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STEM Program for Youth

In this digital age, there has been emphasis placed on the importance of technology and by having the skills to operate them, it will open more opportunities for us in the future. This would be seen as true especially for individuals that pursue a career in a field that has regular use of computers, software, and other digital systems, and also for anyone that won’t work with systems like these but still needs to function in everyday life. In order to assist the youth in their preparedness for the future, these courses have been implemented in their school system to supply them with varying levels of computer literacy, mathematics, engineering, and science depending on their academic level. So far, this has been successful but only to a certain degree. When students want to expand their knowledge from simple computer literacy to advanced fields of computer science and other disciplines, this would require further education that in most cases was not provided in the K-12 school system. This involves study to achieve a certificate, associates, bachelors, etc. and could have been acquired more quickly if the school system provided some of the fundamentals early on. An article written by The National Center for Women and Information Technology, which is a national non-profit organization, further explains the importance of computer science for students and how these courses can be implemented into the curriculum. Doing things such as allowing computer science to be counted toward graduation, enabling them to count as a math or science credit, and making the courses available to all, could be beneficial ways of incorporation. Also, expanding the teacher certification requirements to include computer science and providing professional development for teachers who teach, or would like to teach, computer science is an excellent way to assure that there are teachers qualified enough to relay this information to students effectively (Moving Beyond Computer Literacy: Why Schools Should Teach Computer Science | National Center for Women & Information Technology). This is an example of how one branch of the STEM system could be implemented early on for students and in regards to the other disciplines, the implementation process can somewhat vary but is similar overall.

In an attempt to remedy this issue, the team has thought of a STEM program for youth that will provide them with supplementary information that promotes hard skills such as problem solving, critical thinking, leadership, and collaboration all while incorporating topics that involve science, technology, engineering, and math. We plan on having this program to be an affordable option for students and parents and the proceeds will go towards the equipment and many activities the students participate in.

In order to research this topic, there are factors here that require different disciplines to take part. With any public school, there is federal funding that is provided to keep everything up and running. This would include the employees, programs, maintenance of the building itself, utilities, etc. Through knowing this, it is apparent that some form of economics comes into play and this is the discipline that would provide the portion of research pertaining to the topic. Things such as understanding what funding the school currently has, how to get more, and what can be defunded to provide more funding in exchange are all pieces of information that would then get relayed to others that are currently participating in the research. Another discipline that could assist would be political science and this is due to the policies and procedures put in place by the local and federal government. To make any change possible, there are elected officials that have the final say of what policy can be adjusted to make these courses available, therefore, an individual that specializes in political science could assist in understanding this process of getting laws and policies changed. From here, the data collected will mainly consist of secondary sources such as scholarly journals and other reputable sources to gain a better understanding of the situation and what it is going to take to implement this program.

Education, in regards to STEM topics have been an increasingly discussed subject as we progress through the digital age. There have been great feats accomplished by the students that study these topics thoroughly but it seems as though an adequate amount of progress hasn’t been made, especially when comparing the United States’ educational system with other countries. According to the department of education, The United States is falling behind internationally, ranking 29th in math and 22nd in science among industrialized nations. What’s more, a recent survey revealed that only 29 percent of Americans rated this country’s K-12 education in STEM subjects as above average or the best in the world (Science, Technology, Engineering and Math: Education for Global Leadership | U.S. Department of Education). What it comes down to is a few factors that consist of there not being enough participation of minority groups that account for a substantial percentage of the population, there is an inadequate number of teachers skilled in these subjects, and that the educational system is formatted in a way that many doubt its effectiveness in our school systems.

These demographics play a significant role in understanding where quality STEM learning opportunities are accessible. There have been plenty of studies conducted, and one of which has been done by the department of education itself. According to www.ed.gov, they summarize this issue the best:

We know that only 81 percent of Asian-American high school students and 71 percent of white high school students attend high schools where the full range of math and science courses are offered (Algebra I, geometry, Algebra II, calculus, biology, chemistry, and physics). The access to these courses for American Indian, Native-Alaskan, black, and Hispanic high school students are significantly worse. Children’s race, zip code, or socioeconomic status should never determine their STEM fluency. We must give all children the opportunity to be college-ready and to thrive in a modern STEM economy. (Science, Technology, Engineering and Math: Education for Global Leadership | U.S. Department of Education)

A movement that has been expedited by President Barack Obama in March, 2015 has given the country the push needed to implement more ways and resources for STEM programs to be available to these underrepresented groups. This plan includes the “Committee on STEM Education,” otherwise known as CoSTEM which is comprised of 13 agencies that have the goal of improving STEM instruction in preschool through 12th grade, increasing and sustaining public and youth engagement with STEM, improving the STEM experience for undergraduate students, better serving groups historically underrepresented in STEM fields, and designing graduate education for tomorrow's STEM workforce. These agencies will work together in a coordinated effort and is projected to improve STEM education overall within the next year as it was outlined in the federal, 5 year strategic plan for STEM (Science, Technology, Engineering and Math: Education for Global Leadership | U.S. Department of Education).

