

RISHAB JAIN (& STEM STARS)

The Future is STEM

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Preface

R Hey ChatGPT! What is a preface?



Hello! A preface is an introductory section that appears at the beginning of a book or document. It is typically written by the author or editor and provides information about the book's purpose, scope, background, or other relevant details. The preface may offer insights into the author's motivation for writing the book, acknowledgments, or any other context that helps readers understand the content better. It serves as a bridge between the author and the reader, often setting the tone for the work that follows. Prefaces are commonly found in various forms of literature, including novels, non-fiction books, academic texts, and anthologies.

R Ah, so should I discuss my motivation for writing the book?



Yes, discussing your motivation for writing the book is a common and valuable element to include in a preface. By sharing your reasons for embarking on the writing journey, you provide readers with insight into your intentions, passions, or experiences that have shaped the content of the book. This personal touch helps create a connection between you as the author and your readers, allowing them to understand your perspective and potentially enhancing their engagement with the material. Including your motivation can also add depth and authenticity to your work, making it more relatable and compelling for readers.

Thanks, ChatGPT!

This book contains one hundred stories from some of the brightest youth

minds around the world.

That much may have been clear from the cover of the book. After all, it did say “*a curation of inspirational youth stories*” and “RISHAB JAIN & 100 STEM STARS.”

But wait. Who’s this Rishab Jain person?

Oh, pardon me. I almost didn’t see you there!

My name is Rishab Jain and I’m an author of this book. I say “an” and not “the” because I am joined by 100 brilliant young minds sharing their experiences on STEM.

But, before I present to you the beautiful mural that is their stories — it is only fitting if I share my experience in this space too.

I chose the title, “The Future is STEM” because... it is. I believe, without a doubt, that science, technology, engineering, and mathematics will hold an increasingly large role in our society. Entertainment fades away when you have AI-generated movies. Freight transport is decimated with self-driving vehicles.

But, apart from these *outcomes* of STEM innovation, there are more implicit motivators for my belief.

STEM education shapes creativity and problem-solving. This is the key.

I have obtained this key in my own experiences with STEM education, and passed it on through my non-profit efforts — my work through the Samyak

Science Society to the publication of this book.

So, let me tell you how I obtained my key.

Before I was known as *America's Top Young Scientist*, I was called "Rish."

Rish was a *barely* 4-year-old boy visiting the Oregon Museum of Science & Industry.

Note: I use *barely* because it was my birthday.

I vividly remember my favorite exhibit, a giant six-foot long model of DNA. I spent a long time staring at it, enticed by the pulsating LEDs that illuminated the nucleotides. Eventually, I ran up and grabbed the only thing I could reach. Being three feet tall, it was the codon for methionine near the start of the molecule.

I expected to be reprimanded for touching the exhibit, but I was instead met with smiles from the museum staff, who encouraged me to explore more. My parents took a picture of my little hand holding the nucleotides, and I have hung onto them in spirit ever since. That was the day I came to love the magic known as science.

My passion for science led me to conducting science research and it became rewarding through competition in science fairs where I could share my ideas with others. In 7th grade, I competed in my first national science fair and won the grand prize being named *America's Top Young Scientist*.

This was only the beginning.

When I met with my Congressional Representatives during a science competition at The Capitol, they emphasized the importance of societal service

through science. As an Eagle Scout, this long-range goal of serving society resonates with me. I believe that through science research, I can help serve society. Consequently, I considered a research career.

One of the most influential moments in my journey thus far was when I went to a pancreatic cancer PurpleStride Action Event. There, I met survivors of the disease and family members of current patients. These interactions inspired me and reminded me what a gift life is.

As a part of the National Cancer Act's 50th Anniversary, the NCI published a spotlight featuring 8 cancer researchers. It was a great honor to be recognized in that story, and it helped me learn that there is a two prong solution for the world's toughest problems: they need to be combated on both the bench and bedside. These experiences further fueled my goal to become a physician-scientist so that I can help patients through both research and care. Caring for patients would help me achieve my goal of societal service.

Being involved in STEM since my childhood has shaped a long-range desire to learn. No matter what professional specialty I settle on in the future, I want to keep learning STEM. Learning is a system that enables every goal and can solve any problem. Many great scientists have a mantra of learning something new every day. I aspire to be one of them.

STEM has had a remarkable impact on me. It has had a remarkable impact on the one hundred stars you are about to hear from.

Fund STEM education. Prioritize STEM education. Celebrate STEM education.

The easiest way to do that?

Share this book. Buy a copy of it and donate it to your local library or school.

It will make a difference.

Not just for the Amazon ratings of this book, but in a student's life.

Enjoy.

Acknowledgement

The one hundred STEM stars who made this possible.

I have been thoroughly impressed by the stories of these stars. They are such an inspiration — and give us so much hope for the future. Their diverse experiences give us hope of solving humanity's most complex, challenging problems.

Their essays and stories are the lifeblood of this book. They are listed in no particular order, below. In the main text of this book, their story titles will be followed by their name. Please give them each a round of applause (in your head):

Roberto Quesada

Tsaroana Andrinirariny

Sergio Emiliano Pérez López

Yashvir Sabharwal

Titilope Olotu

Dhruv Ramu

Bernardo Mascarenhas Quintas

Evan Huang

Kudakwashe Chikono

Puja Chopade

Siddhi Dudgikar

Sritej Padmanabhan

Audrey To

Shourya Chhabra

Prisha Shroff

Panav Kalra and Fergus Chung

Maya Swaminathan
Jai Premchand
Vinay Devarakonda
Millena Xavier
Muhammad Fowwaz Moeen
Riya Singhal
Rainey Reese
Kevin Pyo
Zoe Shykind
Divyansh Gunjan
Estefania Olaiz
Roselyn Marrero
Joseph Edwin Selvakumar Joy Merwin
Maitreyi Muralidhar
Nayib Monteagudo
Frances Lu
Abdullah Bin Tanveer
Siddhant Borkar
Shelley Wei
Lance Xu
Vimal Jai Kirithika Vimalanathan Sankarapandian
Chloe Y. Wang
Jackson Doren
Karma Lokhi Bridgman
Kimaya Vijay Deshpande
Laura Zhang
Tanish Gadireddy
Maxwell Love
Ananya Subramanyam
Anna Mohanty
Belinda Lin
Ashley Chang
Ankur Rao

Arvind Indukuri
Ryan Fernandez
Harouna Thiam
Riya Sikand
Manjot Rai
Lidia Prokopovych
Siddharth Rawat
Rohith Lanka
Vidhatri Iyer
Mathavan Arumugham
Christopher Rhatigan
Rayan Mubarak
Kush Sharma
Megan Haubrich
Simone Sah
Eveer Soriano
Avery Ernst
Stefan Chirica
Matthew Jeong
Savannah Levack
Laxyaa Kumar
Jingjing Liang
Rohan Singh
Sabrina Huang
Vignesh Nagarajan
Insar Tungushbayev
Dashel Myers
Jaden Cutinha
Rohil Agarwal
Kaushik Sivakumar
Veer Banwait
Zander Vaux
Annie Zhang

Alexander W. Zhai
Sanaa Ashwin Karkera
Sophia Klima
Aaryan Kushwah
Kishan Namburi
Araf Reshad
Vaibhav Mishra
Vedant Janapaty
Vinay Gupta
Sai Shreyas Nayak
Anushka Peer
Bahiya Areez Ahmed
Sahanaa Nishkaran
Stasya Selizhuk
Garret Richter
Aryan Mudliar
Mahathi Srivatsan
Krrisha Patel
Manan Mittal

My editor: my elder brother, who helped advise me & edit this book: Aditya Jain. Aditya has had his own experiences in STEM, which you can check out on the back of the book.

How to Read this Book?

This book is atypical.

You will not see beautifully organized chapters.

You will see just three parts:

- STEM Moons: Why STEM Education Reflects the Light of Curiosity and Inspiration

This part will include student pieces about the importance of STEM education.

- STEM Comets: STEM Projects and Advocacy Trail the Sparks of Creativity and Impact

This part will discuss inspiring student-led projects, advocacy, and charity work in STEM.

- STEM Nebulae: Stories of STEM Forming the Clouds of Discovery and Achievement

This part will showcase students' own stories of how STEM impacted them.

The students' essays/stories will be organized into these three sections. Each student has written a story for one of these.

Why space? The cover of this book is space-y, so it's cool.

Stop – I know what you're doing. You're judging.

No judgment allowed!

I

Part 1 - STEM Moons: How STEM Education Reflects the Light of Curiosity and Inspiration

“I have no special talent. I am just passionately curious.” -

Albert Einstein

Artists are Engineers, and Vice Versa

By: Divyansh Gunjan

If you look back in time when artists like Leonardo Da Vinci and Michelangelo were designing and creating one of the greatest pieces of art of their time and beyond, they crafted some of the near-perfect pieces of great art and realism respectively. Not every “great” artist can do that. And, certainly what this tells us is that art is not a mere pleasant conversation between the art, the eyes, and the brain. It is also a work of closely knitted and nit-picky craftsmanship and design that only engineers can handle in the modern era. There aren’t many or probably no artists who can build a particle accelerator by merely understanding how to paint and be creative but not be technical. Today, in Western society we see a lack of STEM students or those who wish to pursue it and make a career out of it. Some of the most prestigious and fancy colleges that people dream of getting into are focused on liberal arts and political sciences.



The above graph shows the trend of the word ‘STEM’ in search terms worldwide.

(Source: Google Trends)

We can also speculate from the data above that developing or underdeveloped countries have more people who wish to pursue science, technology, engineering, or math as their future career or at least are interested in knowing more about it.

What Western design and culture of the past 400–500 years has taught us though has been remarkable. If we visit some of the best engineering colleges in the world today like MIT, we see a combination of both – beauty/design + vigorous sciences. Although there are a lot of other colleges that are not able to showcase the culture of which they’re part and also what they believe in that they’re good at, we can now create an argument respective to our idea, “Are the best of artists also the best of engineers or vice versa?”

There is no right or wrong answer to this question and the question in itself is very subjective, but there are multiple examples of some of the most admirable figures in history that we can look upon to know how this idea shapes itself.

Take the example of Sir Leonardo Da Vinci, not only did he create the famous painting Mona Lisa and The Last Supper, etc. but also invented the design of ‘The Flying Machine’ around the 1490s. We know him as a sculptor, an engineer, an architect, and an artist making him a true polymath.

