STEM Pals Policy Proposal

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Executive Summary

Introduction and Background

The importance of a college degree cannot be emphasized enough. This is because on the greater scale of things, college graduates earn more on average which is important in keeping up with the ever increasing costs of living. This goes without mentioning a higher probability of better health and job satisfaction. Narrowing the scope to STEM education, one of the fastest-growing career paths and also largely the focus of our policy, this is a very lucrative field which, unfortunately, lacks underrepresented students. The policy we therefore are proposing is the integration of STEM at the beginning of a student's education (in elementary school) to spark an interest in these fields which are both rewarding and at a deficit currently in the United States. However, despite there being more women than men in post-secondary education institutions, (they make up 56% of university students) they are still lagging behind in the acquisition of STEM-related degrees. To put it in perspective, women earn only 35% of all STEM-related undergraduate degrees according to higher education in 2018. These statistics become even worse within minority communities: Black, Hispanic, Pacific Islander, American Indian, and other ethnic groups. There are a number of both systemic and social factors that have contributed to this state of affairs but this policy has been formulated to focus on the social stigmas associated with this area of study. The overarching idea of the policy is the creation of an organization, 'STEM Pals', tasked with presenting and normalizing diversity in STEM to elementary school students in the State College Area School District.

The Sustainable Development goals that this policy will mainly focus on will include: Goal 4: Quality Education, Goal 5: Gender Equity, and Goal 10: Reduced Inequalities. Goal 4 shall be met by the representation of both male and female students from diverse backgrounds in STEM.

This is especially important for women in STEM who have, over time, linked their success in the field to a female mentor in STEM. Goal 5 shall be met by presenting female students with an equal opportunity to visualize themselves in the STEM field as individuals who are completely capable of everything their male counterparts are. Also, Goal 10 shall be met by diverse representation given its main focus on race. In this policy, diversity has been narrowed down to the aspect of gender and race as these are the perceptible demarcations to elementary school children. Therefore,

STEM Pals Program Structure

The STEM Pals Program will be implemented within CEEL. CEEL is an after school program in the State College Area School District that runs for 3 hours after the end of each school day. This comprises a one hour slot for enrichment opportunity that the STEM Pals programs hopes to take advantage of if the policy is to be implemented. Despite the State College Area School District having a number of elementary schools under CEEL, we recommend the implementation of the STEM Pals pilot program at Corl Street Elementary. This is the school at which the CEEL coordinator is based and it has a small group of students to work with. Since the focus is on STEM, the goal of this policy is to diversify the areas of STEM mostly taught in elementary school which is robotics (mechanical engineering), biology and chemistry. This would involve the integration of other areas such as computer science and machine learning. At the elementary school level, this would involve fundamental basics organized in an engaging manner to spark interest in the field of technology at an early age. This is because staggering differences can be seen at the university level where underrepresented students comprise a very small percentage of students in STEM. Other areas of focus are electrical engineering and mathematics. Math is especially important because it is a major requirement for students studying in any STEM field. Both to spark interest

in math and to provide a strong base for other STEM fields, the goal is to keep students' interest long enough for these elementary school children to realize their potential before stereotypes and cultural barriers get in the way.

For the successful implementation of any goal-oriented policy, funding is of the utmost importance. Despite the Stem Pals Program being mainly dependent on volunteers to interact with the elementary school students, its planned expansion to the other 9 elementary schools will be dependent on the availability of funds. This is because the execution of some of the STEM projects will require materials such as circuit boards that the schools may not have in their possession, not to mention the fees needed to be paid for clearance documents so as to be able to interact with the children. As such, we've compiled a list of groups here at Penn State which could potentially serve as sponsors for the program: The Presidential Leadership Academy, The Millennium Scholars Program, The Schreyer Honors College, Society of Women in Engineering, Eberly College of Science, College of Engineering, Earth and Mineral Sciences, College of Agriculture, and the College of Education.

Rollout/Implementation

The STEM Pals program will be an extension of the preexisting Millennium Society, the philanthropic organization of the Millennium Scholars Program. The STEM Pals Program will be implemented in a series of 6 phases. Phase 1 consists of establishing a structure by defining the roles of the governing bodies. Phase 2 involves defining and collecting data on the pilot school. Corl Street Elementary School was identified as the pilot school for the STEM Pals Program. Phase 3 is strategic planning and preliminary course structure. This phase involves using the data

obtained to prioritize and rank which STEM subjects should be focused on, decide how many teachers are needed, and begin a preliminary course schedule that gauges availability and the amount of courses to be offered. Phase 4 is final review and practice. This is the shortest phase; its purpose is to ensure that the program is ready for implementation. This phase involves assessing risk management, proper information distribution, and obtainment of clearances. Phase 5 is implementation which involves incorporating the STEM Pals Program into the CEEL Program at Corl Street Elementary School. Phase 6 (the final phase) is accountability. This involves collecting and analyzing the responses to the pilot, holding people accountable, and making decisions on what aspects of the program should be altered or eliminated. After evaluating the success of the pilot program, the STEM Pals program will first be expanded to all of the elementary schools in the State College School District and then eventually to high schools and middle schools as well.

STEM Pals Program and the Penn State Community

Given that 'STEM Pals' will essentially be made up of students from the Penn State community, these students could be drawn from different groups on campus that might show interest. The main group of focus will be the Millenium Society, which focuses on STEM-based community service. Other groups on campus are free to volunteer at STEM Pals. Non-stem majors could also join because nothing in-depth will be taught at elementary school level. Students whose field of study is in early childhood education will be very instrumental in the process, as well, as they can provide insights on the theory behind the lessons we're teaching.

Introduction and Background

The growing importance of holding a college degree in the United States is no secret. Of the 15 fastest-growing industries in the country, 11 require successful applicants to possess a college degree (*"FACT SHEET: A College Degree", 2016*). To keep up with the increasing demand for well-educated individuals in the economy, access to higher education has risen considerably through scholarship money, better access to loans, and government support. From both a national and personal perspective, it is critical that members of the next generation adequately position themselves to best participate in the rapidly changing, ultra-competitive job market in a fair and equitable way. A part of this is ensuring that all individuals, regardless of all factors, have the same opportunity to pursue success through higher education.

The U.S. Department of Education says that attaining a college degree is among the best ways to move from a low-income situation into the middle class, "especially for historically underserved students" (*"FACT SHEET: A College Degree", 2016*). Unsurprisingly, individuals with an undergraduate degree earn on average 66% more than those with high school diplomas, which comes out to be an average of $1 million over the span of a lifetime. The advantage to having a degree when pursuing a career is clear. As we strive to create a more sustainable country and society, it is important that we consider making the path to a degree both feasible and realistic for all students. Additionally, it is important to make reasonable accommodations to ensure that all students feel welcome at their institutions.

Importance of STEM Education

In this report, we will be looking specifically at STEM-related fields of study. STEM, as defined by the United States Department of Education, is a rather broad category of disciplines that involve or are connected to science, technology, engineering, or mathematics.

STEM is of particular interest to us because it is one of the fastest-growing career tracks. Demand for STEM professionals is immense, and many STEM jobs go unfilled. The U.S. Bureau of Labor Statistics cite STEM employment opportunities to be growing at a rate of 13% — significantly higher than the 11% average ("STEM 101", 2014). The median wage for STEM jobs sits at $76,000, which is more than double the median wage for all workers in the United States ("STEM 101", 2014). STEM is a very lucrative path.

Providing underrepresented students with access to STEM education is not only a social issue, but also an economic one. According to an Emerson survey, two out of every five Americans consider the shortage of STEM expertise in the country a "crisis" ("Emerson Survey", 2018). There is not enough workforce capacity to fill all of the available jobs; A report from the Manufacturing Institute and Deloitte predicts that 3.5 million new STEM jobs will be created by 2025, and that the skill gap will result in as many as 2 million of those jobs going unfilled ("The Skills Gap", 2015). One of their solutions to this problem aligns with our goal: engage students in STEM beginning in elementary school to help foster an interest in the field.

Education Demographics Overview

There are actually more women than men attending postsecondary education institutions. According to the National Center for Education Statistics, the Fall 2018 semester saw 11.2 million female students at universities across the United States compared to only 8.7 million male students; this means that 56% of all university students are women ("Back to School Statistics", 2018).

