press just below your wrist. Your hand should raise and your fingers might curl! Tendons are what allow our fingers to bend and straighten and they will be the focus of this activity.

How to do the activity:

1. *Brainstorm!*
    a. Look at your hands and examine how it moves. Open and close your fists. Bend your fingers. See what directions they move in, or which ones they don't. How many joints do your fingers have? What about your thumb?
    b. Now, consider which materials would make a good finger. Which materials would make good tendons? What about the hand?
    c. How will you attach a tendon to the end of a joint?
    d. Hints: Consider using hollow materials for fingers. Think about how cutting notches or splits could be used to help the fingers bend and straighten.

2. *Build it!* Using the materials provided, construct your hand.

3. *Test it!* When you are ready to test your hand, pull on all of the 'tendons' and see if the fingers and thumb bend. If it doesn't work the way you hoped, try learning from what doesn't work.

Do Not Give Up!

4. *Tweak your design*, make improvements, and test again! Iteration* is a very important process in the field of engineering.

5. *Post your final result* on the Activity of the Month Discord channel!

Note: With any questions about the activity, you can find support on the Activity of the Month Discord channel.

*Iteration: The action or a process of iterating or repeating: such as a procedure in which repetition of a sequence of operations yields results successively closer to a desired result.

Merriam-Webster Dictionary

Activities Cited:
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https://blog.kaplanco.com/ii/diy-robot-hand
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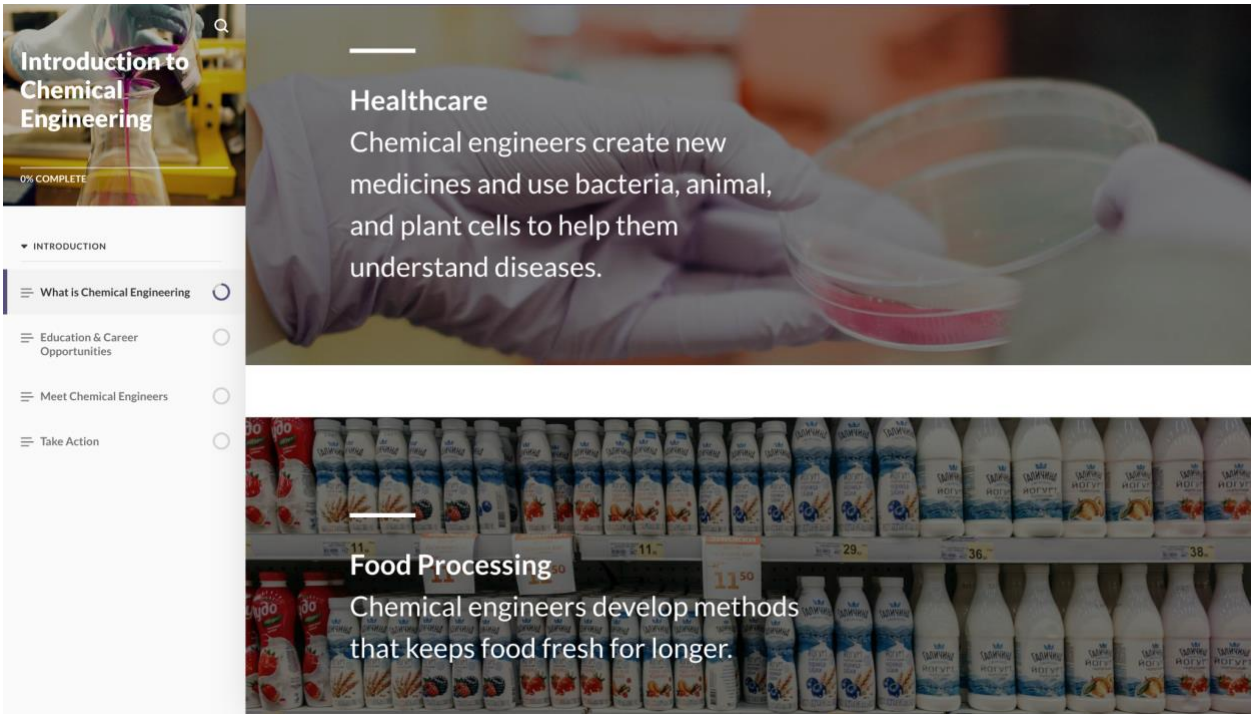
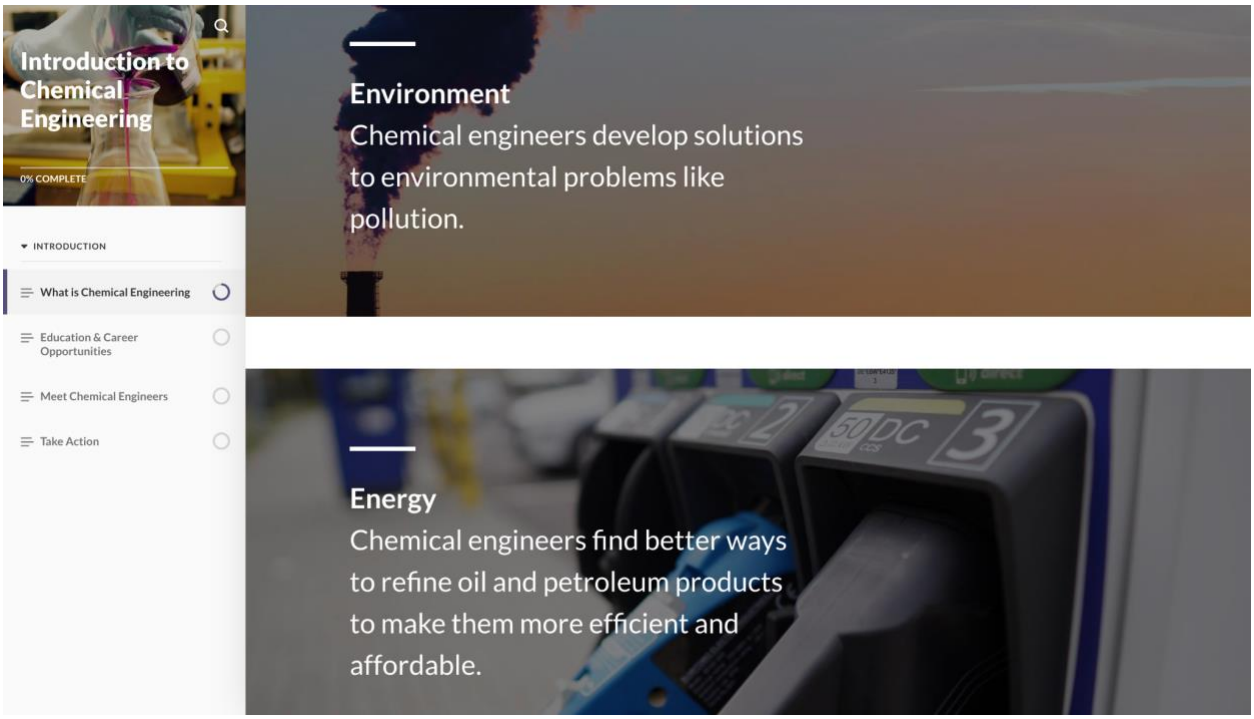
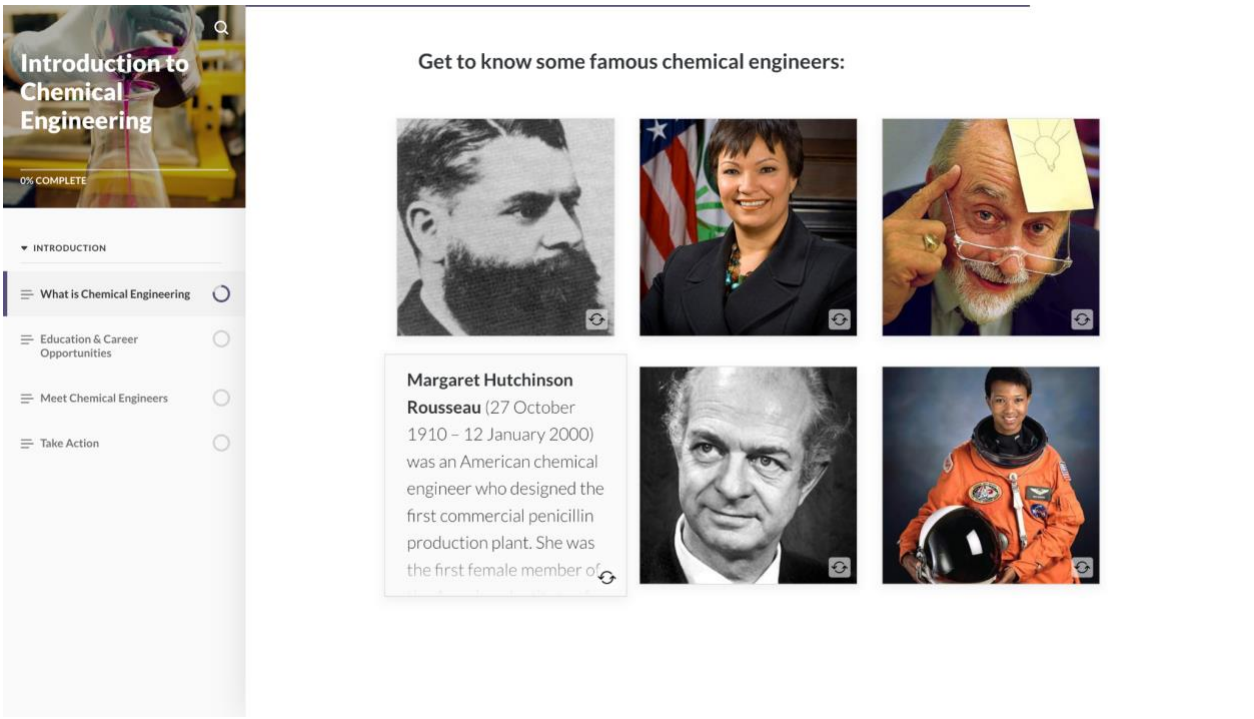
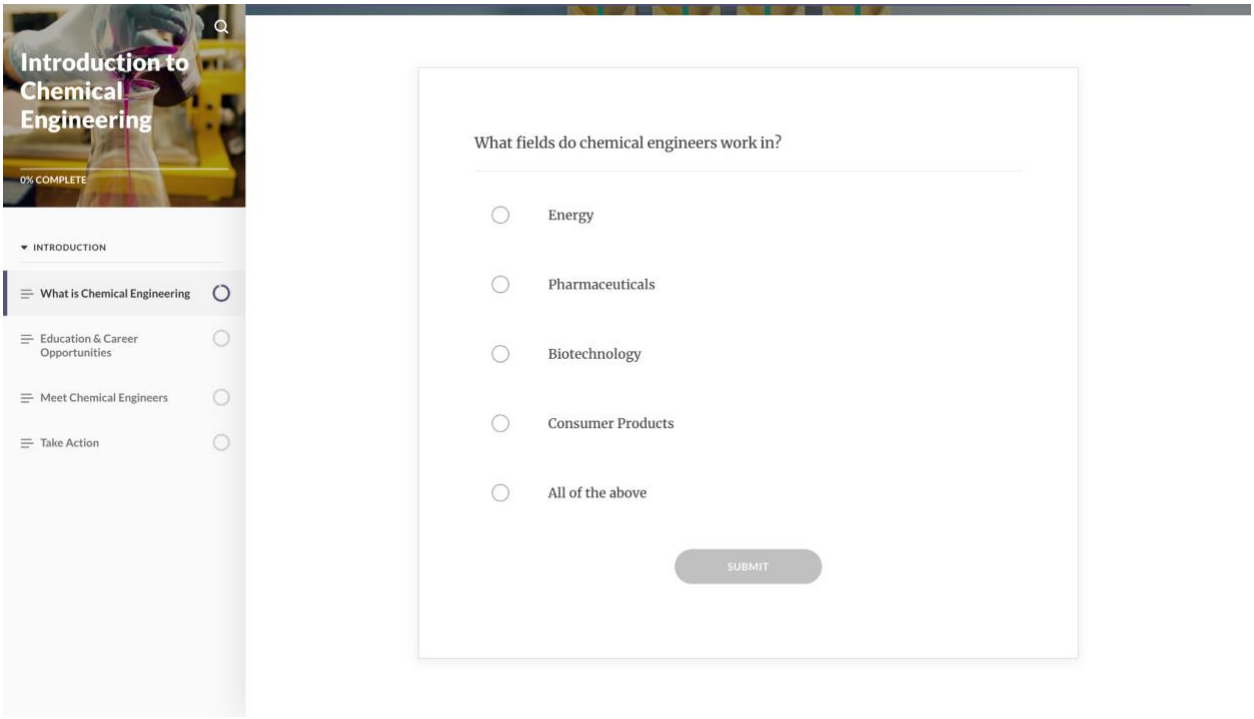
Appendix L: SWE Next Career Module