Similar, was the case with Michelangelo when he set out to bring his art as close as possible to the realistic behavior of nature helping him to create one of the greatest sculptures, the *David*. The creation of the 6-ton figure was only one part of the story. Moreover, Michelangelo had to figure out a way to transport the figure to Piazza della Signoria via carts, pulleys, and levers.

In another incident, Michelangelo had the job to paint a ceiling, 130 feet

long and 45 feet wide. Henceforth, he hoisted himself up to the top via a system of pulleys and levers and painted the entire wall in bright colors on wet plaster using what he called the 'fresco' method. This method is still used to date to come up with beautiful designs and art on walls and interior design.

Another creative businessman and inventor who went on to become one of the most respected engineers of the modern era designed media and entertainment-related tools and devices like the phonograph, later known as the gramophone and motion picture cameras for film-making. This was Thomas Edison, the inventor of the light bulb.

Countless other examples exist in our history that showcase remarkable achievements in both the arts and the sciences and went on to be regarded as 'geniuses' over time. These are the same people who help us understand creative thinking and vigorous math like calculus, algebra, statistics, geometry, etc. that they are not two separate areas of interest.

As for my experience, I have been painting and drawing since I was 6 years old. I even completed my bachelor's at the age of 13 in Fine Arts from Pracheen Kala Kendra, an academy for fine arts and contemporary arts in Madhya Pradesh, India. I read my first space encyclopedia when I was 9 and hence, got interested in knowing more about it. My entire school life, through junior, mid-school, and high-school has been a struggle to get proficient in math. I have loved physics since I've known it, and hence I've got also got my share of payback from the beautiful subject.

The interesting part was that I started to believe in high school that I was just bad at math and that it was not the right subject for me, but because physics in secondary and higher secondary comes down to a whole lot of math and calculations, I was still in the belief of the ideas I got to know from one of my friends who was a subject topper in math in our class, "While physics is the way we understand the universe, math is the language of the universe." This

was a guy who used to put quotes by Ramanujan, Terence Tao, and some other great mathematicians, dead and alive as his WhatsApp status. Neil De Grasse Tyson, one of the most popular astrophysicists today, said the same thing. This motivated me to study more and struggle through concepts where agitation and impatience play a big role in making you throwback to the norm and feel miserable about not being able to do it. I was motivated by my tutor to stick to questions and try to think relentlessly unless I was tired enough to give up and look upon the solution.

Because of my past interests in space and astronomy, I started a podcast in 2022 which grew past 1500+ downloads and got ranked #11 in India in the category. I also got involved in projects from Zooniverse, won science and social science exhibitions, and now I'm planning to work on building a miniaturized reflector-based telescope for commercial and individual-based use cases. It's been a great journey so far, making me believe as a born artist turned "STEM guy" that both are important for the social, economic, and overall development of our society, as our history tells us that both are the very pillars on which our society stands today.

A Note to Pre-Meds about STEM Education

By: Audrey To

A year ago in Hong Kong, COVID patients were sleeping on the freezing streets. Frontline workers were rushing around the emergency room 24/7. The sight was heartbreakingly, unsettling and harrowing... As COVID restrictions gradually relaxed, a question popped up in my head. *Why do students still opt for pre-med after understanding the risks involved in medical professions?*

I asked 30 aspiring pre-med high school students why they preferred to take up the responsibility for people's lives and sacrifice long hours of sleep during medical school over any other profession in areas like investment banking, law or engineering that had similar career prospects (in Hong Kong, at least). Some of the answers I heard from them were a mixture of "I actually don't know" or "My family says being a doctor would grant me high social status and a stable salary" or "I want to be a surgeon making millions a year".

Any pre-med student or trained healthcare professional would probably tell you those statements barely cover the entire perspective of what entering the profession is like. I may not be a trained professional (yet), but from what I've seen during medical internships, interviews or discussions with

licensed medical workers, entering the profession involves a lot of sacrifices, some of which may not be inherently observable at first glance.

So the question goes, why are there still so many misconceptions around careers in healthcare? A simple answer would be the lack of pre-professional opportunities and career-navigation resources available among STEM education for students. Now that you think of it, it doesn't look that much like a simple answer, does it? It's not as simple as it seems because pre-professional opportunities highly depend on how privileged you are and how well-connected your family is. Students with parents coming from medical backgrounds obtain more job-shadowing or research opportunities from their parents or their parents' connections. Students who can afford to attend prestigious private high schools may also find it easier to access relevant STEM opportunities. However, what happens to the other students who don't have the privilege to access these opportunities?

A year ago, I founded an organization to advance educational equity by providing underprivileged high school students with free medicine-related opportunities. Last Easter, we held Global Health and Development Case Study Sessions with medical professors at the Li Ka Shing Faculty of Medicine (the local medical school within the University of Hong Kong). Our participants were able to shadow medical professors as well as discuss public health and epidemiological issues with one another. This summer, we're also organizing a free summer research programme for 30 students jointly with medical professors as well. These experiences are crucial in every student's high school career, because they let students immerse themselves in hands-on pre-professional learning and gain practical or vocational skills otherwise not taught at school. In our sessions, not only will participants be able to interact with laboratory equipment under the mentorship of medical professors, but they will also get the chance to have their research work published in reputable journals. To this day, we've impacted over 1000 students worldwide and we hope to extend these opportunities to even more students!

A NOTE TO PRE-MEDS ABOUT STEM EDUCATION

Undoubtedly, everyone would agree that the growing recognition of STEM education can be affiliated with society's rapid technological advancements, but while governments worldwide are focusing on increasing funding for STEM education campaigns or projects, we can't deny that there are still discrepancies in the quality of the STEM education students receive. Pre-professional opportunities and career-navigation resources in STEM education allow students to communicate with STEM professionals directly and gain a more realistic perspective on what undertaking certain STEM careers would be like. In my case, conversing with medical professionals has allowed me to understand whether or not I would want to commit several years of my 20s to medical school and the rest of my life to bearing responsibility for people's lives. This says a lot about the impact high-quality STEM education can leave on people's lives — they'll come to understand what they want and what they don't.

“So, why do you want to be a doctor?”

Unseen Talent: Addressing the Lack of Black and Latino Representation in STEM

By: Roberto Quesada

I've always had a love for learning. Whether it was reading old historical texts as a child or understanding a new equation as a middle schooler, I felt that learning was a way for me to understand the world and provide my own contributions to it. Hence, when I found out I could take rigorous AP Calculus BC class in my junior year of high school, I knew I had to take it on. I was excited to get a brand new perspective on math that broke beyond the *limits* of Algebra and Geometry (pun intended). On the first day of class, however, I noticed something odd: I was one of only two Latinos in my entire class, and there were no Black people in my section.

I was upset but not surprised. While my high school, Brooklyn Tech, is one of the top STEM schools in the country, its diversity lags behind. Only 6 percent of the school is Black and only 8 percent is Latino.

Upon further research, I realized this problem was not unique to Brooklyn Tech. Black and Latino students make up 38 percent of the students in schools offering AP, but only 29 percent of those enrolled. According to the American Mathematical Society, there are 1,769 tenured mathematicians in the math departments of 50 U.S. universities that produce the most math PhDs. The number of Black mathematicians in those departments is thirteen.

That is 0.73 percent.

Dr. Edray Goins, a former math professor at Pomona University, wrote in a New York Times article about the struggles of being one of the few Black people in United States mathematics. “To say I feel isolated is an understatement,” he explains. He reported constantly facing racist remarks and having mathematicians and teachers question his abilities because of his race.

Lack of support and motivation means Black and Latino students are more likely to opt out of taking advanced math classes since they know they will likely be the only Black or Hispanic person in the room.

While many students of color are discouraged from taking classes that they have access to due to fears of isolation, many students of color don't have that choice. Their school will make the choice for them by not offering any advanced math courses at all. The U.S. Department of Education Civil Rights Data lays it bare, finding that only 33 percent of high schools with high Black and Latino enrollment had access to calculus courses in comparison to 56 percent of high schools with low Black and Latino enrollment. 29 percent of high schools with high Black and Latino enrollment do not even offer Algebra 2! This is a basic math requirement for the majority of fields including environmental science and economics. Without a solid foundation in these math subjects, many Black and Hispanic students fall behind and cannot participate in more advanced STEM majors and courses.

One of the largest causes of these inequalities comes down to funding gaps between wealthier high schools and lower-income high schools. The schools with the most resources tend to be located in zip codes where there is more taxpayer funding, while schools in lower-income neighborhoods, which tend to have more Black and Latino students, get significantly less funding. This means that they can barely afford even the basic requirements. How many math geniuses have we lost simply because they could not advance to

a higher-level math class or get the resources they needed?

More representation in STEM would have the potential to bring new and fresh ideas to the table that could revolutionize fields as we know them. Black and Latino innovators and researchers like Kunle Olukotun and Sabrina Gonzalez Pasterski have already made massive strides in their respective fields of computer science and physics. Having more people like them in the world of STEM could inspire others and bring new perspectives that previously weren't considered.

More importantly, however, STEM has the chance to uplift Black and Latino communities. According to the Bureau of Labor Statistics, STEM jobs generally pay nearly twice the national average. By creating conditions that cause people of color to have more access to advanced STEM courses, the wealth gap between white people and people of color can shrink.

If we don't turn the tide, whether that is by funding STEM programs in low-income areas or by taking smaller steps like teaching about the accomplishments of people of color in our classrooms, we will not see an improvement in the small number of Black and Latino people in STEM fields. As STEM becomes increasingly present in our lives, our educational system must evolve to ensure that a STEM future is one that is accessible to everybody, and not just a small few.

Roberto Quesada was the Salutatorian of Brooklyn Tech's Class of 2023 and is a member of Harvard's Class of 2027.

Not a Later, but a New Life

By: Shourya Chhabra

*Something this foggy day, a something which
Is neither of this fog nor of today,
Has set me dreaming of the winds that play
Past certain cliffs, along one certain beach,
And turn the topmost edge of waves to spray:*

*Ah pleasant pebbly strand so far away,
So out of reach while quite within my reach,
As out of reach as India or Cathay!
I am sick of where I am and where I am not,
I am sick of foresight and of memory,
I am sick of all I have and all I see,
I am sick of self, and there is nothing new;*

*Oh weary impatient patience of my lot!
Thus with myself: how fares it, Friends, with you?*

*-Later Life By Christina Rossetti
– – My grandma's last words*

The atmosphere in the hospital room was heavy with an overwhelming sense of absoluteness. Like a wave of darkness, a blanket of doom, it descended

upon all and showed no mercy. Silence enveloped us like a dense fog, leaving us dangling in between yearning and grief. As the stillness settled, my grandma's delicate voice pierced through the empty void, capturing my attention like the Sirens of Greek myth, a distant melody that enticed me to come closer.