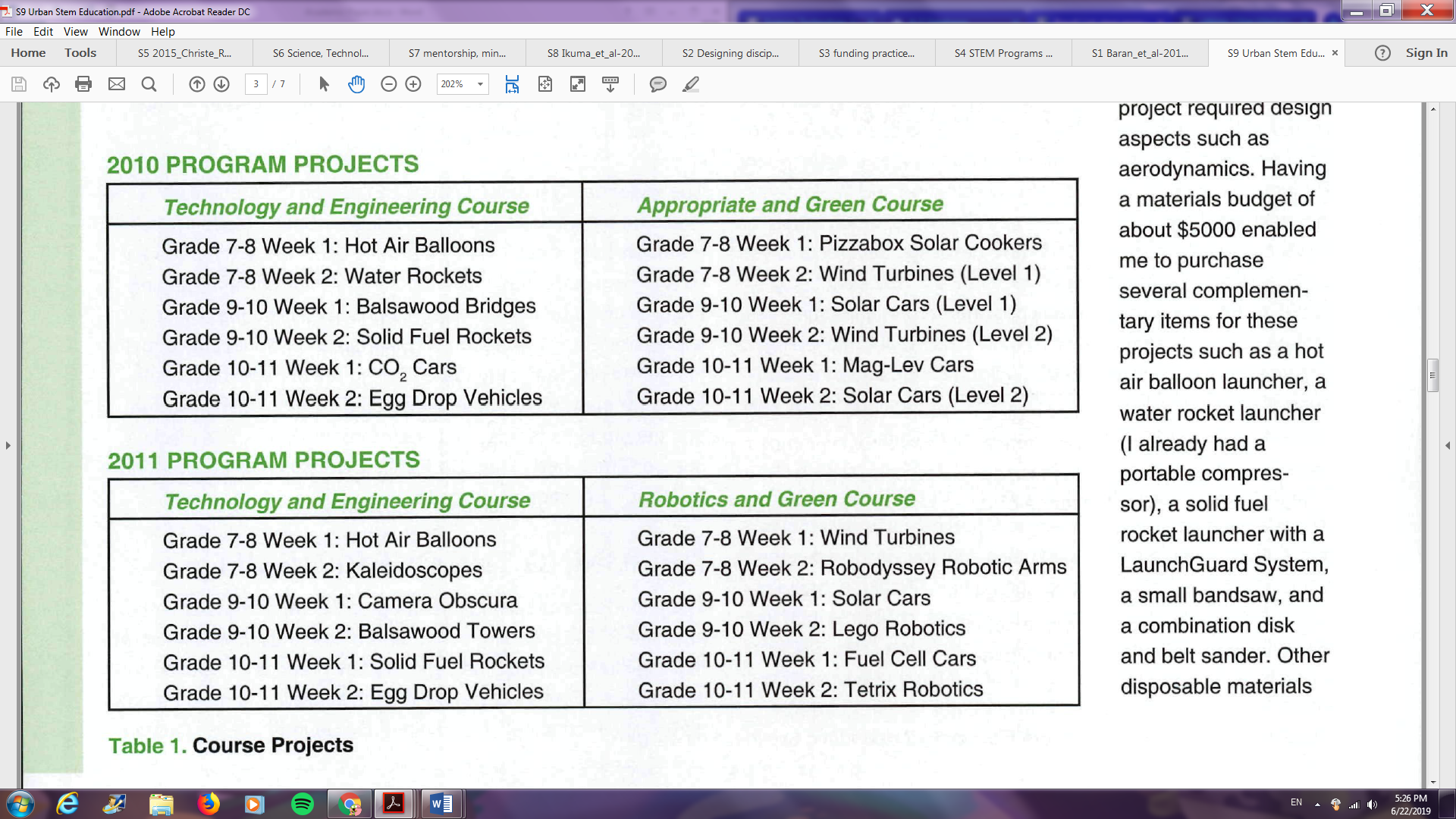
In the article “Raising interest in STEM education: A research-based learning framework for improving minority participation,” They have a similar discussion about the lack of minority groups in this field. A few facts that was provided give a glimpse of the severity of the situation, consist of minority ethnic groups accounting for approximately 30% of the United States population, but only 9.1% of those working in STEM occupations, underrepresented minorities, defined herein as women and members of minority ethnic groups accounting for approximately 70% of today’s college students, while comprising only 45% of students who receive undergraduate STEM degrees, and as of 2011, minority ethnic groups accounting for approximately 30% of the United States population, but only 9.1% of those working in STEM occupations (Christe et all, 2015). These are just a few statistics that further explain the need for increased participation of these programs to maintain our nation’s prowess and living standard. In the instance that these students do partake in programs such as this, in some cases, there are intimidating situations since these student have no prior experience through family members or friends (Christe et all, 2015). This can lead to impeded enrollment or higher dropout rates, however, the authors introduce the “Tinto Model of Student Retention.” This model is something that can be implemented early on and focus on social and academic integration and has shown repeated results of students overcoming these factors that hinder their education (Christe et all, 2015).