Despite this, women lag behind in the STEM fields. According to the National Science Foundation, women earned approximately 62% of all associate degrees between 2000 – 2015, and yet earned only 44% of STEM degrees. Interestingly, according to the same report, women earn approximately 50% of the degrees in science and engineering (which is, to note, still skewed against them considering that women make up 56% of the student body population), but fall significantly behind men in completing degrees in computer science, physics, and other technology-related degrees. The same phenomenon can be observed in bachelor programs where, according to the National Center for Education Statistics' 2017 Status and Trends in the Education of Racial and Ethnic Groups report, women earn only 35% of all STEM-related bachelor degrees ("Higher Education", 2018).

Other minority students are even worse off. While Asian and White students have the highest rates of enrollment at colleges and universities, Black, Hispanic, Pacific Islander, and American Indian and other groups fall behind. When looking at STEM fields, this gap only widens. Black students are disproportionately affected, with only 11% of degrees earned by such students being STEM-related degrees. Hispanic and American Indian students see less severe but also concerning statistics.

The following two figures, both courtesy of the National Center for Education Statistics *2017 Status and Trends in the Education of Racial and Ethnic Groups Report*, depict this discrepancy:
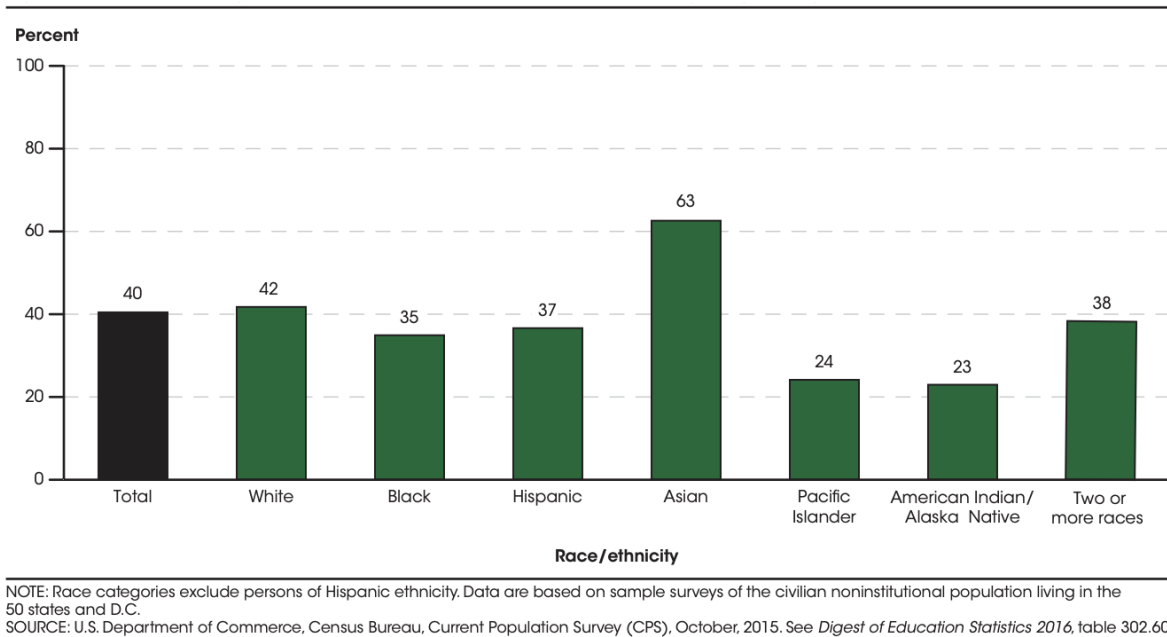
Percent

Figure 1: Total college enrollment rates of 18- to 24-year-olds in degree-granting institutions, by race/ethnicity: 2015 (NCES, 2017).

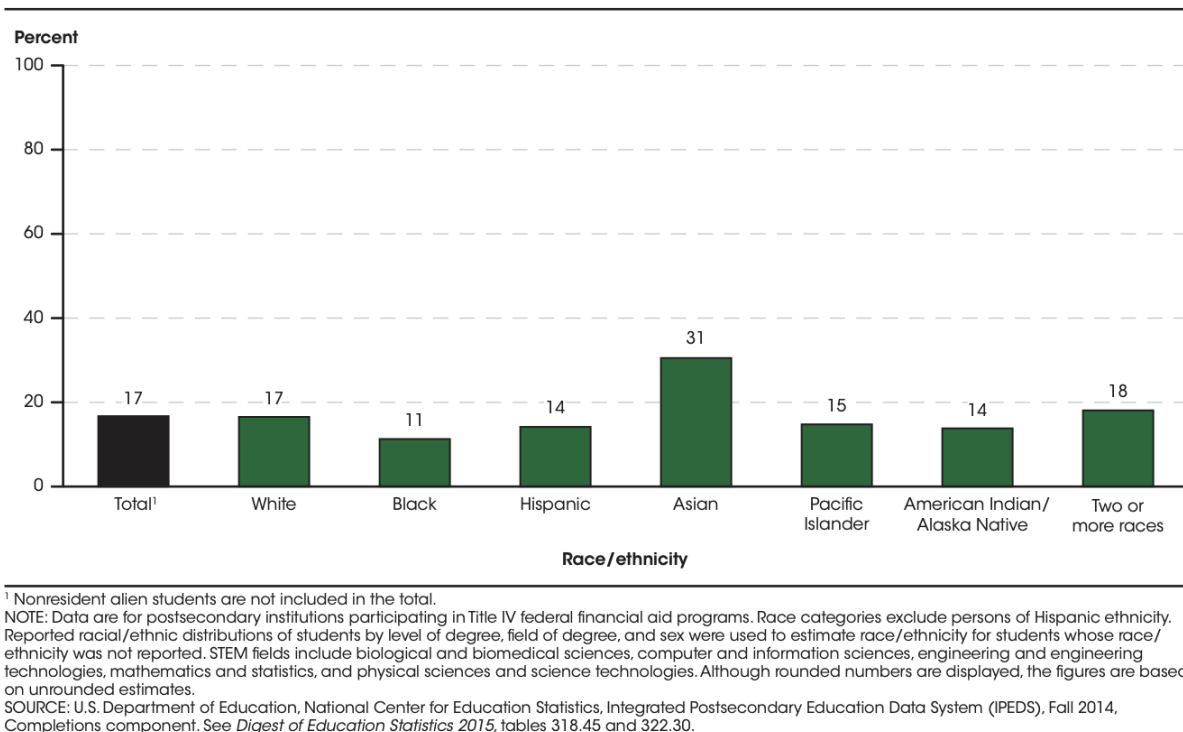**Percent**

While engaging minority students in STEM education is a very multifaceted issue, this policy paper strives to address one contributing factor: social stigma. There are obviously many barriers to minority students considering higher education, but we have chosen this specific barrier because we believe it is the most actionable on a small scale.

The policy discussed in this paper proposes the creation and maintenance of a Penn State philanthropic organization, currently under the working name "STEM Pals", tasked with presenting and normalizing diversity in STEM to elementary school students in the State College area. The specifics of this organization's structure, goals, and duties are discussed extensively throughout this paper.

It is important to note that, in this policy paper, we will be defining both "diverse" and "minorities" in terms of race and gender only. Although there are many other marginalized and underrepresented groups in higher education across the United States, we will be focusing on *visually obvious* traits that are easy to notice and recognize. Our goal is to connect students with a diverse group of STEM mentors without explicitly discussing diversity with them; we hope that by interacting with people who look like them that they may begin to normalize the idea that anyone can do STEM. In addition to this, it is unlikely that the target age group already possesses the maturity to grasp less obvious minority classifications.

United Nations Sustainable Development Goals

This policy, if implemented and maintained correctly, has the potential to address many of the sustainable development goals outlined by the United Nations. The most relevant of the goals include Goal 4: Quality Education, Goal 5: Gender Equity, and Goal 10: Reduced Inequalities ("UN Sustainable Development"). Each will be discussed in-depth below.