In that precious, frail moment, I leaned in. My ears were straining to catch the voice that escaped her lips, and her words, filled with persistence, carried the weight of a lifetime of experience and love. She turned to her side to pick up her journal of poems – poems that she had read and loved so much in her life that she wrote them down in an old, worn out journal. Its coloring, yellow pages bore witness to the moments in life that she held close to her heart.

As she turned the worn-out pages, her fingers tracing the texts of her favorite poems collected, I couldn't help but feel a connection to her. Each poem etched onto the aged parchment seemed to hold a piece of her soul, a tribute to the moments that had shaped her life. Some pages had lived through eras like Indian Independence, The Emergency under Indra Gandhi, etc, times of danger, where my grandma had stood her ground.

With a quivering voice that mirrored her frailty and sounded nothing like the grandma I knew, she began to recite, *Later Life*, a poem penned by her favorite poet, Christina Rossetti. It was a poetic expression of yearning, much like her own longing for the days when life thrived within her.

As the lines flowed from her lips, each word resonated with the sorrowness of her impending departure. The poem's melancholic imagery of cliffs and winds, waves crashing against a pebbly strand, all painted a vivid picture of her desire to break free from the limitations of her weakened body and embrace the unknown.

Those ended up being her last words.

My grandma's voice grew fainter, each verse spoken with pain until the final words were murmured as she slipped into a deep sleep. Sensing the approaching end, the doctor, a solemn figure in a white coat, quietly urged me to leave the room. Reluctantly, I kissed my grandma on her forehead, knowing it would be our last earthly encounter.

One short day later, my grandma passed away. She was just 63.

As time went on, I had lost all meaning of life. My world lost color as everything turned to gray. The absence of my grandma left a permanent scar on my life—it felt as if someone had stolen my heart. Her departure became an encouragement not only for self-reflection, but reflection on her last words. As the five stages of grief passed, the tears soon halted, but the replay of her last words never ceased. It was a constant jumble in my head, and I soon sought solace through the poem.

As I soon came to realize, *Later Life* by Christina Rossetti is a poem where one embraces reality. With vivid descriptions of a distant shore one can never reach, a show of desperate longing an individual is always reaching for, it is a must to recognize the significance of life and all it has to offer.

After recognizing this, I asked myself, *How can I honor my grandma's legacy?*

As I pondered my grandma's death through her last words and the stages of grief, I started and discovered my love for STEM and STEM education.

*Ah pleasant pebbly strand so far away,
So out of reach while quite within my reach,*

Denial was my first natural response to loss, like many people. It shielded me from the truth I didn't want to conquer, the reality I never wanted to face. As I began to discover STEM to help me overcome my grief, I realized how many people overlooked and denied STEM education, ruining the potential to change not only their own, but society as well. In my grandma's last words, the poem depicts a distant and unreachable pebbly beach, which inspired a sense of doomed loneliness, but also hopeful curiosity, in me. Any STEM field requires exploration and curiosity. Just like the pebbly beach and its mysteriousness, STEM education invited me to delve into the mysteries of the universe through science, solving complex problems to persuade all to engage in the process of discovery.

*I am sick of where I am and where I am not,
I am sick of foresight and of memory,
I am sick of all I have and all I see,
I am sick of self, and there is nothing new;*

Anger was my next natural response. I was angry that my grandma had unjustly left, and had abandoned me to deal with the rest of the world by myself. Similarly, as my STEM education continued, I became frustrated with the lack of change going on in the world—instead, more problems arising. The pursuit of STEM allows people, no matter from where, to go beyond the limits of societal and scientific barriers to make a long lasting impact on the world. In her last words, when my grandma highlighted how she was sick of nothing new, I realized she was talking about how she wanted a change for the better, so that the entire world would benefit. STEM education keeps that dream alive for me, and for anyone, wanting to make a meaningful impact once and for all.

As out of reach as India or Cathay!

Bargaining was the stage of grief that inspired me to dive into STEM education the most. After my grandma's death, I was actively involved in seeking a nonexistent solution to bring her back. As my STEM knowledge increased as well, I realized that STEM education was also important because I was able to bargain with my limitations regarding my capabilities and strengthen my weaknesses. In a time of grief in the bargaining stage, there was nothing more wondrous than being able to truly mitigate my loss through improving myself in STEM. The poem describes reaching out to India or Cathay as one would improve their horizons in STEM, combining passion with perseverance, resulting in solutions with innovative perspectives, something that could benefit us all.

Oh weary impatient patience of my lot!

I experienced deep, prolonged sadness over my grandma's death. The poem also expressed impatience mirrored by my sadness and frustration at not being able to do anything. It reminded me both of the world of individuals waiting to be discovered, and a world of knowledge waiting to be discovered. It symbolizes the true importance of a new world over an old world, and how not to delve on the past. With the power of STEM, I overcame my depression, where I was inspired by how STEM always focuses on defining new things, and only continues to grow by learning from the past, not delving into past failures. Therefore, I realized, not only was STEM education important and fun for the several reasons mentioned above, it was key in teaching us one of the biggest life skills : to always learn from our mistakes.

Thus with myself: how fares it, Friends, with you?

When I finally accepted my grandma's death, I came to terms with my loss and finally embraced my reality. Whilst in and continuing my STEM education, I recognized the opportunities STEM presented to not only change the world, but to change myself for the better. Through the help of STEM, I discovered that with acceptance came peace.

In the end, that's what matters.

Seeds of Hope

By: Sritej Padmanabhan

Neanderthal 1 sits on a stormy night eating a delicious slab of tree he was able to acquire. For what seems to be an ideal day for this ancestor turns into a realization that shapes the 21st century. An introduction to the science and engineering of S.T.E.M as he finally perfects the way he rubs the sticks together as a flash arises in front of him in the form of heat. This spark of fire is one that ignites a forever endeavor of growth for the human race. For a world without S.T.E.M would be one enveloped in decivilization.

Perhaps my awakening into this world of S.T.E.M was not as exciting as our fellow Neanderthal but it nonetheless changed my life. As a carefree seven-year-old, I roamed the fields, blissfully ignorant of the disease that had taken root within my family. My mind wandered, contemplating the mysteries of the universe, pondering questions as deep as, “Why did the chicken cross the road?” My curious nature led me to explore countless areas, much to my mother’s chagrin, who often described me as someone who “would not shut their mouth.” However, a pivotal moment arrived when my family brought home a computer, a glassy, shiny treasure that captivated my young eyes.

“Chinnu, have you ever seen a computer before?” my grandfather, visiting us from India, asked. Little did I know that this encounter would shape the trajectory of my life. Perhaps, if I hadn’t been present in that room, or

if I had asked fewer questions, my life might have taken a different path. However, one undeniable fact remained: no matter which road I chose, a life intertwined with STEM was inevitable. The radiant glow that once adorned my face, inspired by cotton candy skies and thrilling daydreams, was now replaced by the luminous screen reflecting in my eyes.

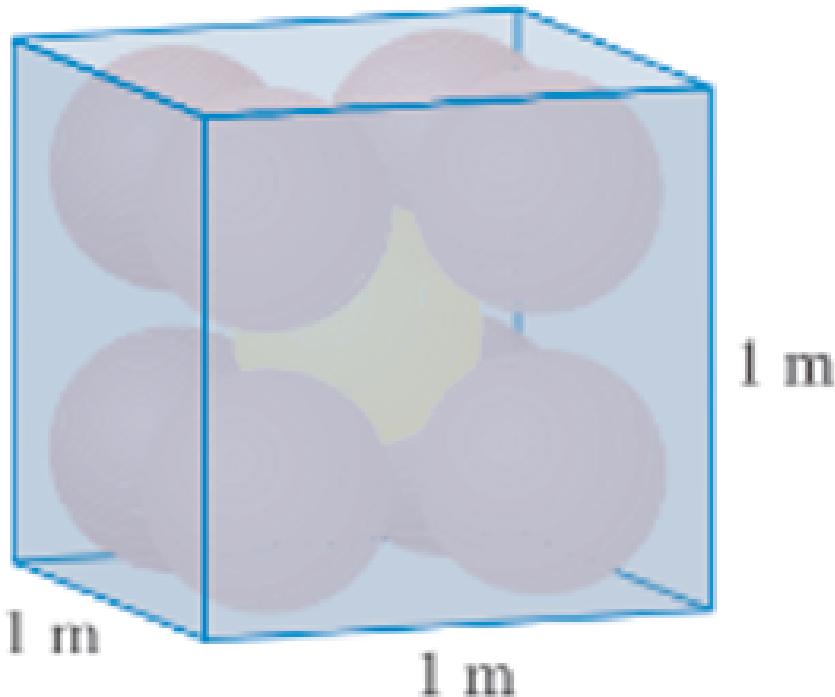
With technology's introduction into my life, a gateway to the world of STEM emerged, revealing a society far beyond the confines of the playground. Time continues to bewilder me as this seems to all be yesterday but perhaps it's more the effects of technology rather than time itself. It wasn't until seventh grade that I fully embraced the reality that STEM had become an integral part of me. Around the same time, my grandfather was diagnosed with Parkinson's Disease—a life-altering event for my family. Previously, I had been trained to believe that such challenges and global issues were reserved for adults, leaving us children with nothing to do but mourn the harsh truths. However, the world was changing, and the realization that STEM education was a societal imperative became clear.

It is true that one can navigate through life without the outlet of dreams and passion ingrained in our DNA. However, such an existence would resemble that of Neanderthal 1 before his spark of hope. Perhaps a past is where you seek fruition but that is not the direction this stream of life flows. It became evident that STEM education is not solely my future, but the future of billions around me and what once seemed to be an adult problem was simply a problem. A problem for our generation and the future that rapidly emerges. As we continue along this path of confusion, pain, love, hope, and success, we will continue to make advancements. For me, this transformative journey began on a playground, gazing at a sky adorned with cotton candy clouds, pondering life's profound questions that had been answered all along. In that fleeting moment, countless seeds were planted. And with each seed, a **stem** sprouted, promising a brighter future.

STEM is Your Toolbox

By: Lidia Prokopovych

Consider the following problem from James Stewart's *Calculus* textbook:



Each edge of a cubical box has length 1 m. The box contains nine spherical balls with the same radius r . The center of one ball is at the center of the cube and it touches the other eight balls. Each of the other eight balls touches three sides of the box. Thus the balls are tightly packed in the box.