Another article that has a similar outlook on minority student underrepresentation is titled, “Mentorship, Mindset and Learning Strategies: An Integrative Approach to Increasing Underrepresented Minority Student Retention in a Stem Undergraduate Program.” This article starts off by explaining the offset participation of STEM participation in regards to certain demographics. “Disproportionately low retention of underrepresented minority (URM) students in STEM degree programs continues to limit the overall size, strength, and diversity of the STEM career applicant pool.” In order to promote retention of these students, mechanisms that give better support through early academic challenges are needed and increase the number and diversity of students entering the STEM workforce. There are 4 listed mechanisms:

* Peer And Faculty Mentorship
  + Having a faculty member or a peer mentor would assist is alleviating social pressure that’s associated with college and softens the transition into the academic community. It also provides an environment in which a student can address challenges that is tied with being an underrepresented minority and promotes effective coping skills and resiliency.
* Familiarity With Programs And Faculty
  + Even with many programs such as office ours, academic support programs, student organization, undergraduate research, etc., there are many students that don’t use these. Mechanisms that would increase student use of support programs can potentially increase the effectiveness of the preexisting programs.
* Student Mindset: Growth Mindset And Alternate Lay Theory
  + The growth mindset is the understanding that intelligence can be developed rather that something that is fixed. Students that have this mindset bode well for STEM fields, instead of a student that would find challenges insurmountable due to their fixed intelligence. Having this mindset could result in the student having little incentive to seek assistance from faculty, staff, and/or peers. Fostering growth mindsets can improve student academic success in STEM fields and reduce achievement gaps between advantaged and disadvantaged student groups. The alternate lay theory is also something that should be introduced to students as it is the expected occurrence of an academic setback that would happen regardless of the student’s background or ethnicity.
* Student Learning Techniques
  + According to the article, employing active learning in classrooms have shown an increase of student’s grades and retention rates in STEM courses. These methods can also be integrated into the studying process and through the creation of study materials such as concept maps, the student can more effectively and actively achieve greater learning outcomes (Lisberg, Anneke, and Brett Woods, 2018).

Since this is an issue that affects the entire nation, there has been many instances of varying programs introduced to minimize this lack of participation in STEM programs. One such article is an example of this and is titled, “Large scale student programs increase persistence in STEM fields in a public university setting.” It introduces Louisiana State University’s STEM Talent Expansion Program (STEP) and it was established to increase student’s persistence in first-year, declared engineering majors, in science, technology, engineering, and math, and in all majors at LSU. A key point in developing this program is gaining a better understanding the factors that contribute to student’s decisions to leave their declared STEM majors. According to the article, it can include high school GPA and SAT math scores, self-identifying with math or science, self-perceived practical competence and time devoted to preparing for classes, calculus entry-level proficiency, and gender and racial/ethnic affiliation (Ikuma et all, 2019). This program is a multidimensional supplementary program and was developed over the past 8 years in the College of Engineering at LSU. Four of the largest programs included consist of the Encounter Engineering Bridge Camp (E2 bridge camp), the introduction to engineering course, and the development of activities in the new Engineering Residential College (ERC), and a mentoring program that initially conducted by faculty, but after surveying the participants, it was changed to peers. Overall, the impact of this program on students showed increase in persistence in the engineering college. The data showed that the STEP activities at LSU have reached 3,097 students, or 27% of the College of Engineering's undergraduate population, over 8 years. Students participating in STEP exhibited significantly higher persistence in engineering by approximately 11–14%. Six-year persistence in engineering hovers between 45 and 55% in similar institutions, and LSU falls within that range. Furthermore, the regression analysis showed that even after accounting for demographic and academic preparation variables, STEP participation was consistently and significantly associated with higher persistence in engineering majors, in STEM majors, and at the university either alone or in conjunction with higher ACT math scores (Ikuma et all, 2019). From this, one can see that implementing stem programs would be beneficial for students that have an interest in these fields.