Goal 4: Quality Education is one of the focal points of this policy paper. Goal 4.5 states, "By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations." This goal is also outlined within this policy on a very small scale — the State College area. The aforementioned philanthropic organization STEM Pals will present both male and female students with a diverse representation of the STEM workforce. By diluting stereotypes and reducing traditional social pressures and expectations, women may feel more welcome and comfortable entering into STEM fields at the university level.

Goal 5: Gender Equality is similar. Goal 5.1 states, "End all forms of discrimination against all women and girls everywhere, and Goal 5.5 states "Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision making in political, economic and public life." Stereotypes and gender roles may not necessarily be direct discrimination, but when applied to institutional biases, especially in education, they are incredibly harmful and act as very real barriers to women's chances of success. By not depicting women as being as capable as men in all reasonable disciplines and fields, we do a tremendous disservice to them and do not enable them to succeed. In turn, under the current social system where women are excluded from some critical societal functions, women cannot be expected to rise to the same leadership status as men.

Goal 10: Reduced Inequalities focuses more on race as a factor in determining future success. Goal 10.2 strives to, "By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status." Similarly to Goal 5, our policy addresses this through diverse representation, and helps to tear down cultural and social barriers. Although this policy is only applicable to a specific, somewhat niche area (STEM education), it is intended to be just one piece in a much larger movement with many other initiatives.

In addition to its three main UN Sustainable Development Goals applications, the STEM Pal program may indirectly contribute to other goals, including:

- Goal 2: Zero Hunger

- Goal 3: Good Health and Well-Being

- Goal 6: Clean Water and Sanitation

- Goal 7: Affordable and Clean Energy

- Goal 11: Sustainable Cities and Communities

- Goal 12: Responsible Production and Consumption

- Goal 13: Climate Action

All of the listed goals above require extensive development in systems and technologies to be achieved, which in turn requires STEM expertise. The United States, as a world leader in STEM education and development, has both the capital and structural resources to contribute immense

talent into this sphere. It is the responsibility, then, of the United States to ensure that all people have access to equal opportunity to succeed so that no talent is lost due to social or financial reasons.

STEM Pals Program Structure

CEEL Program

The CEEL Program is an afterschool program for students attending the elementary schools of the State College Area School District. Many students are enrolled in the program, and each day after their classes have ended, they spend three extra hours at their elementary school. This time includes slots for play, snacks, and enrichment opportunities, and provides an important service to students and families. Not only can this program act as a substitute for childcare until a point when most guardians have finished work, but it gives students time to receive extra enrichment that Common Core or time constraints have pushed from the normal agenda.

Although the CEEL Program runs at all of the nine elementary schools in the State College Area School District, we recommend the implementation of the STEM Pals pilot program at just one, Corl Street Elementary. We have chosen this location because it is a smaller school, and the school at which the CEEL coordinator operates. This is especially useful because this way, we have a small group to test our program on, and if we have any questions about operating in CEEL, we can easily communicate with the coordinator.

As an established program with many attendants, the CEEL program serves as an ideal way to incorporate the STEM Pals program into the lives of students without taking away valuable instructional time or putting additional burdens on parents or guardians.

The prior existence of the program also cuts down on a lot of potential problems as a result of red-tape and bureaucracy. The groundwork has already been laid; the hurdles leaped and the bridges

crossed. The STEM Pals program can begin its existence as a part within an already successful organization; and even better, a program committed to quality enrichment of elementary school students.

Focus Areas

The STEM Pals Program seeks to encourage everyone to feel welcome in STEM. Just as we want to include every child who is interested, we want to include every field of STEM that we can. Many STEM programs geared toward children tend to focus on just a few fields (biology, chemistry, mechanical engineering) and end up performing essentially the same experiments again and again. We want to change this standard, and give attention to some of the fields which currently have the least diversity (and which often receive less attention).

Especially with some of the older students (3rd or 4th grade), we would like to present computer science. Even considering this disparity just at the university scale, the lack of diversity of those studying computer science is staggering.
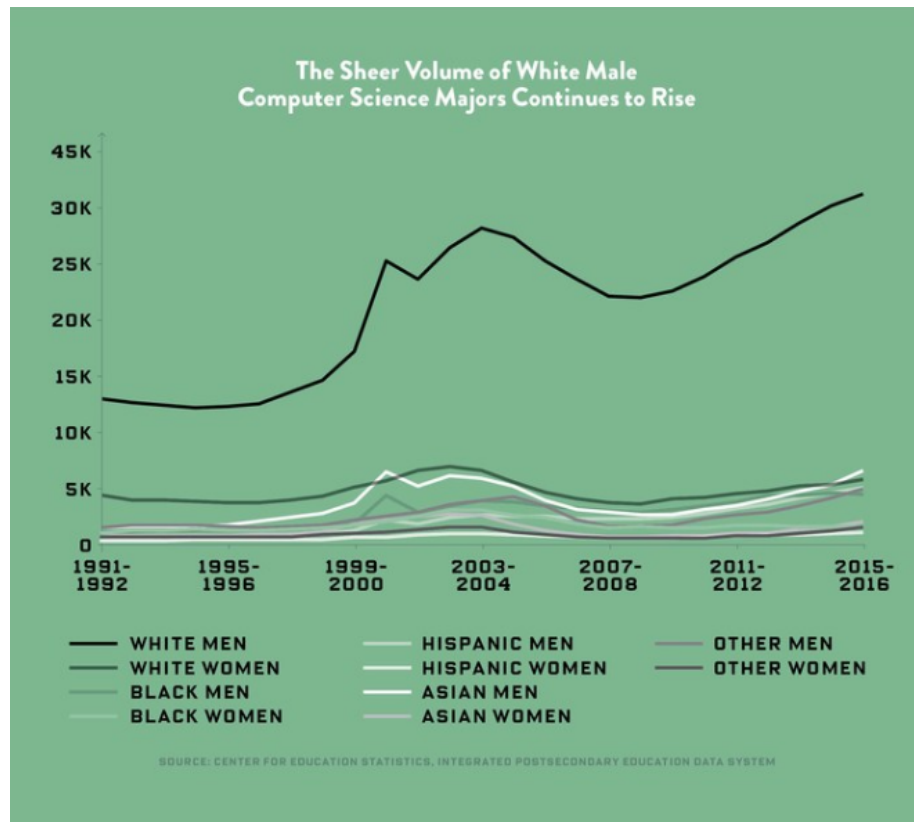
Figure 3: Computer Science Earners by Race (https://www.wired.com/story/computer-science-graduates-diversity/).

Considering the enormous gap shown in this graph, it's clear that the group of students graduating in computer science is not a very diverse one. We want to show kids that not only is computer science fun and interesting, but that they can be a computer scientist, no matter who they are.

We would also like to introduce electrical engineering. Doing activities or experiments with breadboards and LEDs is safe and easy, and can be a fun way to show kids what kinds of things they might see as an electrical engineer. Electrical engineering has one of the lowest rates of gender diversity in the workforce; only 9% of employed electrical engineers are women

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Finally, we would like to place an emphasis on math. Math is a subject in which many students feel excluded from early on, and a lack of a solid foundation in the subject can hinder participation in STEM fields further down the line, even if interest is present. We want to make sure that all the students know that they can succeed in math, and help to subvert the negative stereotypes surrounding the subject which are so prevalent in the media.

Funding

Should the program continue past a trial phase, funding would likely be necessary to continue running the program. Although our mentors would be volunteers, giving their time both to interact with students and to develop plans for visits, some of the more interactive activities might require supplies the elementary school is not able to provide. In addition, in expanding the program to all nine of the elementary schools in the district, whatever costs there may be would increase dramatically. As such, the program ought to consider and seek funding from various sources.

Although we have no guarantee that these funding sources would come through, we have compiled a list of organizations here at Penn State which could potentially serve as sponsors for the program:

- The Presidential Leadership Academy
- The Millennium Scholars Program
- The Schreyer Honors College

- Society of Women in Engineering

- Eberly College of Science

- College of Engineering

- Earth and Mineral Sciences

- College of Agriculture

- College of Education

Rollout/Implementation

Due to the lack of precedent of this policy, we plan to roll out the project in different phases. This way, we will ensure the project's efficiency and its ability to stay sustainable for the coming years. It is remarkably critical to make sure that we do not rush the application of the project. Otherwise, we might not be able to ensure the success of our project. Furthermore, due to the nature of the policy, we must guarantee a comprehensive and well thought-out blueprint. This plan aims to accomplish one goal: to create a comprehensive scheme for the overall structure and define long-term objectives. It will serve as an outline of how the first steps of the project will be taken and the general direction it should follow. Part of this plan will be discussed in this paper, but further details will be defined once the policy is approved and an initial team is assembled.