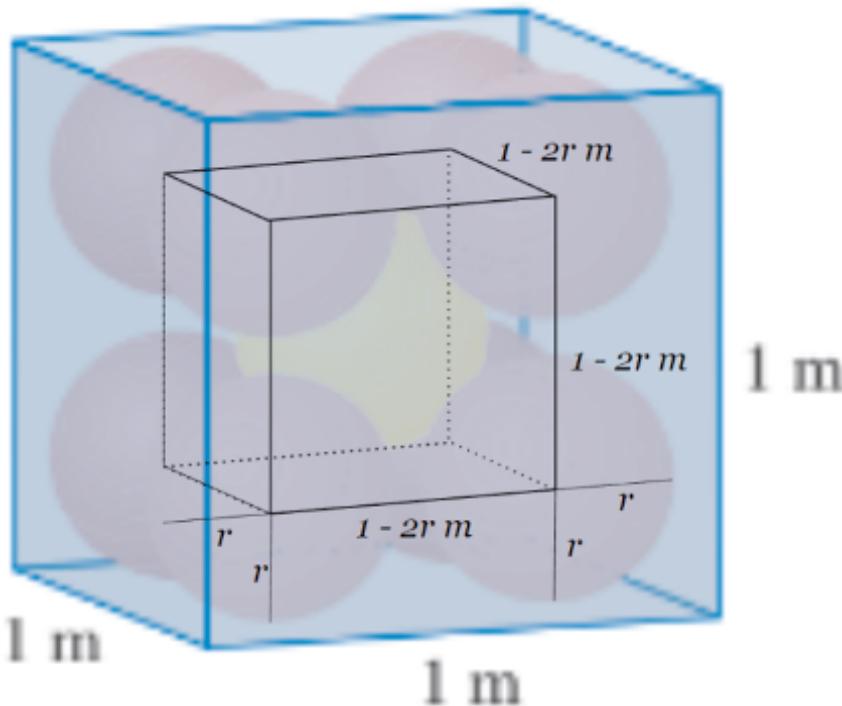
Find r .

-Stewart, J. (2016). *Calculus*. Cengage Learning.

At this point, you may be tempted to flip to the next article, where a more interesting story may await you. I get it. With the exception of those who find abstract, mind-boggling math problems enjoyable, most students would

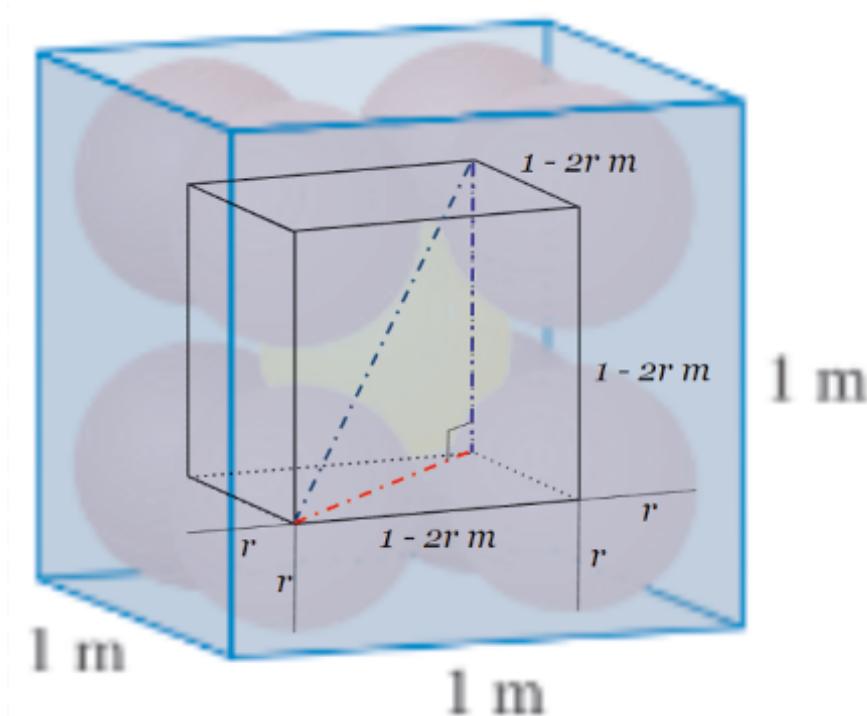
let out a deafening groan if they saw this problem. Moreover, its practical applications seem nonexistent: when in life will any of us ever need to calculate the exact radii of nine tightly-packed spheres?

Nevertheless, bear with me as we walk through the problem together.



We are given that each of the outer eight balls touches three sides of the box, so the distance between the center of each sphere and a surrounding face is r . We can draw a similar, smaller box, where the corners are superimposed onto the spheres' centers. The side length of this box is $1-2r$, as shown in the figure above.

Now, if we draw a line between two of the opposing corners, we notice that this cubic diagonal passes through the center of the lighter sphere and has its endpoints at the centers of each of the darker spheres in opposing corners. The diagonal thus has a length of exactly $4r$, passing through one radius in each of the two purple spheres and two radii in the lighter-colored sphere—that is, its diameter. Therefore, if we find the diagonal length, we can find the value of r :



There are several possible methods to find the length of the cubic diagonal, some of which involve complicated formulas, but we will use a simpler strategy. First, we use the Pythagorean theorem to find the diagonal of one of the cube's faces (light bottom line in the figure above). Since each face

has a side length of $(1-2r)$, the length of the face's diagonal is

$$s = \sqrt{(1-2r)^2 + (1-2r)^2} = \sqrt{2}(1-2r).$$

Now if we use the Pythagorean theorem a second time, we find that the length of the cubic diagonal is

$$s = \sqrt{[\sqrt{2}(1-2r)]^2 + (1-2r)^2} = \sqrt{3}(1-2r).$$

From here, we can use the fact that the diagonal crosses four radii to find the value of r :

$$4r = \sqrt{3}(1 - 2r)$$

$$4r = \sqrt{3} - 2\sqrt{3}r$$

$$4r + 2\sqrt{3}r = \sqrt{3}$$

$$r(4 + 2\sqrt{3}) = \sqrt{3}$$

$$r = \frac{\sqrt{3}}{4 + 2\sqrt{3}}$$

To simplify, we multiply the numerator and denominator by the conjugate

$$r = \frac{\sqrt{3} \cdot (4 - 2\sqrt{3})}{(4 + 2\sqrt{3}) \cdot (4 - 2\sqrt{3})} = \frac{4\sqrt{3} - 6}{(16 - 12)} = \frac{4\sqrt{3} - 6}{4} = \frac{2\sqrt{3} - 3}{2}$$

See, even for those who don't find math to be enjoyable, that wasn't so bad,

was it?

Now let's return to the original question: when on Earth would you ever need to calculate the radii of nine spheres tightly packed in a box?

Here's a secret: unless you are planning to become a mathematics professor, engineer, or some other math-heavy professional, the operations, formulas, and trigonometric functions that you learn in your math classes will never be applicable to your real life. You will never, ever use them. So why learn them?

See, the value of math doesn't come from knowing how to calculate the radius of a sphere, or the sum of an arithmetic series, or the integral of a function. The real treasure is found in the reasoning and logic skills that you learn while solving math problems, such as the one above.

In the spheres problem, we were given an abstract situation that we had never encountered before (unless, of course, you *are* one of the rare students who enjoys tackling challenging math problems in your free time) and were instructed to find the answer using tools that we already had—in this case, the Pythagorean theorem. However, even if I had told you from the start that we were going to use the Pythagorean theorem, you would still have to think deeply and critically about how to apply the tools in our toolbox. Simply “plugging and chugging” or memorizing the solution will not work here. That is the real beauty of mathematics.

In the real world, we can't just memorize the solutions to global problems like climate change, poverty, political instability, or inequality. We have to use what we already know and find out what we don't know in order to tackle these nuanced problems. We need creative solutions, drawn from our toolbox of skills.

A STEM education seeks to arm its students with basic tools and then throws

them into a maze with nothing else but the instructions, “Find your way out.” And the truth is, that’s how the world works.

Whether you are pursuing a math-heavy career or not, a STEM education empowers you with a toolbox of reasoning skills and innovative thinking. Even if you won’t ever use the Pythagorean theorem or multiply a fraction by its conjugate, in a world full of complex problems and nuanced challenges, the type of innovative thinking you use while doing so in a math problem is invaluable.

So even if you see math as an annoying class that you have to get out of the way, the struggle and process of working out solutions with your toolbox of numbers and formulas will unknowingly help you solve the other issues that you’re passionate about, whether they involve finding the radii of nine tightly-packed spheres or battling world hunger. Building that toolbox of skills is what truly makes a STEM education powerful.

Unveiling the Tapestry: Weaving STEM Education into My Nepali-American Journey

By: Simone Sah

17 years of being born and raised in America, with many opportunities. On the other hand, a first-generation child of immigrant parents who came from Nepal. Everyone always talks about the sacrifices parents make for their children, for a better opportunity, and what did I get? Where do I dream to be?

In the realm of infinite possibilities, where dreams intertwine with reality, I, a first-generation Nepali girl living in America, find solace in the wonders of STEM education. Like a kaleidoscope of knowledge, STEM — Science, Technology, Engineering, and Mathematics — illuminates the path toward a future filled with endless opportunities, unveiling the undeniable essence of STEM education.

Within the walls of my imagination, STEM education blossoms into a vibrant garden, where young minds cultivate seeds of curiosity, blooming into magnificent creations. It is here, amidst the lush landscapes of possibility, that I find my place as a Nepali girl embracing the treasures granted by STEM.

I am torn between my two identities: being born and living in America with

a Nepalese background, and going back to Nepal, “being too white” for my culture. STEM, like a celestial symphony, weaves together knowledge and empowerment. It is a sanctuary where I find the courage to defy conventions and redefine the narratives that once shackled me. As a Nepali girl navigating the vast terrain of opportunity, I am granted the gift of self-discovery, of unearthing hidden potentials buried beneath the weight of cultural expectations. STEM nurtures my spirit, allowing me to embrace the beauty of my heritage while reaching for the stars.

As I step into the realm of STEM, I discover a world where boundaries are shattered like fragile glass, where gender holds no dominion over ambition. In STEM’s embrace, I am no longer confined by the limited expectations society may impose upon me. Instead, I am free to chase the ethereal dance of innovation, to sculpt the contours of my dreams with hands guided by logic and reason.

My parents sacrificed everything for their three children. My father was interested in STEM, and soon after getting his bachelor’s in computer science, his life began to grow exponentially. He visited the United States of America and fell in love with what more he could do. Just a couple of months after his first son was born, he wanted his wife and son to move to America, so that they could experience more. Adjusting to the American lifestyle was difficult enough, and to have a world full of opportunities was superabundant.