Another program based in Florida is pointed towards the urban community that houses a portion of the minorities that make up large portion of the population. In the article “Urban Stem Education: A Unique Summer Program,” the author discusses a proposal he is writing that would provide grant money to fund a summer program that would take place at the Florida Agricultural and Mechanical University’s Developmental Research School (FAMU DRS). This school functions as a normal K-12 school and is administered by the Florida A&M University College of Education. The approval of this funding would enable students in grades 7th through 12th to participate in this program for free (White, 2018). The result of this program provided over 120 African American students over a two year period the opportunity to learn in a STEM related atmosphere and expose them to academic and career paths within these disciplines. The way the program was set up was the students were broken up into different groups based on their grades such as 7th and 8th graders, 9th and 10th graders, and 11th and 12th graders. Each group would rotate between math, science, two technology and two engineering classes with a 50 minute period for each class. They were also given a project to complete every week that would employ the skills that was taught in the curriculum. Here are charts that display the projects assigned for 2010 and 2011:



From the information provided from these numerous studies, it is apparent that many found that there was a need for supplementary programs to be available in order for the United States’ to have a substantial number of students involved in STEM that would not only be comprised of the majority demographic of the population. In order to implement these programs, there is a need to consider factors such as sociology, economics, psychology, and ethics. While these are all topics that fall outside of my main area of study, the group that I am in would be able to assist in some aspects of this research. When studying the sociological nuances of this issue, we must look at the areas and demographics that are mainly affected. In this case, it was the underrepresented minorities that make up a substantial portion of the overall population but do not represent as prominently when compared to other demographics in the case of involvement in STEM studies. While I knew this to be true since I am part of this statistic, it was interesting to study and understand the reasons that many are not partaking study in these fields. There is also the case of low income areas that would not have enough funding to not only pay the teachers and faculty, but for students and parents to pay for any tuition or fees that are associated with the program, however, this is a factor that can vary. From the research that was presented in the article “Urban Stem Education,” we saw that the author was able to procure a grant that was funded by the department of education and was mainly geared towards families that had low income but displayed initiative by being involved in the Gear Up program, which was one of the requirements to enroll in the STEM program.

Psychology is a complex topic that none of my group members primarily study, however, grasping these concepts proved to be a rewarding process as they provided further knowledge on how to properly implement our own STEM program. With the main goal of giving students the opportunity to learn about these topics, the role of an educator is to create a curriculum that can effectively teach as well as having an engaging narrative behind the knowledge, thus, giving these students the will to learn a topic that they either hadn’t the opportunity or wasn’t interested in. Another factor here would be the mindset that many students can have that leads to a bleak outlook on their education. As it was introduced in the article “Mentorship, Mindset and Learning Strategies: An Integrative Approach to Increasing Underrepresented Minority Student Retention in a Stem Undergraduate Program,” there are students that believe that their knowledge is not something that can be expanded. Once they fail or have signs of difficulty in the subject, they feel that it is an indication that pursuing education in this field is not for them and they must quit. This is a harmful mindset to have because it blocks out any chance of progression. In contrast, there is the growth mindset that enables students to acquire knowledge effectively despite some challenges that they may face. One last issue that I saw that psychologically affects students is that some can be faced with intimidation. I do not mean this in a sense of other students being bullies, more so that the student is unaccustomed to college life and they feel that there is no one that they relate to or feel that they can go to in their time of academic, mental, or emotional need. This would further emphasize that the offices and faculty that are there to assist students, need to be well known and are easily contacted by students should the moment arise.