Phase 1: Defining Structure

First, we must define the overall structure of the project. The initial plan is to create something similar to a sub-organization, a division under an existing STEM-oriented group such as The Millennium Society, an active organization with members from many colleges. We are seeking out an existing organization because it will be able to better provide the necessary structure and resources, making it easier to launch the project when compared to starting a student organization from scratch. However, the project will still need to maintain its autonomy. One way to achieve this is by having its own leadership team, with only the head of the division reporting to The Millennium Society. The proposed leadership structure in the division is illustrated in the following graph.
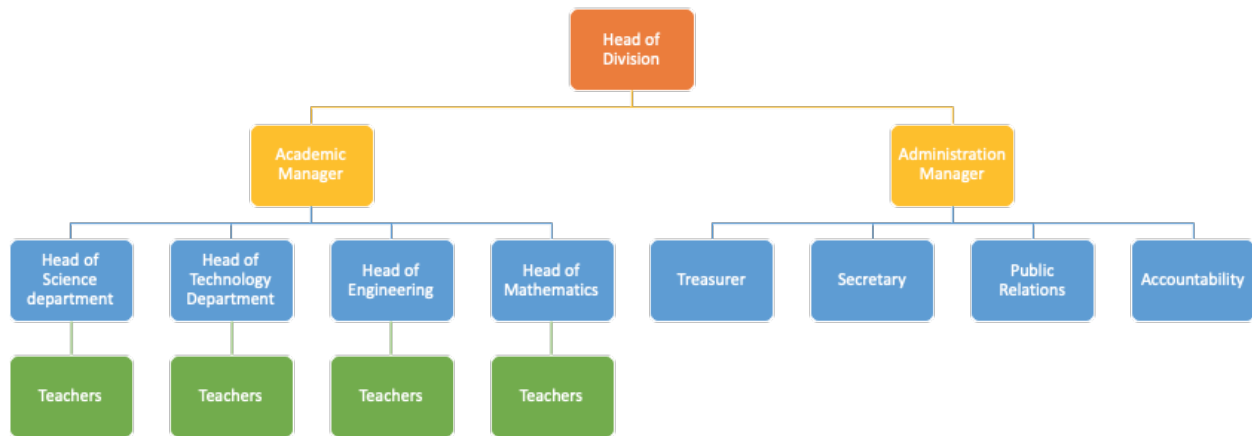
Figure 4: STEM Pals Organizational Structure.

Although the structure might seem bureaucratic with many administrative positions, we believe it to be necessary because of later expansions. This structure is designed to support a teaching staff that might be covering all nine elementary schools in the State College District. Further positions can be added under each label as the organization size grows and the need arises.

The decision of creating two major departments is to ensure that a group can focus entirely on how to create the best program for the kids, while the other can focus on how to run the organization. Each position has a clear set of responsibilities, and none of them overlap with each other. A hierarchy structure was chosen to define more clearly the responsibility and accountability of each position. Each position's responsibility is outlined below.

Head of division

This is the highest position within the program and has the duty of external spokesperson and general supervisor. Its responsibilities might include but are not limited to:

- Communication and representation within The Millennium Society;

- Communication with other significant stakeholders during major decisions or discussions;

- Overseeing planning and status of different projects;

- Reviewing all projects' performance;

- Overseeing and approving major purchases;

- Alining short-term actions with long-term objectives.

Academic Manager

This position reports directly to the head of the division, aiming to oversee all educational projects the organization has taken. Its responsibilities might include but are not limited to:

- Overseeing projects' advancements;

- Making preliminary approvals for new projects and ideas;

- Coordinating activities and scheduling classes;

- Making sure each department is following the layout plan;

- Planning the overall schedule for courses during the academic year.

Department heads

There are four of such positions: science head, technology head, engineering head, and mathematics head. They are divided to represent each of the components of STEM. Their main duty is to lead projects under their specific academic area. Their responsibilities might include but are not limited to:

- Coming up with new projects;

- Managing small issues that might arise with scheduling;

- Providing basic training for STEM Pals;

- Ensuring schedule is being met;

- Coordinating resources to accomplish each project;

- Constant revising of the syllabus.

STEMPals/Teachers

These are the people who will be teaching the children involved in the programs. They report to their specific department head and must first receive training from their department. They also participate during the planning of the courses syllabuses and schedules.

Administration manager

This position reports directly to the head of the division, aiming to oversee all administrative decisions of the organization. Its responsibilities might include but are not limited to:

- Creating annual budgets with treasurer;

- Planning and coordinating internal activities;

- Creating a monthly report of the status of the organization;

- Serving as temporal head of the organization at the absence of the president;

- Assigning projects to ensure short-term targets are met.

Treasurer

Reports directly to the administration manager. Its main goal is to ensure financial goals are met and keep financial records. Its responsibilities might include but are not limited to:

- Creating annual budgets with both managers and the Head of Division;

- Monitoring and modifying budget frequently;

- Creating monthly and annual report of financial activities;

- Holding all financial operations records.

Secretary

Reports directly to the administration manager. It aims to ensure all administrative records are kept. Its responsibilities might include but are not limited to:

- Redacting and keeping meeting agendas;

- Scheduling locations for events and programs;

- Responsible for completing the necessary paperwork for members, including necessary background checks, federal provisions, etc.;

- Keeping all records of members of the organization.

Public Relations

Reports to the administration manager. It ensures a line of effective communication between stakeholders and the organization and is responsible for all advertising/promotion of the organization. Its responsibilities might include but are not limited to:

- Creating strategic plans for advertising campaigns;

- Making preliminary contact and background research on potential investors;

- Maintaining frequent communication with CEEL;

- Making contact with different news sources;

- Maintaining social media platforms.

Accountability

Reports to the administration manager and its goal is to hold all members of the organization accountable, reviewing projects' efficiencies, and gathering data for future expansions. Its responsibilities might include but are not limited to:

- Evaluating the results of the various projects;

- Collecting and analyzing data of the organization's progress;

- Creating a monthly report on projects feedback;

- Resolving issues that arise between members of the organization;

- Collecting information on new potential elementary schools to expand the program into.

Phase 2: Assigning Target School

Because this is a new program, we plan to implement it with one single school first, before expanding to other CEEL affiliated institutions. This establishment will most likely be Corl Street Elementary School since our principal CEEL contact is its manager. The reason we chose only to implement the program in one single school at the start, is because we want to study the effects of our program. Furthermore, a single location will help us solve any arising issues at a smaller scale. We can also target and tailor our programming since no school requirements are the same.

After defining the target school, we will start collecting data and information. We will schedule interviews with the manager of the said location to ensure that we have a better understanding of how CEEL is implemented. We would also want to visit the school during one of their after class programs to better understand the dynamics that happen during that period. After all the data is collected, we will create a comprehensive report on the institution's needs and wants. From there, we will begin the next phase.

Phase 3: Strategic Plan and Preliminary Course Structure

During the third phase, we will begin the strategic plan and preliminary course planning and structure. As we integrate the new information collected, we will tailor a strategic plan to the specific school. We will first design the necessary courses, by prioritizing and ranking the STEM fields most needed. Then we will define the goal we would like to accomplish during the particular semester. By acquiring this information, we will begin a preliminary course schedule aiming to set a rough draft of availability and amount of courses needed. Once this information is obtained, we can begin to determine the number of teachers the program will require for the coming semester.