My mother and father settled down, and eventually, had my sister and me. Growing up, I felt out of place. With partial knowledge of my culture, I would never fit in anywhere. I would always find myself cowering beneath everyone else, worried about where I could go wrong. I felt as if I were an inconvenience to both my parents and my culture, and to being in America. But adjusting to American culture was easy enough, but in Nepal, I was lost. I hid in the shadows and followed people’s footsteps. I wasn’t who I truly wanted to be.

In the grand tapestry of life, the thread of STEM education intertwines with growth, forging a path toward a prosperous tomorrow. STEM education possesses a profound inherent worth in molding and delineating our shared historical narrative and culture, among various other aspects. The skills and knowledge acquired within the halls of science and technology unlock doors to a realm of promising careers and boundless potential. As a first-generation Nepali girl, I hold within me the power to become an agent of change, a catalyst in propelling both myself and my newfound home, America, towards brilliance.

Yet, STEM's significance transcends personal ambition and prosperity. It weaves an intricate web, connecting the strands of humanity as we embark on a collective journey toward progress. In an age where global challenges threaten our shared existence, STEM education emerges as a beacon of hope. It empowers me, a Nepali girl living in America, to tackle different problems. It is through STEM that I find the tools to shape a brighter future, not only for myself but for the world that embraced me.

I learned a lot about myself throughout my years of schooling in America and figuring out where I stood, where my interests lie. After everything my parents did for me, I realized that I had my own story to forge, one that integrates my American and Nepali cultures, one that incorporates STEM into my life.

As I traverse this path of discovery, my journey merges with the mosaic of my community. STEM education becomes the thread that stitches together the tapestry of my Nepali heritage with the vibrant American landscape. It allows me to bridge cultural divides, cultivate unity and understanding, and uplift those who, like me, strive to transcend the limitations imposed upon them.

In this symphony of imagination, where words create worlds, I stand firm in my belief that STEM education is not merely essential but indispensable.

As a first-generation Nepali girl living in America, I bear witness to the transformative power of STEM, a power that shapes dreams, empowers generations, and propels us toward a future illuminated by innovation. Through the lens of STEM, I find my voice, my purpose, and my unwavering determination to craft a world where endless possibilities are no longer confined to the realm of dreams.

Ten pinches + two circles = STEM.

By: Eveer Soriano

In a world where knowledge dances and innovation unfold, there exists a captivating story—a tale that weaves together STEM education and the vibrant language of American Sign Language (ASL). Imagine a young child, immersed in a world of silence, discovering the profound connection between sign language and the boundless possibilities of science, technology, engineering, and mathematics. This child's journey, intertwined with the influential presence of a deaf father, showcases the transformative power of STEM. Through scientific exploration, technological marvels, and the fusion of communication and knowledge, STEM education empowers individuals with diverse abilities, opening doors to a sustainable and inclusive future. It's time to learn STEM through ASL:

S: Science

(Hold up your dominant hand into a fist, palm facing out, and ensure that your thumb is tucked in front of your fingers.)

Science, the backbone of human progress, fuels our pursuit of knowledge and understanding. Through scientific exploration, we unlock the fundamental truths of the universe, unveiling possibilities that shape our lives. Drawing from personal experiences with my father and witnessing the impact of assistive technology, I realized the profound significance of scientific advancements in empowering individuals with disabilities. The union of STEM education and science not only equips us with vital skills but

also promotes inclusivity and a more compassionate society.

T: Technology

(Hold up your dominant hand into a fist, palm facing out, and tuck your thumb in between your index and middle fingers.)

Technology, the driving force behind innovation, serves as a catalyst for change in our rapidly evolving world. With each passing day, groundbreaking technologies such as computer vision and AI revolutionize the way we interact with the world around us. As I delved deeper into the realm of technology, I witnessed firsthand its potential to bridge gaps and overcome barriers. Through STEM education, we can empower individuals with the tools and knowledge to harness technology for the greater good, paving the way for a more inclusive and accessible future.

E: Engineering

(Hold up your dominant hand, palm facing out. Touch the tips of your top 4 fingers together, tightly curving them inward. Curl your thumb tightly into your palm, touching the tips of the fingers above.)

Engineering, the creative art of problem-solving, lies at the heart of human ingenuity. It is through engineering that we transform concepts into tangible solutions, shaping our environment and improving lives. As we embrace STEM education, we unlock the power to address the challenges faced by people with disabilities. By integrating engineering principles and inclusive design practices, we can create technologies and infrastructure that cater to the needs of all individuals, fostering a sustainable and fair world.

M: Mathematics

(Hold up your dominant hand, palm facing out, and curl all your fingers into your palm. Tuck your thumb between your ring and pinkie fingers.)

Mathematics, the language of patterns and logic, forms the backbone of scientific inquiry and technological innovation. It enables us to unravel the complexities of the universe, providing a solid foundation for problem-

solving and critical thinking. In the context of STEM education, mathematics equips individuals with analytical skills, fostering a mindset that embraces innovation and drives progress. By integrating mathematical concepts into the fabric of education, we lay the groundwork for a future where everyone can actively participate in the advances of STEM.

We could spell it out as the acronym it is, or we could say it way easier as the lexical sign STEM is represented by. Let's follow the next steps:

Imagine standing at the threshold of knowledge, hands poised in a neutral position. Pinch your fingertips together, embodying the precision of STEM inquiry. Extend your arms forward, embracing the forward-thinking mindset of innovation. Move your hands in circles, symbolizing the continuous cycles of learning and discovery. Bring your hands closer, intertwining the circles to represent the interconnectedness of STEM fields. As the circles overlap, embrace collaboration and synergy. Separate your hands, acknowledging the iterative nature of scientific progress. Lower your hands, humbly recognizing the vastness of knowledge. That's it! You just said "STEM" in American Sign Language.

All we need in the advances of our education are ten pinches and two circles (STEM). Let this vibrant tapestry of knowledge guide us as we march forward into a new era, propelled by the advances of AI and the transformative potential of STEM. Together, let's embrace the power of STEM education and unlock doors to endless possibilities to shape a future where the brilliance of every individual can shine through their own language.

STEM in the Black Community

By: Christopher Rhatigan

As a member of the Black community, I believe that STEM education is essential for our community's future. STEM fields offer the potential for economic advancement, societal progress, and personal growth.

Firstly, STEM education provides a gateway for economic advancement. In today's world, technological advancement is the key to economic success. STEM professions are among the highest-paying and fastest-growing occupations in the world. By gaining skills in these fields, Black individuals can increase their earning potential and secure better job opportunities. This, in turn, will lead to greater financial stability for individuals and their families, and ultimately the community as a whole.

Secondly, STEM education is crucial for societal progress. The Black community is disproportionately affected by issues such as poverty, lack of access to healthcare, and environmental injustice. STEM fields are essential in addressing these issues and developing solutions to improve our communities. For example, medical advancements in STEM fields can lead to new treatments and cures for diseases that disproportionately affect the Black community. Furthermore, technologies developed in STEM fields can be used to combat climate change and improve access to clean water, food, and energy. By increasing representation in STEM fields, the Black community can contribute to developing innovative solutions that will

benefit society as a whole.

Lastly, STEM education offers personal growth opportunities. Many individuals in the Black community face systemic barriers that limit their opportunities for personal growth and development. STEM education offers an opportunity to overcome these barriers and achieve personal success. By gaining knowledge and skills in STEM fields, individuals can improve their critical thinking, problem-solving, and analytical skills. These skills can be used in various areas of life, leading to personal growth and development.

Unfortunately, the Black community is underrepresented in STEM fields, and this has been a persistent problem for decades. According to the National Science Foundation, only 9% of the science and engineering workforce in the United States is Black. This underrepresentation is due to various factors such as lack of access to quality STEM education, systemic racism, and implicit bias. Therefore, it is crucial to increase access to STEM education and create a supportive environment for Black individuals to thrive in these fields.

To increase Black representation in STEM fields, we need to start at the grassroots level. We need to provide quality STEM education from an early age, starting in elementary school. This education should be accessible to all, regardless of socioeconomic status. Furthermore, we need to create mentorship and internship programs that offer opportunities for Black individuals to gain experience and exposure to STEM fields. By doing so, we can create a pipeline of Black individuals who are interested in pursuing STEM careers.

Additionally, we need to create a supportive environment for Black individuals in STEM fields. This includes increasing diversity and representation in STEM organizations, creating safe spaces for Black individuals to discuss their experiences, and addressing implicit bias and racism in the workplace. By creating a supportive environment, we can ensure that Black individuals

STEM IN THE BLACK COMMUNITY

can thrive in STEM fields and contribute to the advancement of society.

In conclusion, STEM education is essential for the future of the Black community. STEM fields offer opportunities for economic advancement, societal progress, and personal growth. However, the Black community is underrepresented in these fields, and we need to take action to increase representation. By providing quality STEM education and creating a supportive environment for Black individuals, we can increase diversity in STEM fields and ensure that the Black community can contribute to the advancement of society.

Science Diplomacy: How STEM Effectuates Global Change

By: Megan Haubrich

On June 28, 1974, the paper “Stratospheric sink for chlorofluoromethanes: chlorine atom-catalysed destruction of ozone” first appeared in *Nature*. Its hypothesis? Anthropogenic chemicals called chlorofluorocarbons (CFCs) were ripping a hole into the ozone layer, the atmospheric blanket that protects humans from harmful ultraviolet (UV) radiation.

Authors Mario J. Molina and Frank Sherwood Rowland of the University of California Irvine intended the publication to alert the scientific community to the potentially catastrophic global problem. However, they likely did *not* expect to be called to testify to the U.S. House of Representatives six months later or to inspire one of the most monumental global environmental legislation collaborations in history: the 1987 Montreal Protocol.

I have this short story committed to memory. It is one of the many fan-favorites I rattle off when asked during my science, robotics, and engineering presentations, “But why is STEM education so important?” Of course, there are many economic and social reasons I could give – doctors and engineers *do* make a lot of money, and medicine and engineering *are* viewed by society as honorable professions. However, my favorite argument is political. We can leverage science and engineering collaborations to

strengthen international relationships and, often, effectuate global change. What I am describing here is an emerging field known as science diplomacy.

Science diplomacy is an overarching term for three categories of activities, defined by the Royal Society and the American Association for the Advancement of Science in January 2010: diplomacy for science, science for diplomacy, and science in diplomacy. The first and second categories, diplomacy for science and science for diplomacy, are what I will focus on.