The implementation of any program would need some form of funding in most cases. In the realm of economics, where I have little experience in, this is a pivotal factor that could make or break a well-constructed program. According to the article, “STEM Intervention Programs: Funding Practices and Challenges,” the recession in 2016 presented a number of challenges to institutions of higher education. State budget shortfalls had forced some public research universities to consider and/or implement tuition increases, furloughs, and hiring freezes. This would mean that during uncertain economic times, many public colleges and universities would make difficult decisions regarding the funding of student programming, support services, and staffing, including intervention programs that increase the enrollment and success of underrepresented students in STEM (Rincon and Casey, 2016). This would then result in the supplementary STEM programs, which are seen as ‘add-ons’ being sacrificed to disperse funding where the college or university finds it to be needed the most. In some instances, there are opportunities where local and federal grants can be supplied to promote these programs, however, if these programs are not provided with consistent funding, staffing, and service delivery, it would be difficult for the program to have long term sustainability.

As I researched, it was fascinating to find an ethical issue that many would not think would be a factor. With many programs popping up regarding STEM education and schools pushing that narrative that this is the field that is needed the most and is highly paid, where does that leave the students that are genuinely interested in business, liberal arts, humanities, etc.? By there being such heavy focus on STEM careers, there is a chance that students could be discouraged from pursuing a field that they had a strong aptitude for (Myers, 2018). While our STEM program will still focus on the main subjects of science, technology, engineering, and math, we will let students understand that these other fields also play a part in the overall success of pursuing a career. Take this STEM program for example. It takes business to get a license, pay the staff, and to know how the market is for this type of program. Also, there is humanities such as communication that goes into speaking and understanding how to relay knowledge in a clear manner that students would understand. This displays the importance of how disciplines may be different but manage to work effectively together.

In order to determine if our program would be effective, several points of information need to be analyzed. First, we must figure out where the funding is going to come from to start up and keep the program running. While many first time business owners have opted to apply for a business loan to fund their startup, I would suggest gathering local sponsors or applying for grants that would be willing to provide assistance. Funding could also be gathered from the participants of the program that pay tuition or fees that are reasonably priced based on the amount of amenities provided. Next, we would look at what programs that would be similar in the local area and see what age groups they cater to. For us, we provide services for students, ages 7 to 17, which is the range that we found to have the least representation in STEM participation. Lastly, we can project to see our overall enrollment rate by comparing ourselves to other programs that we have the most similarities to. By looking at how they were able to get started, gives us a good indication of how our rates would be. This would also apply to our pricing because it would be best to know what would be too high or low of a price to charge participants.

To get this program to be a reality it would be in our best interest to look at the local community colleges. According to the article “How Community Colleges Are Closing the Skills Gap through CTE and STEM Funding Innovations,” uniquely positioned to develop the pipeline of STEM professionals and produce more STEM-skilled workers to meet the demand for middle- and high-skill jobs, community colleges are also an inexpensive option for the many low-income, low-skilled adults who want and need to boost their education and training. Surprisingly, the highest earnings for STEM workers are for those with less than a college degree. Through knowing this, it is apparent that these community colleges place significant importance on skills like these and it is a common occurrence for them to have head start programs that allow high schoolers to attend classes there for college credit. If we established our program, it would be in our benefit to seek a partnership with this college for it would open a STEM education to a wider range of ages than they provide. This would not only bring in more revenue for the school, but it will also increase both the program’s and the school’s popularity. Next, it would be best to research the market to see if establishing this program at this moment would be the best thing to do. As many economist would attest to, markets tend to fluctuate and in some cases, this can make it difficult to predict what moves should come next to keep the program running. It is just as the authors of “STEM intervention programs: funding practices and challenges” state. Many programs struggle with changes in funding over time.

When it comes to our next steps, we’ll look at partnering up with additional people that have a varying skill set that would make the process go much smoother. You can compare this to how a business owner would hire different advisors based on the needs of the business. Since my major is cybersecurity, my skillset mostly would be geared toward understanding how the technology aspect of STEM should be laid out for students to understand. Other members of the group are both criminal justice and sociology majors and they will be able to contribute to the understanding of what demographics and areas that this program would flourish in the best. Lastly, we could go with either option of starting the program by taking out a loan or finding grants, or we would find a sponsor by pitching this idea. This is where the last portion of the assignment holds so much weight. By composing an effective pitch, we will have the chance to affect our communities through education and rather than just being an assignment for a class, this would have effective, real world applications.

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