With our teaching staff complete, we will begin the necessary paperwork processes and start with academic planning. At the same time, we will begin planning the semester syllabus. This effort should be made as a group by the Head of each department and their teaching staff. However, it is very crucial that the syllabus stays open and flexible in case the need to modify it arises late on. This step should be completed at least two months before the beginning of the new semester. The process for syllabus and schedule creation should follow the path illustrated below:
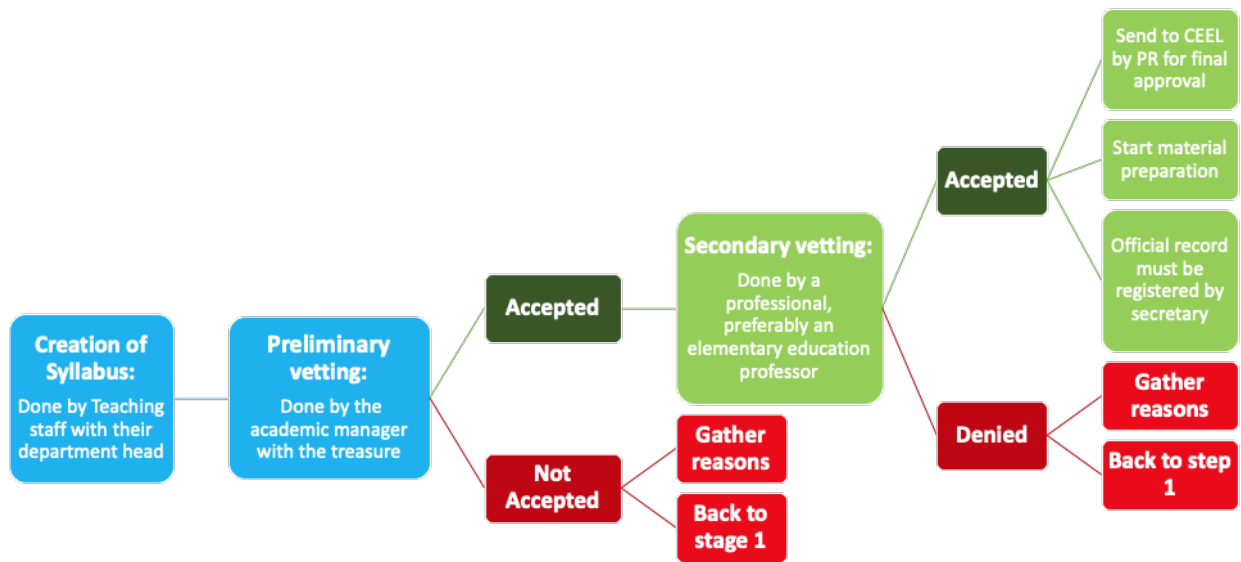
Figure 5: Curriculum Flow Chart.

During this stage, we must also complete all paperwork needed by our organization's members. This includes any clearances and background checks required by both the State and Federal government. We will need the following clearances to interact with children:

- Child Abuse History Clearance (CY113)

- Pennsylvania State Police Criminal Record Checks for Employment (SPA-164) or Volunteers (SPA-164A)

- FBI Fingerprinting

Phase 4: Final Review and Practice

The fourth stage in this process is to be one of the shortest ones. The purpose of this step is to ensure the program is ready to roll. This way we can decrease the room for error and detect and resolve some issues before the plan is implemented. This process should not take more than one week and, by the end, each manager should have a complete report of all safety-checks and status on every single step/process. Some of the checks might include:

- All relevant and necessary paperwork has been completed, sent to the appropriate officials, and copies kept on file by the secretary;
- CEEL has seen and given the final approval for our project's plan;
- Funding and budget are on track;
- All necessary materials have been purchased;
- Information on the courses has been made available to parents;
- Training has been completed.
- Teachers/tutors are aware of their schedule and confirm availability for those particular times.

Phase 5: Implementation

The 5th phase is the most critical phase of the plan. Every single step beforehand has been building up to this. Before reaching this phase, all preparation should have been completed. However, it is critical to stay flexible during this process, to better answer and adjust to emergency issues that might arise. Furthermore, it is crucial to maintain regular supervision and control over the advancement of the project. This will allow us to detect issues early before they worsen.

Nevertheless, we must remember not to micromanage the project, allowing members of the organization to have sufficient freedom and enabling them to be creative.

Phase 6: Reflection

The sixth and final phase of the program has the goal of analyzing and reflecting on the performances over the past semester. Using data collected over the previous semester, we will review our performance. This will allow for better accountability and allow us to improve our program. Although there is a specific department within our structure that is in charge of the internal review, this phase is still important because it will be an organization-wide review. Some of the main points needing reflection include:

- Budget usage;

- Courses' effectiveness;

- The satisfaction rate;

- The rate of retention;

- The turnover rate of staff;

- Leadership performance.

STEM Pals Program and the Penn State Community

We are lucky here in State College to have a large university with numerous resources. We have many clubs and organizations which focus on promoting STEM, especially for traditionally underserved groups. One group we plan to partner with specifically is the Millennium Society, which focuses on STEM-based community service.

This club is housed within the Millennium Scholars Program, which supports a diverse group of students planning to pursue advanced degrees in STEM fields. As such, this club would be able to provide a diverse group of students who are knowledgeable in STEM to help with the STEM Pals program.

Moving forward, we plan to partner with other groups as well, such as Schreyer, PLA, SWE, and any other groups that express interest in supporting diversity in STEM from a young age. STEM Pal mentors do not have to be STEM majors here at Penn State; the scientific concepts we will be covering will not be so in-depth as to require in-major experience. Students focusing in early education could also serve as amazing mentors and contributors to the club in general. Their expertise could be used to improve our lesson ideas, and bring field-specific knowledge into the lessons we are trying to teach. Including a wide variety of majors as STEM Pals Mentors will allow us to create well-rounded, well thought-out plans, so we will be happy to include anyone who wants to create a more equitable STEM environment for the future.

Recruiting STEM Pal Mentors

Especially in the infancy of the STEM Pal program, it is not likely that we will need many STEM Pal mentors, but the ones we do have must be committed. These initial mentors will be sourced from groups who are strongly invested in the program and its ideals, such as our policy group members and interested students from the Millennium Scholars Program.

Once we expand the program to multiple elementary schools, we will need significantly more mentors, and then we will have to focus in on strategies for recruiting new mentors. The organizations we plan to recruit from are listed above; we will discuss the process here.

When recruiting mentors, we want to make it clear that this is a commitment; mentors should visit the elementary schools regularly so that the program can have its maximum effect for the students. They should also be made aware that they will need to obtain several clearances and background checks (discussed below). Interested students will be added to a group messaging chat, as well as an email server, so that they can be kept up to date on happenings within the program.

For the physical act of recruiting members, we plan to visit already planned meetings of organizations to discuss our program. One of us can give a brief presentation, and take names of anyone who is interested. Additionally, we plan to develop a few informational flyers which can be posted in buildings in the colleges we hope to target (Engineering, EMS, Eberly, Ag, Education, etc.). Two of our potential flyers are included in the appendix.

Although we do not plan to incorporate the program into a separate club (and rather run through the Millennium Society), we could potentially attend the Fall and Spring Club Fair, so that people

looking to join organizations or get community service experience could familiarize themselves with our program.

The number of mentors we have will dictate the number and frequency of the visits we can make, and so we hope to recruit numerous people passionate about the goals of our organization.

References

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Appendix

Interview with Ashley Swallow

Ashley Swallow is a CEEL supervisor at Corl Street Elementary School. As a Penn State alumni, she decided to stay in the State College community and join the CEEL team.