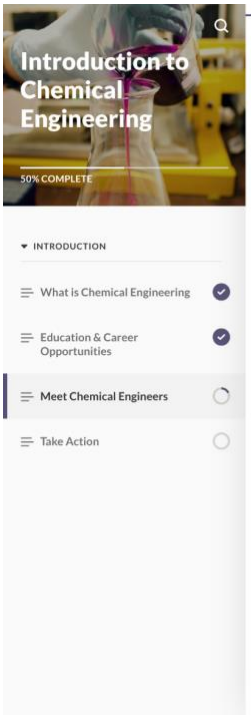
Career exploration module from the Society of Women Engineers Next program. These modules were used as reference when creating our own learning module for Girls into Tech.






Introduction to Chemical Engineering
0% COMPLETE
INTRODUCTION
What is Chemical Engineering
Education & Career Opportunities
Meet Chemical Engineers
Take Action
Get to know some famous chemical engineers:
Margaret Hutchinson Rousseau (27 October 1910 – 12 January 2000) was an American chemical engineer who designed the first commercial penicillin production plant. She was the first female member of


Introduction to Chemical Engineering
0% COMPLETE
INTRODUCTION
What is Chemical Engineering
Education & Career Opportunities
Meet Chemical Engineers
Take Action
What fields do chemical engineers work in?
Energy
Pharmaceuticals
Biotechnology
Consumer Products
All of the above
SUBMIT



A Day in the Life of Chemical Engineer Rosa Rueda, Ph.D

Meet Rosa Rueda, Ph.D., a chemical engineer from Colombia who now works as a Product Quality Specialist for the Whiting Refinery in Indiana.

"...believe in yourself and get out of your comfort zone. Remember that in life nothing is granted—you need to work hard to achieve your dreams and never stop learning. When the path you chose gets tough, don't quit. It is in these moments that, besides all the people who believe in you, you must believe in yourself."

- Rosa Rueda, Chemical Engineer

Learn more of her story here: https://alltogether.swe.org/2019/10/a-day-in-the-life-of-chemical-engineer-rosa-rueda-ph-d/