The Montreal Protocol is a perfect example of science for diplomacy, the way scientific discoveries and advances can promote diplomatic objectives, creating opportunities for constructive partnerships among nations. First, scientists identified a problem: the presence of CFCs was depleting atmospheric ozone concentrations, exposing humans to dangerous levels of ultraviolet radiation. This threatened human health while posing a risk to global agricultural productivity and ecosystem sustainability. This challenge created an opportunity for nations across the globe, regardless of other political, social, and economic differences, to come together in search of a solution. As of October 2022, 198 parties have signed the Montreal Protocol – including nations often in conflict with each other, such as Israel and the State of Palestine, or the United States of America and the Russian Federation. Additionally, it was the first universally ratified treaty in the history of the United Nations.

Similar patterns of international cooperation exist across pollution control law and natural resource law, including the Kyoto Protocol, which regulated greenhouse gas emissions across various nations, and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which aimed to protect endangered plants and animals. Meanwhile, the same technological advances that spurred the development of intercontinental ballistic missiles inspired the Outer Space Treaty, which set the basis for international space law.

Sometimes the promise of scientific or technological breakthroughs can drive international cooperation, as described by diplomacy for science. The International Space Station (ISS) is one example of this. The United States had planned to build its own space station named *Freedom*. However, they eventually agreed to merge their plans with those of Roscosmos, the Russian State Space Corporation, while accepting contributions from the European Space Agency (ESA) and Japan. ISS collaborations have increased human understanding of neurodegenerative diseases, such as Alzheimer's and Parkinson's, improved methods of combatting osteoporosis on Earth, and analyzed cosmic particles using an alpha magnetic spectrometer. Even in periods of geopolitical tension, such as Russia's 2014 invasion of Crimea and the 2022 invasion of Ukraine, the ISS provided a point of commonality despite the global conflicts.

Other examples of diplomacy for science are the establishment of the International Thermonuclear Experimental Reactor (ITER), a sustainable energy generation project between seven international parties, and the UN's Intergovernmental Panel on Climate Change. Projects like these seek to tackle global challenges such as pandemic management, exploration of the global commons, and clean energy generation.

Back to that initial question: why is STEM education so important? STEM is an olive branch; it provides opportunities for nations to set aside their differences and walk together in pursuit of shared, noble goals. So, the next time you're grappling with a challenging math problem or biological concept, just remember – you might be one step closer to changing the world.

Solving Real World Problems Using STEM

By: Prisha Shroff

STEM. What does it really mean? An acronym. A concept introduced in schools as a combination of subjects. From light bulbs to ChatGPT, STEM is the backbone of all innovations. STEM has been driving our lifestyles for centuries and is already shaping the future. STEM has the power to develop critical thinking skills. It requires students to think creatively, analyze data and solve problems.

Let us truly understand the importance of STEM by diving into the story of a girl who used STEM to solve one of the world's biggest problems: wildfires.

S: Science is the process of understanding and acquiring new knowledge of the natural world. It is asking questions and delving into the curiosity of how everything works.

My journey started when I witnessed a wildfire firsthand as I was driving back home from Los Angeles. For me, the experience was close to my heart since my friends had to evacuate their homes, houses were destroyed and the air pollution was so bad that we were advised not to step out of the car. A few days later, I realized the gravity of this problem when I watched the burning of forests on a larger scale in Australia and the Amazon.

And then I was engulfed with curiosity. How do wildfires start? What are

the factors that keep them growing? How can we detect them? And most important, how can we prevent them from occurring?

This is when I used Science to conduct deeper research on wildfires.

I learned that wildfires are affected by vegetation, temperature, precipitation, wind, soil moisture, land cover, humidity, burned area index, Ozone and CO₂, and decided to use this knowledge to create a solution.

T: Technology is the application of scientific knowledge to solve problems and improve efficiency. It involves utilizing tools and techniques for a practical purpose.

To create the solution, I had to develop a framework, and settled on using 2 technologies: AI and Drones. Artificial Intelligence is replicating human intelligence in machines. Drone are unmanned vehicles that reach a location and take action faster than humans, a skill needed for tackling a problem such as wildfires. How do I combine these technologies to develop a real solution to be used by the fire departments?

E: Engineering is the process of applying science and math principles to develop and build a solution to the problem. It is the process of redesigning, and retesting until the solution can be used in the real-world.

Utilizing the engineering design process, I developed the AI-based Prevention, Detection and Suppression System, which could prevent, detect and suppress wildfires. And after working on the system for months, and redesigning and retesting, a final solution was built.

First, the solution loads real-time satellite and meteorological data for the factors that affect wildfires. Then, it eliminates areas where wildfires cannot occur; such as water bodies and areas with rainfall.

It utilizes a random forest classifier, a type of AI, to detect the hotspots (areas where wildfires can occur in the future) and identify those actual wildfires. But the model wasn't just built on the first day.

One of the first methods tested used OpenCV and image processing to identify hotspots and wildfires. When using OpenCV and image processing, an accuracy of 33.3% was obtained. The model was redesigned to utilize the satellite data directly rather than images and logistic regression (AI model). The new design attained an accuracy of 74.8%. Then, the model was revised a third time with the random forest classifier. The system attained a 98.6% accuracy.

M: Math deals with the relationships between numbers and patterns. It can be used to analyze data and determine the accuracy of results.

Math is a part of the algorithm and is also used to analyze the performance of the model. The third design attained the best accuracy of 98% and was utilized in the final solution. Math helped me understand that my product worked and has potential for the future.

STEM. It seemed like a concept that only the smartest people could understand, but in reality, an 8th grader was able to use this to solve the global problem of wildfires. STEM is a medium for anyone to create a solution to a problem that they are passionate about.

To conclude, STEM is essential because we have the power to use it to shape the future.

Blank Canvases

By: Jai Premchand

Equality. It's a word we hear a lot these days, be it in speeches about pay gaps, or in connection with discrimination. I feel the size of the gap in educational STEM experiences is often overlooked and yet the area is so important. Learning opportunities in formative years, when the brain is a blank canvas, are the best time to build STEM foundations. Education frequently improves life opportunities, job prospects and social mobility, sometimes moving individuals across the poverty line so that they can eat regularly and afford housing, yet nearly a fifth of children around the world do not even get the opportunity to attend primary education. The circumstances we are born into all too often dictate the narrow life path we lead, which can be hard to stray from, particularly without STEM educational experiences in early years and in adulthood.

STEM usually changes the world for the better and it provides life opportunities. Last year I assisted in the development of a website to sell handmade paper made by a small community of marginalised women in India, the profits of which were sent back to the village to be used as they felt fit. The women soaked dried paper pulp to make paper sheets which were dried in the sun in batches. Their main job was often elsewhere in the village so hours at the paper hut were flexible, working from a building which relied on good water availability and a predictable power supply during the hours of darkness. Children were welcome to watch or learn the skill and help, as

there was no other childcare provision.

My STEM education enabled me to embrace my website work within the UK. My maths education allowed me to devise an appropriate costing pathway, my computer science lessons meant I was familiar with any IT challenges that arose, financial stability meant I had access to a computer, the internet and a comfortable place to sit and work, and my ability to read and write meant I could adequately articulate the product description in a way to attract customers.

My STEM education was essential to the website design, but I also reflected on how it would help me if I lived in the village where the paper was produced. STEM skills would still be essential, but vastly different ones. My knowledge in, for example, mathematical integration would be redundant, but my ability to rapidly add, subtract and multiply numbers of paper balls and sheets, much more useful. Could I fix a generator if the power went down and we needed light? Without the internet I am not sure I could, and in the village, the internet may be unpredictable. Furthermore, if I recognised the problem, would my STEM education enable me to fix the machine or build a new part rather than try to acquire one? I would need to understand the weather, not by relying on Google but by learning about the environment around me, what affected our water supplies, how to improve ventilation within the paper hut during the hot months and keep rain off the drying paper through the Monsoon. How would I learn this? My parents, a teacher, a school? All my needs would require STEM at a level, but I would need the educational infrastructure and financial support in place to allow me to learn and develop concepts. Would there be microfinance opportunities for the village community, such as those developed by Muhammad Yunus? If I could embrace and overcome the challenges faced, I could survive and if the community and I had access to the targeted STEM education we needed, my community and I could potentially grow and prosper.

STEM education does not necessarily need to bring dramatic change to

communities. Too much change can bring resentment. Education often brings with it social mobility which can change the population dynamics in communities as the educated may seek employment and choose to settle away from their hometown. This can be positive at the individual level but have more negative effects for the village as their more skilled members leave. STEM education, however, can bring employment opportunities and with it, better wages that increase the quality of life for the whole family if earnings are shared. There are always pros and cons to consider.

I believe that STEM education is essential, but it must be well funded and appropriately targeted to ensure it is tailored to meet the needs of the population at which it is aimed.

Achieving the SDGs with STEM

By: Muhammad Fowwaz Moeen

In Norway, almost 40% of fish species are overfished or depleted.

In Pakistan, about 1 in 4 primary school-age children are out of school.

In the US, non-renewable energy sources (dominated mainly by fossil fuels) account for over three quarters of energy consumption.

What do all of these statements have in common? They show that reaching the United Nations Sustainable Development Goals (SDGs) is no easy task. These 17 important goals, launched by the United Nations in 2015, call for the global community to adapt, innovate, and revolutionize social structures and economies to achieve humanitarian and environmental goals. Although it won't be easy, achieving these goals is a necessary task for everyone. STEM (Science, Technology, Engineering, and Mathematics) is one of the most significant drivers of innovation and implementation of change in our world – placing it at the forefront of the mission to achieve the SDGs by 2030. Educating youth in STEM is essential to achieve the SDGs as it not only provides young learners with the necessary knowledge to understand scientific and technical advancements, but also improves many skills which are increasingly important for embracing change and shaping the future. This article highlights just a few examples of how STEM (and an effective education in it) can advance progress on the SDGs in different countries.

Driving down a road through Islamabad, the capital city of Pakistan, we stop at an intersection, drawn to a halt by the sea of vehicles patiently waiting

for their turn to proceed. As we come to a standstill, my gaze drifts to the bustling scene unfolding beside us. Tens of street vendors maneuver amidst the chorus of honking horns – each carrying unique items ranging from homemade candies to crafted bracelets. None of them particularly stand out, yet one catches my eye – a child, no older than twelve, not at a school learning the alphabet or solving equations, but moving swiftly through the labyrinth of cars, their worn-out sandals barely touching the scorching pavement. An estimated 22.6 million children in Pakistan face similar challenges and are out-of-school, hindering progress towards SDG 4 – Quality Education. A STEM education enables students to develop problem-solving and innovation skills, providing them with the tools to develop novel solutions to global challenges – such as online learning platforms and mobile applications to provide education to millions of more children across the world, and advancements in medical technology to provide low-cost essential services to remote or underdeveloped regions.