- How many students participate in the program?
  - So we have about, um, I would say anywhere from 50 to 56 students a day, and the sometimes even that can vary. Because today they had IM intramural swimming, so a ton of kids got bused to the high school. So our number where pretty low. But yeah, overall we have 46 part-, like I said around 46 who showup, but 54 registered probably on a daily basis. So we are lucky, we are one of the smaller sites. Um it's just, I mean, when you have smaller number you're able to do more, it is not as overwhelming, more peaceful. So we'll see what our numbers would look like next year. But right now that's where we're at.
- Which school would be a good place to start with collaborating the after school program?
  - So, I think our Penn State students often will, I mean I think Corl Street is good fit, but in the past, because Corl Street didn't have a program… all of our Penn State students almost always went to Easterly Parkway just because that is the school closest to campus, um… people are pretty familiar with it, what no. But yeah, I would say that whatever school you feel most comfortable with. I think since we are meeting, it wouldn't hurt to start at Corl Street that way you have like a strong foundation, and then you could, you know, rotate to all the other schools. If that is something you're interested in.
- So, if we want to incorporate a STEM program for the kids in the school, what age bracket of kids would you think is most impactful?
  - So I think, um… I mean I think it could be impactful for all of them, but when we do think about their grade level, we all at every CEEL site have a habit to look at our elementary school kids in the brackets of youngers and olders, and I hear like the improper english, which drives me crazy, but our younger bracket is usually k through two so we group them together. However, it's still extremely challenging, when you have, you know, a kindergartener and a second grader, they can do, they have different skill sets, they have different interests, the whole nine yards. Um…, so recently I've been trying to do k through one and then three through five and I give second grade the choice, so it's like if they wanna hang out with the little kids they can, if they feel like hanging out with the older kids they may as well. Um… I will say though overall, just because I don't know every school is different, like I said, the numbers are different, but for some reason at Corl Street I have very, very, very few students between the grades three through five, like I

would say if you added up all my third, fourth and fifth graders, of that lump sum that I have, there will probably be about 16, so, not many. So over all, our larger numbers are kindergarteners, first, and second grades. So, it could be more beneficial just, you know, if you wanna gear it towards them since there are more of them, but that's just one way to look at it.

- ○ That's very interesting (Interviewer)
- ○ It is, yeah and like not every school is like that, but I've guess that, we…, I don't know if it's..., they join other clubs, or if mom and dad think they're old enough to suddenly stay home, my third grade, mmm, no. Maybe fifth grade, but…

● So moving onto the next question. For example, you call it the "We Do Robotics", so what are the proportions of the girls who take part in it versus the boys who take part in it given it's ???

- ○ You know, right now, it is probably half and half, but there (are) only seven kids in the class. So, you know, it's not um…, nothing too crazy. I'm trying to think, you know I saw Avery, Aiden, maybe some... maybe more boys, just… Yeah, maybe… Probably slightly, um… The boys probably have, yeah, the advantage.

● What do you think makes kindergarteners definitely have boys more into robotics than girls?

- ○ You know, I don't know if it's just because, when they're in kindergartner they're still learning so much, and though I think, you know, I don't go home with these children. I don't know what they're home lives are like. But, maybe we… you could just make the argument that they're still… I think that because they're so young they just have such basic concepts of gender roles almost, and we've had an issue not that long ago come up that I had a student, who went and bought in something for Show and Tell, it was a picture of him and his dog wanting to share it, and he was wearing um… a nightgown and like a little princess nightgown and cute and, you know, regardless of what his intention was, like a lot of the other kindergartners were like laughing and snickering. But I don't think it was… (interruption) ...was it malicious like they didn't know what to do. It was like they knew it wasn't what they normally saw on boys. So, what will you expect almost…

● I wanted to ask you a little bit about the makeup of the student population and the staff, how many would you say proportion of minorities, it doesn't matter of os on term of women, or people of color… What would you say is the proportion of minorities?

- ○ Well, I mean, it's an interesting question specially because I, you know, I work for the State College school district, but I am from Philly, I've also have worked in Philly, teaching in Philly. So, I just think, you know, State College… in a way not every school… like when I look at Corl Street I would say um… the minorities if, if, if we're looking at the numbers the I mean, yes there are probably some, you know, we can say like the girls probably aren't being empowered as

much as they should be, or thing like that. But overall, I don't think there are too many minorities. I, I just it's hard to identify, it's like a very… I don't know, I just, I mean at Easterly Parkway I would say at least, like they have a very big ESL program. So they are constantly having families rotate throughout their school, they'll come over for six, six months to a year. Um… So it's a little bit, I mean, I guess you could, I don't even know if you want to consider them a part of your numbers though. Because it's like then they go on their way, then they go back to their home country. Um… So, but it is interesting that that school that always something that is, you know, different, a different part of their culture compared to the other schools is that they do have a really great, they have to have a really great ESL program and how is that obviously make a community a little bit different than the other schools.

- It also reflects the population of State College, because the majority people who go to school here are actually from State College and it is interesting.
    - Right, yes, yeah the State College community um… yeah, and then it's like I feel as though especially at Corl Street and Easterly Parkway, I think a lot of our families are, they're parents are professors, of Penn State, or if they grew up in here and it's, you know, it's just their way of life almost.
- My last question to you before we move on to Xin's would be: So for this program, that wants to incorporate some things at your afterschool program, what time frames do they like take up and um… how long does it last. In terms of the the time how available is it and how frequent is it?
    - So, as I said, Monday through Thursday we have definitely classes from four to five. So that's an hour, um… the classes don't always last an hour, and, you know, we obviously try to plan different activities within the hour. It's not like they're just doing one thing for that, for the sixty minutes. Any, if we're doing an activity and a secondary option on a Friday, that's less structured. Sometimes, we will spend the half an hour, sometimes we will be down there for an hour and a half. So, we're pretty flexible and.. I always like to, I always like to play by year like, you know, with your, working with your kids. Once you get the hang of it, you can sense if things are going well, or if they aren't, or if they're interested, or if they're not, or if they things are about to hit the fan, sort to speak. So, you kind of fee, try to feel every single situation out. If all the kids are, you know, working hard, having a good time, getting really into.. I'm not going to lie, I'm not going to stop. I'm going to let this go as long as I can, umm, they're really into it. But if I see they're you know, throwing things, nitpicking at each other, if they're losing interest, them I'm gonna say, we're probably gonna wrap this up, you know, sooner than later. So, really sometimes it's just a judgement call. You never... I mean, I always say sometimes they're gonna love the activities that I have planned and they hate them, and the things that I'm like: "Oh, this is pretty, pretty

lame" and like (kids say): "this is so cool", and I'm like: "Okay, whatever, let's do it."

- So, I guess moving on to my questions, because we're talking about STEM fields, I wanted to know what equipments does the school have already? I understand you have Lego Robotics, what other equipment do you have?
  - So we have our CEEL supplies, which is kind of tricky, because even though we are part of Corl Street, and we function out of Corl Street, we actually can't use any of their teacher supplies. So if um… we, like a lot of our programs provider that come and or other students who teach classes they actually would bring their supplies. So, we have like very basic things, like the robotics people bring their Legos, and whatnot. Um… if there is something that your interested in, I can always look into it. I can't make any promises. I mean, my, my boss is the one who approves things that I order. But yeah, I mean it's more so, like, we have something coming up that I have a shopping list sort to speak. But our everyday, um… I call it our CEEL survival kit, is like board games, Legos, Connects, um… paper pencils, coloring, jump ropes, hula-hoops, balls, just like your… Like i say your basic things just to keep the kids occupied, really.
- So, um what other classes do they have going on apart from robotics, math course, or um computer science…
  - Yeah. we actually tried this new program this year, and we've gotten some extra views, but mostly positive. But it's called "Crazy Eights Math Club", and it's actually completely free. Which seems kind of crazy, and it's based on, it's like home based somewhere in New Jersey. So what, I, I don't really know where the funding comes from it, but I just let Billy, who is in charge know um.. What I need and she sends me all the lesson plans, all the of the supplies, she ships it over. It's, like I said, it seems too good to be true. And obviously the whole objective is to try to get the kids to look at math in you know, a more fun. So like, the one day they did um… a lesson on geometry with different shapes and yarn, and they had to like create like, I don't know, a maze with the chairs and the yarn, and pretend to be ninjas and they had to like identify the shapes they were making. And one day they were making something with like glow-sticks it was like, once again, with like shapes and um… Yeah I mean sometimes the lessons are questionable, but for the most part I think is a really good resource, I think as far as math goes that's probably all we have, um, right now
- Yeah. We'll compare comparing stem programs, so courses like this one or robotics, how did they do compare to older programs such as, um, arts and music and, um, somebody outside of the stem field. How do they compare? Like what's the interest of the children?
  - Usually the stem programs are pretty popular I would say. And I've noticed even with my kids throughout, um, you know, I see some of them in the morning, not all of them, but you know, stem is one of their favorite specials. They all love

going to Sam and I, you know, they're always having a good time in there. And I know the stem teacher at Coral Street, um, is always doing, you know, pretty cool things with them. And I dunno, I always walk in at the same time with the same first grade or so. I know they're a good class too. But um, yeah, I mean I think that it's interesting to them in comparison to art. It's like, you know, it's funny, I have the same crew that like does the art stuff not, it's not crazy. I wouldn't say it's as popular, but I would say it, it reaches far and wide. Now this we do robotics class was kind of limiting because I can only offer it to first and second graders. So who's to say what the numbers would have looked like had we been able to do case