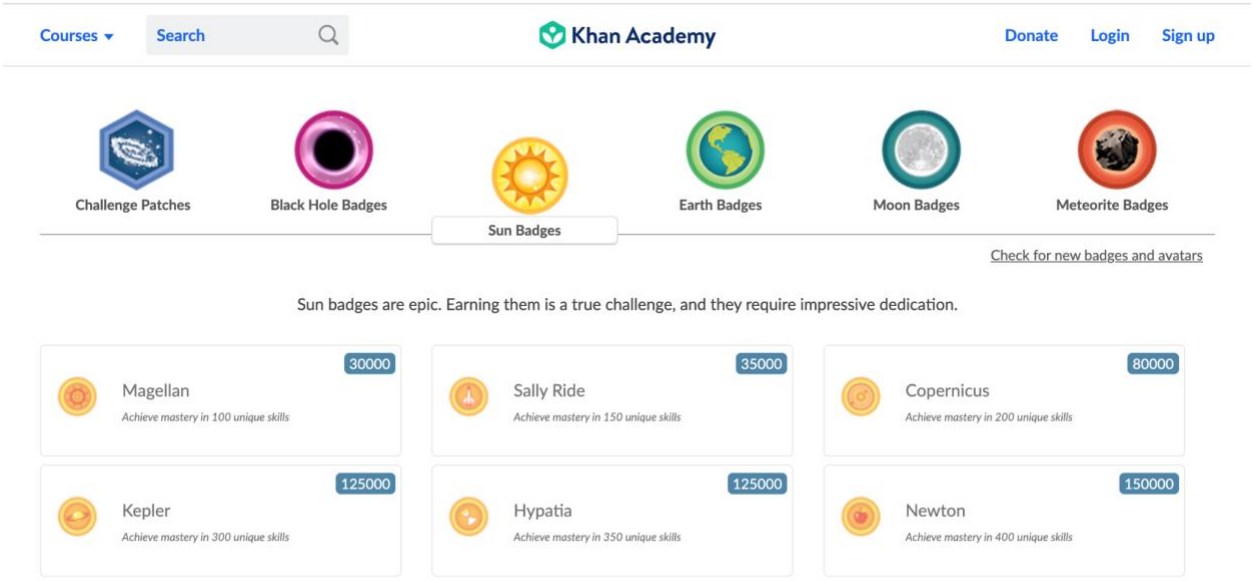
CONTINUE

Appendix M: Example of GIT Digital Badge

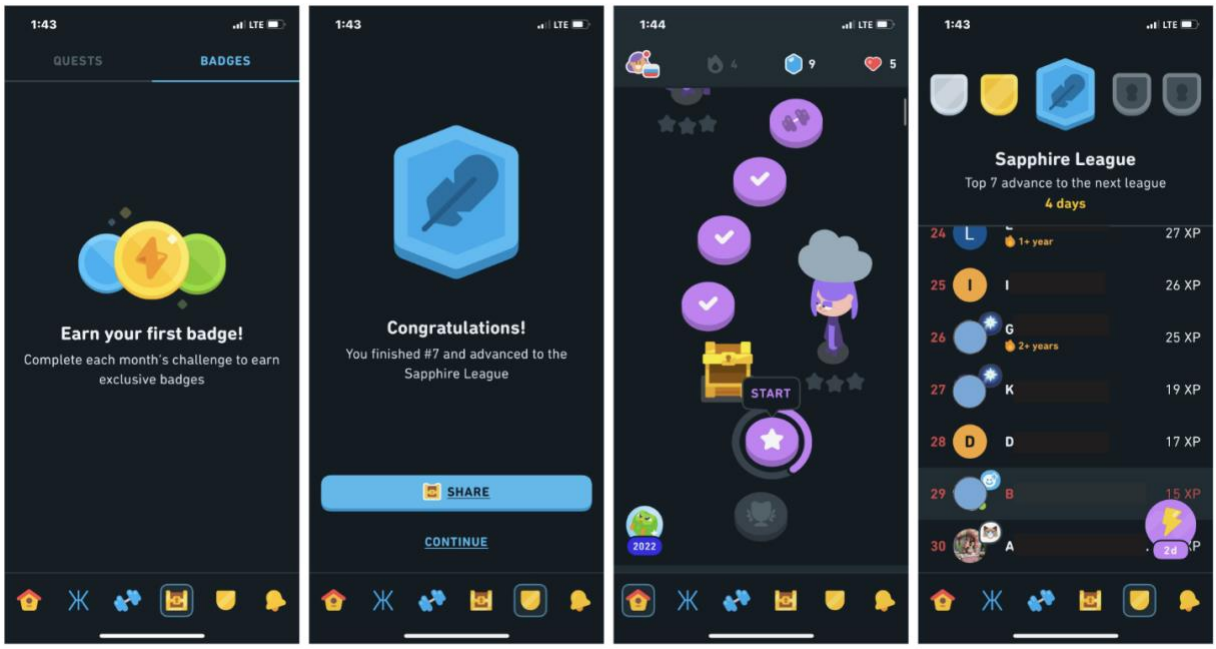
Example of what a digital badge for the Girls Into Tech program could look like. These badges are awarded after completing a career learning module or a hands-on activity.

Appendix N: Existing Digital Badge Systems

Examples of existing digital badge systems. Khan Academy and Duolingo are popular educational platforms that utilize a badge system to promote learning.



Khan Academy



Duolingo