Sailing along the picturesque coast of Norway, the mesmerizing beauty of the fjords envelops me, but beneath the serene surface lies a pressing concern: overfishing. As our boat glides through the chilly waters, I notice the telltale signs of an industry in turmoil. Fishing vessels, once bustling with activity, now struggle to find abundant catches. Fishing in Norway is at a staggering 164,000 metric tons above scientifically advised sustainable levels – resulting in adverse effects on SDG 14 (Life Below Water). STEM holds the key to innovative solutions that can help restore and sustain fish populations in Norwegian waters – helping us better understand fish behavior, migration patterns, and reproductive cycles. This knowledge, coupled with advancements in marine technology, enables the development of sustainable fishing practices, including the implementation of size limits, closed seasons, and marine protected areas. STEM can also provide invaluable tools for monitoring and surveying progress through operated vehicles, satellite imagery, and acoustic technology.

As we step into a bustling metropolis in the United States, the cityscape re-

veals a different but equally pressing concern. Towering buildings and urban sprawl dominate the horizon, presenting quite the grand sight, yet the air here is thick and filled with smog. The culprit is easily found – power plants billowing thick plumes of smoke, a stark reminder of the extensive use of non-renewable energy sources. The reliance on fossil fuels accounts for over three quarters of the nation's energy consumption, presenting a formidable obstacle to achieving sustainability goals, especially SDG 13 (Climate Action). STEM education emerges as a crucial catalyst in this context, equipping individuals with the scientific and technological knowledge to address this challenge. By fostering scientific and technological problem-solving skills, STEM empowers learners to develop alternative energy solutions, ranging from renewable sources like solar and wind to advancements in energy storage and efficiency. With STEM education at the forefront, we can pave the way for a sustainable energy future, minimizing environmental impact and steering society towards a cleaner, greener path.

STEM education is essential to ensure the achievement of the United Nations Sustainable Development Goals as soon as possible. The examples of Pakistan, Norway, and the United States demonstrate the pressing challenges faced by different countries. Whether it's in the UK or Nigeria or anywhere else, addressing anything from poverty to climate change, STEM education emerges as a powerful tool to address complex global issues. By equipping learners with scientific, technological, engineering, and mathematical skills, STEM education enables innovative problem-solving and fosters a deep understanding of the challenges at hand. It empowers individuals to develop sustainable solutions by cultivating critical thinking, creativity, and adaptability – crucial skills for embracing change and shaping a future that aligns with the SDGs. Given the prevalence of these issues across the globe, investing in STEM education for all is paramount to drive meaningful progress towards the SDGs, creating a more equitable, resilient, and sustainable world for the betterment of humanity and the planet.

Breaking Barriers: The Vital Role of STEM Representation in Closing the Gender Gap

By: Rainey Reese

I started high school in Chicago, Illinois at twelve. I tested into the highest-level math class at my school, and my freshman-year math teacher inspired me to join the math team. Math became my passion. I began to push into mathematics through workshops in the city, clubs at school, and online. I searched for math everywhere I could. As I gathered all of these different experiences, one thing stuck out to me: I was often the only Black girl in the room. As a result, my experience as a Black girl in STEM was filled with discrimination. People refused to take me seriously or labeled me ignorant before working with me. This experience was isolating, and I was often discouraged. Still, I persevered, and I began a program for high school students learning about artificial intelligence. This cohort was full of incredible kids from all backgrounds. The girls were brilliant, insightful, and passionate about STEM. As I connected with the other kids, I quickly learned that I was not alone in my experience. Following my passion for STEM liberated me. I made genuine connections, discovered things about myself I had never realized, and grew as a lifelong learner. Sticking with STEM allowed me to be the representation I always wanted in mathematics. Therefore, the importance of STEM representation cannot be overstated. STEM education is essential; without proper representation, gender discrimination is reinforced through the division of men and women

in all STEM fields.

The division of girls and boys in STEM happens early on in academic careers. Girls and boys have the same level of interest in mathematics in elementary school. As girls move into high school, however, fewer pursue math. Girls are often discouraged from pursuing STEM fields from a young age, due to gender stereotypes and biases from teachers, parents, and peers.

This discouragement leads to fewer girls majoring in STEM fields in college, which leads to fewer women in STEM-related jobs. Disproportions in these interests have real consequences for us all. Women being left out of STEM fields creates disparity for everyone.

This disparity can be seen in artificial intelligence's insensitivity. For example, most voice assistants respond inappropriately to abuse and harassment. Some statements considered creepy or predatory in real life are seen as playful when said to feminine voice assistants. These dated gender stereotypes remain unchanged in the ever-changing world of technology, reinforcing harmful stereotypes on a massive scale. This sexism is left unnoticed because women represent a small minority of the largest technology companies. Because of the lack of diversity, discrimination remains unnoticed. As a result, women are often forced to navigate technology fields without the same access to resources or funding that men have. It is harder for women to break into the industry, which leads to gender disparity. This bias reflects the issues of inclusion and representation.

With women being underrepresented in these workplaces, women are underrepresented in technology. As advanced technology grows intertwined with daily use, considering the future is more imperative than ever. Accepting these stereotypes in technology projects harmful gender roles globally, effectively continuing the cycle of sexism. This lack of gender diversity can have a huge impact on products and services. Without a diverse perspective, products and services can be created biased. This has negative outcomes, including reinforcing the notion that women are less capable than their male counterparts. Furthermore, cultivating diverse perspectives drives innovation and problem-solving. For example, Eugenia Cheng, a British female mathematician, utilizes her experience to uplift women in STEM

through her service in books, programs, and teaching. She brings a unique perspective to combating sexism, empowering girls interested in STEM in ways that undiversified projects cannot achieve.

Discrimination has no place in society. Acknowledging bias is the first step to closing the gender gap in STEM. It is crucial to prioritize women's inclusion in STEM industries when a noticeable gender gap is present. All barriers that prevent women from entering these fields must be removed from the moment they begin their academic careers. Fostering inclusion is the most important part. Actions can be taken, including mentorship programs for young girls interested in STEM and diversity and inclusion training for STEM companies. These programs can continue into adulthood, actively fighting against sexism at all stages of life. Therefore, STEM education is essential to ensure women can pursue their dreams and excel. If discrimination flourishes in STEM fields, our futures are at stake.

There is a critical call to address the gender gap and discrimination in STEM. STEM education fosters inclusion, diversity, and progress for everyone, especially the younger generation. With the obligation to nurture students, ensuring equal opportunity for girls and boys is the first priority. The potential of representation in STEM is completely transformative, shaping a more inclusive and equitable future. STEM education for girls must be protected and encouraged to truly advocate for greater women's representation in STEM industries. STEM education is key to projecting representation and unlocking a brand-new world of inclusivity.

Redefining Success: My Journey in STEM and the Power of Failing Up

By: Estefania Olaiz

STEM education (which encompasses science, technology, engineering and mathematics) offers an exciting pathway for exploration and discovery. Being passionate about physics myself, I have experienced first-hand both the challenges and benefits associated with STEM education through research projects. These required managing remote telescopes, analyzing data, writing papers for publication – and, accepting failure as a transformative force. Through sharing my story involving research, I hope to shed light on its practicalities as well as failure being an enabler to growth and learning.

I have always found inspiration in the night sky, its vastness captivating me while inspiring a profound curiosity of its inner workings. This fascination led me to pursue STEM study – particularly double star research. Along my scientific journey I have come to appreciate that failure can provide important lessons, opening opportunities for personal growth and unveiling meaningful insights.

Researching double star systems has exposed me to the intricate mechanisms governing celestial bodies existing in binary systems. I discovered the fascinating mechanisms governing their interactions, but understanding them required careful study and dedication; while exploring this field has required both patience and dedication. As my studies progressed deeper, challenges and setbacks began to teach me important lessons about

resilience and adaptation. Failure became part of this journey and led me to adjust my approaches and try to broaden my knowledge base – and, to write this paper itself.

My research involved managing remote telescopes, which presented a lot of unique challenges. Coordination among observatories across time zones and surmounting technical obstacles were far from glamorous – late nights spent troubleshooting experimental setups or waiting patiently for clear skies were part of the journey; and acted as a very important reminder that scientific inquiry requires dedication, resilience and acceptance of its practical limitations in pursuit of knowledge.

Then, researching data sets presented me with another challenge during my research journey. I found that delving deep into binary star systems required meticulous care and persistence. Sometimes this involved long sessions of poring over spreadsheets and graphs, wrestling with complex statistical analyses or recalibrating my approach and refining methods – yet these challenges taught me the value of adaptability and resilience needed for scientific exploration.

On the other hand, writing scientific papers was essential in sharing research findings, yet it came with its own set of obstacles. Constructing an engaging paper meant navigating technical

jargon, editing carefully and facing occasional writer's block. Also, any revisions required multiple passes to achieve clarity and precision; ultimately this exercise required persistence in acknowledging that science takes time, hard work and revision – sometimes complete rewrites of sections are needed along the way!

As I reflect upon my journey through STEM, I realize that redefining success was a critical turning point in my personal development. Failure, once something I saw as a setback, now holds an inspiring significance in my life. At moments of seemingly defeatist failure, I have come to appreciate the true potential of “failing up.” Instead of dwelling on setbacks, I’ve come to embrace their lessons as valuable tools for growth. Each stumble along my journey has served as an opportunity to gain greater achievements – resilience, adaptability, and perseverance.

Adopting this mindset shift has enabled me to evaluate success not solely by final outcomes but also by the personal growth and unwavering determination I've developed throughout my scientific endeavors. Through this new lens, I've gained the courage to take risks and venture uncharted territories in STEM without the fear of failing. For me nowadays, failure has become a stepping stone rather than an end point, one that I can use to learn and grow.

My experience in STEM research, specifically double star research, has demonstrated the realities of the scientific process and the transformative power of failure. From managing remote telescopes, analyzing data, and writing scientific papers to adaptability in managing remote telescopes and adaptability when handling failure as an integral part of my growth as a person and researcher; I've come to learn that STEM education equips us with the right mindsets for embracing mistakes, while learning from them, and striving for learning experiences that expand our understanding of the world.