- Through five or something like that. In terms of courses which causes the most popular, it seems like building like different sciences building. So I'm trying to think what is it, other stem class that they had.
  - It was something about, um, like designing like, you know, and it was kind of similar to that. We do robotics, but it seems like we use connects perse Lego's. So they've got really into that. I unfortunately didn't see that one, but I've, I've heard of it.
- All right. Can I ask a question, which, which courses do you think would be most useful for kids at this age?
  - You know, um, I know that's a tough question too because I sometimes think we have a course called academic enrichment to where they can just go in and try and get some extra resources but can get the Chromebooks, get some homework time. So I think, you know, every class can make an argument that it can be beneficial for them so to speak. But I think it's really a lot of it, I'm not to sound cliche, but a lot of it is really about building up their social skills because as I said, the content is important and we do want them to have a good time and to be interested. But also they've been in school all day. So it's a combination of kind of, as we say, building their social skills and then hopefully building a positive, a positive perspective for them. Of Education that doesn't have to be, you know, what the school day looks like and that can be more fun. So really we like to think that all of the classes will benefit them in a way. Um, but I can tell you right now and you know, I have kids who walked in classes never want to leave and other ones who will like be crying on the way to the hallway. Like how are you doing today? Like, so it's, you know,
- Um, I guess cultural to that question, which, which of course, which depends, you'll do think that we show boy for temple. Um, if we show up boy talking like physics or
  - You know, I think like I personally, right now I'm taking physics, physics and chemistry. I mean, I don't know because I'm not a science based person, but I'm imagining that might be a little bit far effect. Like out of their reach. I don't, like I said, it all seems out of my reach so I can't really answer with complete certainty.

But I would say that, yeah, physics and chemistry can be kind of hard. I don't know if this is something you guys have heard of what we eat. The coral street just did a steam expo, so it was like stem with art. So that seems to be very popular with the kids and they really got into that and I don't know, I think that's, I like that cause it's just like one more, um, aspects that allows them to somehow incorporate the humanities and it so to speak. So it can be a little bit more well rounded.

- Um, so do you think that either of course in your experience, do you, but do you believe that our team's needs are taught in more and more for the kids? I'm more hands on or then, you know, just the standard.
  - Yes. Hands on is great at CEO. Um, especially I think in any class, but especially at CLL. And like I said, when I do see that stem teacher at the end of the day, like the one day they had these bumblebee robot cars, I dunno. And then they had like all these different wooden things and they were creating amaze. And then that'll be that to get through the maze. So they were all moving around and having a good time. They were working together. So I think oftentimes when we tell kids, you know, sit here and do this, read that. It's, I can be great for a certain type of learner, but it's also a of strict specs that's so many of the kids can learn that way, especially when three o'clock rolls around. So that way, um, you know, I try to always utilize my education backgrounds and no matter what the activity is, I might not always, but I tried to think about differentiation so you know, maybe they can, like he can sit down and meet a packet, but then maybe another kid can and they'll get up and you know, see what's happening and move around and try something out.
- I guess. Do you think that we should align or courses easily do these site teams limit and afterschool stem scores? Do you feel like we should make it more freeways, so more fun or we should align yourself how with what they're learning in class. So for example, if their learning, um, you tried with math and then we jumped from project with them, we think that we should align into their daily curriculum or just just have it be completely independent.
  - I wouldn't stress about mentality cornfield and also because, um, as I said, you can have two kids from, you know, ms so and so's first grade and then another person from this first grade class and then someone from fourth grade. So it can be challenging in that regard. And also just the way that I know that these classrooms are working through concepts and um, you know, even thinking about this past winter, like what a nightmare I was with the snow days. So I think sometimes it's just though, I think that's one of those things that just sounds so great on, on paper, the idea of, you know, correlating with what they're covering in the classroom. It's one of those things that I don't think always pans out. I think if you're a stem teacher working side by side and you know, as in the faculty kind

of sense, I think that's awesome. I love, you know, when you can work across the curriculum so to speak or have a project cap for you know, x, Y and z. But in the afterschool setting I, like I said, it's probably a little bit more challenging. I think your best bet would be to just come up with things that you, maybe topics that you know that they haven't been introduced to this year, but maybe it was, you know, a few months ago or weeks ago. It doesn't have to be, you know, what they covered that week, so to speak.

- Um, do you think there's any chance we could go to one of your [inaudible] afternoon class is just absurd? Definitely, yes. And, or if we do decide to, like, it ended up being able to pull this off, um, we'd be able to like do kind of a mock who has, so we go in one day and then tries to teach. I'm trying to work out the dynamics with the kids for what?
  - Yes, you could. And I then I would just have to make sure that all of the appropriate people have your clearances. So I'm, I would have to double check on this, but I'm pretty sure if you want it to just come in and observe, I wouldn't need all of your clients is, I definitely, I think I need at least the child abuse one. Um, and probably the PA criminal background check, but when you want to actually start working with the kids, that's when we need FBI fingerprint one as well. So I don't know. Um, like I said, often times and like I was part of the college of Ed, so clearances are like second nature to me and I don't think anything of it and I always have them on me, but I know not everyone does come from an education background. So I can, if you need me to, I can share information with you about how to secure those clearances if you don't already have them. That would be amazing. Yeah, definitely. Yeah, I can get that all to you and thank you so much.
  - And yeah, I mean, and they do cost some money. So I would even say maybe
  - reach out to, um, I don't know. This would, I mean they're not crazy expensive, but maybe you guys shouldn't just your professor to see if there's, I don't know, I don't want to say a stipend, but almost like a, like a reimbursed, like I feel he should get reimbursed perhaps. So I would just hold onto your receipts if I were you. Like I said, the PA come on back roads like is $10 the FBI fingerprint mon is usually like, I think 17, something like that. And then, um, I can't remember how much the child would be used by us, but it's nothing crazy. But when you get them all done at once and it's, yeah. More money than anyone really wants to spend. So
- Yeah. More questions. Oh yeah. So my question is just going to be dangerous. So what do you think causes that disparity is kind of make their maintenance system since kindergarten.
  - Yeah. So k through five is elementary school, so that's kindergarten through fifth grade. So that's elementary and the middle school is most likely, usually sixth through eighth grade. Um, and then high school is nine through 12. But it's interesting cause I mean I, I grew up in Philly and I just had a grade school. I

didn't have elementary school, so like I just had kindergarten through eighth grade. And then some people also will have like when you get to high school then you'll have junior high, senior high. So it can be separate buildings. It is that you, you, you're never quite sure what, how they're getting, um, how they're getting broken up. And I just went on a tangent, but yes. So kindergarten through fifth grade is our elementary. Um, and I, did I answer your question? I don't know yet cause they had arrested, you know, I'm so sorry.

- I needed into the too. What do you think was his biggest very into people is one of the professors here talking to us, telling us about help with the camp kids get to high school was interesting. Certainly closed. Most of the AP classes, all the big boys. So the trick, because this gets quite of kids
    - I think at least, I mean based off of observations and even my experiences as a student, I really think that it's just a lack of opportunity. And even like the, the, the clubs and the like the summer programs that are offered, like I know science you assigned to a Penn state has a huge really cool summer camp that um, a lot of my families talk about. But it's, it's really expensive. Like it's super expensive for them to go to. So not everyone can do things like that. And I'm, I don't know if this will be something that will shift in the upcoming year as, because I know like when I was teaching in Philly, stem was not as special offer it in that elementary school. Here it is. I'm so almost like, I feel as though it seems silly to say that in a new weight, but maybe just with it becoming more a part of your everyday curriculum because as I said, there are many schools out there that are still don't even have the stem class and you know, they're just going for the science and math so to speak.
    - Um, I don't really, I don't know. I mean it's, it's, it is, it's true. I don't know what, what is happening that the way that it's panning out at the high school level. But it does seem as though there are not as many girls interested in the math and science departments sometimes. Um, if I ever have any sort of accountability during the day, which is where I tried to set it at the high school. So if I ever go into like one of the three d design classes are like AP chem or whatever, there's like one or two girls truly. And it's just, it really makes you wonder and I don't know. I don't know if it is the lack of opportunity. That's just the, maybe the mindset of the teacher, but I don't know. I see the teachers, they're awesome. I don't think it's that boys are getting favored by any means. So it is definitely something to think about for sure. I'll have more questions. Do you have any more questions? Thank you. So, yeah, of course. Yeah. And I'll reach out to you about the clearances and then anything else on, you know, and then.
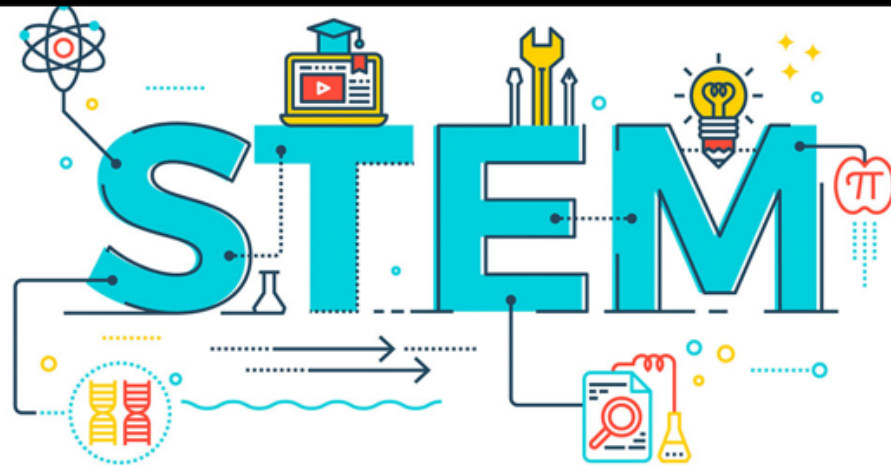
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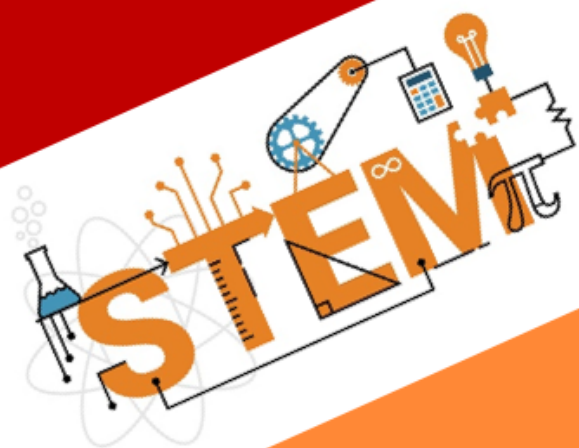
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Survey of Penn State Students

A survey of six questions pertaining to when Penn State students gained and/or lost interest was distributed via the messenger GroupMe. 40 people, majority women in the STEM field, responded to the survey. The majority of the respondents reported developing an interest in the STEM field in elementary school and/or losing interest in either elementary or high school. The majority of the respondents also reported that difficulty in math and/or science courses as well as lack of representation did not significantly impact their decision to pursue STEM-related majors.
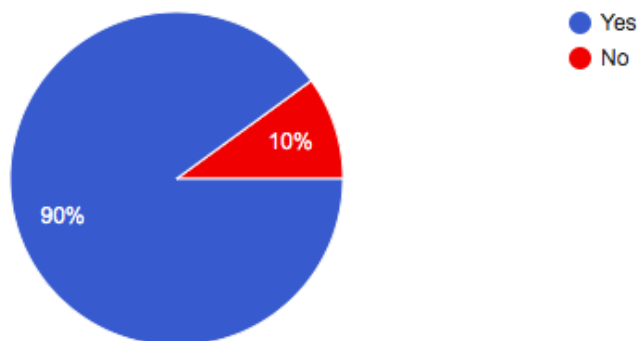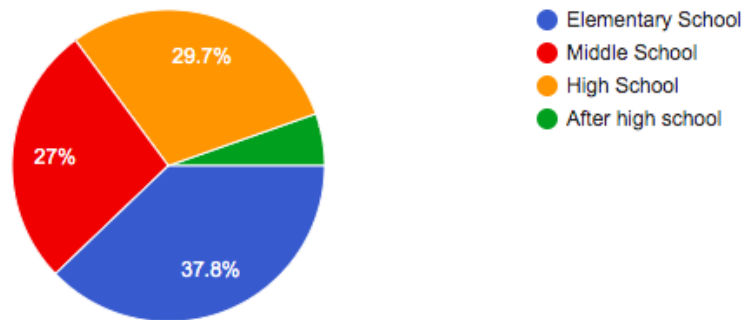
What is your gender identity?

40 responses

- ● Female
- ● Male
- ● Prefer not to say

22.5%

77.5%
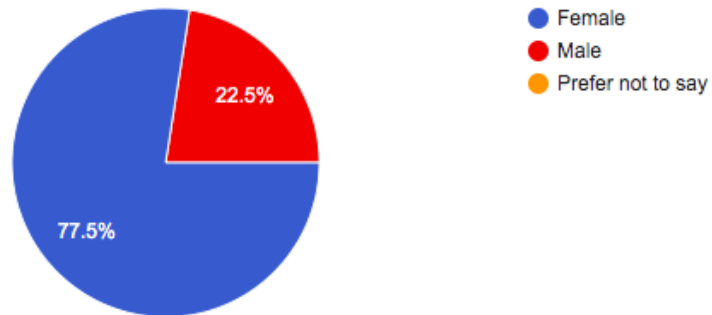
Are you currently enrolled in a STEM major?

40 responses

- ● Yes
- ● No

10%

90%

If enrolled in a STEM major, when did you first develop an interest in the STEM field?

37 responses

- Elementary School
- Middle School
- High School
- After high school

29.7%
27%
37.8%

If not enrolled in a STEM major, when did you decide that STEM was not for you?

5 responses

- Elementary School
- Middle School
- High School
- After high school

80%
20%
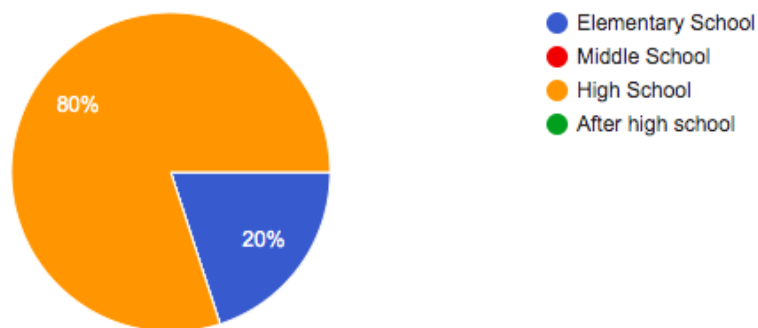
Did difficulty in a math or science course deter you from pursuing a STEM major?

39 responses

Legend:
- Yes
- No

64.1%

35.9%
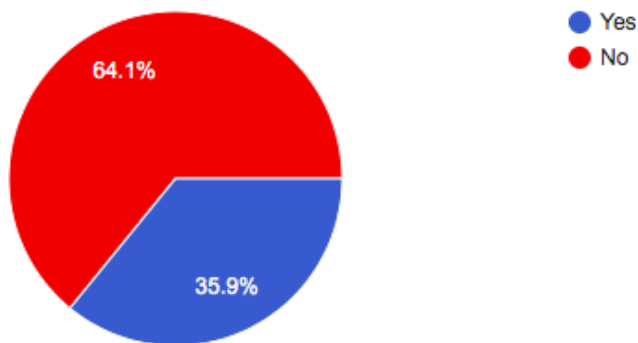
Did lack of representation deter you from pursuing a STEM major?

40 responses

Legend:
- Yes
- No

82.5%

17.5%