Empowering Hispanic Women in STEM: The Importance of STEM Education for Women

By: Roselyn Marrero

The STEM (science, technology, engineering, and mathematics) sectors have historically had a low representation of Hispanic women. However, their contributions to these fields are priceless and have a strong chance of spurring advancement. As a hispanic woman from Miami, I found it intriguing that many hispanic woman are destined to overcome financial barriers that enables them to prosper a higher level of education in order to fulfill the end in suffrage. Hence, writing about the importance of obtaining an education, specifically STEM, widens the perspective of others to understand the significance it has on women and to aspiring STEM majors.

STEM education acts as a catalyst for gender equality by addressing barriers that have historically prevented women from entering STEM disciplines and challenging cultural preconceptions. STEM education helps to combat gender biases and empowers women to pursue careers in historically male-dominated fields by fostering an environment that encourages them to pursue their interests in science and technology. It encourages equal opportunity so that women can offer their special perspectives, abilities, and skills. Women learn to approach problems methodically, make informed decisions, and adjust to new circumstances through practical experimentation, analytical thinking, and logical problem-

solving techniques. These abilities enable women to be resilient, creative, and flexible in a world that is constantly changing and are important in a variety of employment fields.

Hispanic women bring a rich tapestry of cultural strengths and experiences to the field of STEM. Their unique perspectives and insights allow for innovative problem-solving approaches and the exploration of new avenues in scientific research. By embracing and celebrating diversity, the STEM community can harness the full potential of Hispanic women, promoting a more inclusive and holistic approach to scientific advancement. The presence of role models is crucial in inspiring young Hispanic women to pursue STEM careers. Representation matters, and when Hispanic women see others who share their background and experiences excelling in STEM, it instills a sense of possibility and achievement. By increasing the visibility of Hispanic women in STEM fields, we can inspire future generations and create a supportive network where they can thrive.

In fact, STEM education plays a vital role in empowering Hispanic women by providing them with the knowledge, skills, and tools necessary to excel in STEM fields. Through quality education and hands-on experiences, Hispanic women gain proficiency in critical thinking, problem-solving, data analysis, and technical expertise. These skills not only prepare them for successful careers but also enable them to make meaningful contributions to scientific research, technological advancements, and societal challenges. Hispanic women in STEM have the potential to address the specific needs of their communities and contribute to the greater good. Their cultural understanding and insights allow for the development of targeted solutions in areas such as healthcare disparities, environmental conservation, sustainable development, and social equity. By nurturing and supporting their endeavors, we can foster positive change that positively impacts Hispanic communities and society as a whole.

Moreover, STEM education empowers women to tackle pressing societal challenges. Whether it be climate change, healthcare disparities, poverty, or technological advancements, women with STEM skills can drive meaningful change. With their diverse perspectives and collaborative abilities,

women can bring unique insights and solutions to these complex issues. STEM education equips women with the tools and knowledge necessary to contribute to sustainable development, social equity, and the betterment of society. Thus, by inhibiting further source of educational recognition for women through STEM, women have the opportunity to build supportive networks and receive mentorship from experienced professionals. These connections not only provide guidance, advice, and inspiration but also offer a sense of belonging and community. Mentorship allows women to navigate the challenges they may encounter in their educational and professional journeys, fostering resilience and confidence. Supportive networks foster a culture of collaboration, promoting the success and advancement of women in STEM.

In conclusion, Women are empowered by STEM education to realize their full potential, dismantle obstacles, and help create a society that is more inventive and inclusive. STEM education gives women the skills they need to succeed in a variety of areas through advancing gender equality, developing critical thinking abilities, encouraging creativity, and tackling societal concerns. Women's potential is not just unlocked when we invest in STEM education for them; we also harness the collective genius and contributions of women, advancing development and ensuring a better future for everybody.

STEM - The Greatest Flashlight

By: Joseph Edwin Selvakumar Joy Merwin

A Flashlight. Illuminating the uncertain darkness and revealing truths that lie hidden, the simple yet significant invention serves as a beacon of light through the most treacherous endeavours. With every step forward the light grows stronger and more resilient, the perfect companion to a maverick.

Now, one might wonder, what does a flashlight have to do with STEM? The answer is : Everything. Despite being a term that was coined in the recent 2000s, STEM has been intricately intertwined with our lives since the dawn of mankind. Lighting up and guiding society's every step, STEM is undoubtedly the best flashlight that we have received. From the days of riding on horses to the current modern era where electric cars rule the roads, STEM has moulded every inch of the world that we live in today.

Back in the early 2000s, there lived a man. He lived in a small city in the state of Tamil Nadu, India. Life back then was a great struggle for him. Despite his difficult plight living on minimum wage, he always had an eternal passion for STEM. One fortunate day, he got the opportunity to work in a distant country named Singapore. Reluctant to leave his newlywed wife and family, he took the decision to work in Singapore. When one hears the word "Singapore" they immediately think of the tall skyscrapers, clean streets and luxurious lifestyles. But on the other side of Singapore lie the unsung heroes who have built Singapore from the ground up. This man was one of

these brave migrants who struggled to survive in this unknown territory. His only guidance was his flashlight, STEM. Using this tool, he was able to work as an Engineer and slowly but steadily traverse through this thick forest. He could finally move his wife and two kids to a tiny rented room in Singapore. Even then, life was difficult providing for a family of 4 in a country with high living costs.

This man is none other than my father. Even before I was born, STEM had begun its influence on my life. Being a migrant, it was a daily struggle to keep up with Singapore's rigorous academic demands. Every time I went to school, there was this unbearable pressure on my shoulder to do well in my academics. At that time, it was my only light at the end of the tunnel to improve the life of my family. There grew my liking for STEM. Soon, my dad got better jobs and our family was able to live a comfortable middle-class life. However, my interest in STEM still persisted. Singapore's excellent education system allowed me to grow my interest in STEM to a full-on obsession. Be it robotics, research or general science projects, I was fully occupied with STEM in my free time.

One of the key characteristics of STEM is that it gives rise to numerous opportunities. My abilities in STEM allowed me to represent my school in many olympiads and competitions which provided me a platform to truly showcase my talents. When I was in Secondary 3 (9th grade) my love and aptitude for STEM resulted in me being picked for the Science Mentorship Programme (SMP) where I together with my 2 groupmates got to work with professors in a local university to conduct research. Until now it is one of my fondest memories. I will never forget the tireless days and nights working in the labs conducting experiments, collecting data and troubleshooting problems. It was a meaningful experience as it prepared me for my future and taught me vital skills such as critical thinking and improvisation. Whatever challenges we faced during the course of the experiments, STEM continued to act as the flashlight to me and my teammates. This brings me to my second point that STEM creates new

friendships, strengthens bonds and allows you to socialise. Despite being a rigorous programme, SMP allowed me and my group mates to become as close as family. Moreover, after this programme, we continued our research and were selected for the Singapore Science and Engineering Fair (SSEF). There we got to meet a myriad of like-minded individuals from all walks of life. Regardless of the awards that were won during SSEF, it was an enjoyable experience for all of us as we got the platform to share our knowledge and learn from others.

Moving on, STEM education is the flashlight for the future. In a world where we face uncountable global challenges, STEM provides the solutions to all of them. One of the main problems that me and my group mates wanted to address was food security. Hence our project for SSEF was about increasing crop yield using a novel method. I still remember us not expecting to win anything in SSEF. We were the youngest participants with other participants being 1 or 2 years older than us. However, to our surprise, we ended up winning gold which stands as evidence that STEM can lead you to achieve success even if the odds are against you. Therefore, I encourage everyone reading this right now to go and explore the vast sea known as STEM. Just like the saying, it's not about the destination but rather the journey taken to reach the destination. Throughout your journey in STEM, you are bound to fall in love with it just like me and many other people have.

In a nutshell, STEM is a flashlight that is truly important for society improvement, individual growth, and global progression. It gives people the abilities, information, and mentality they need to succeed in the modern world and make a contribution to the solutions of difficult challenges.

For the Love of STEM

By: Maitreyi Muralidhar

“Didi, what will happen if I see radium?”

“Didi, if radium is in the earth, how is it not affecting me?”

“Didi, how do people stay safe while working with radium?”

One of my favourite ways to destress after a long day is to call up my little cousin and speak to her until my heart feels light. My cousin is starting the third grade this year and it has been so exciting to see her blossoming into a well-read and sharp-witted person. A few days ago, I narrated the story of Marie Curie and her awe-inspiring work with radioactivity, and by the time I came to the event of Madame Curie receiving the Nobel Prize, my cousin was bubbling with curiosity! I was astounded to see how well she assimilated the story and formed a myriad of questions, some of which I had to google after our call ended!

STEM has been etched onto my personality since forever, and I am immensely grateful to my parents for inculcating a scientific temper in me from a young age. It initially started with weekend museum trips and bedtime stories of fascinating discoveries, which made STEM fun and intriguing to explore. It never felt like a manuscript of hundreds of formulae, or a plethora of intricate diagrams; it was a safe space for me—a place where my imagination could go wild, and dreams could be fulfilled.

A huge part of me was molded by my early STEM education and now one of my guiding principles is to pass on the baton of STEM, so that everyone gets to experience the thrill of uncovering the secrets of the universe! Dear

reader, if I could sum up the awesomeness and vastness of STEM in three words, they would be- ***inspire, innovate, and immerse.***

“Out of the mountain of despair, a stone of hope.”– Martin Luther King Jr.

Humans are social creatures. We enjoy being with other people and sometimes pick up their behaviors and inculcate them into our dispositions. Being inspired by a fellow caveman’s triumphant hunt and using his techniques to fill a family’s stomach—that’s what has helped us survive and this has passed down from generation to generation. *Inspiration* drives us to be the best versions of ourselves and shows us that there is a better tomorrow. One of the best platforms to inspire and be inspired is STEM.

There were times in my life where I felt worthless and drained of self-esteem, but in those depths of despair, looking up to fearless scientists felt like sunshine illuminating a stormy day. ‘*Women in Science: 50 Fearless Pioneers Who Changed the World*’ by Rachel Ignotofsky is a book that always puts a smile on my face. It introduced me to extraordinary role models like Hedy Lamar- the mother of Wi-Fi and a dashing Hollywood actress, Hypatia- the earliest recorded female mathematician, Rosalind Franklin- the crystallographer who literally showed us what we’re made of, and so many more. Scientists have revolutionized our perceptions of the universe and it is absolutely electrifying to read about their journeys!

In 2021, I had the privilege of joining the New York Academy of Sciences as a Young Member when I was accepted into their ‘Junior Academy’ and ‘1000 Girls 1000 Futures’ programs. It gave me a glimpse of science academia and introduced me to a wide range of amazing scientists who are doing incredible work! Being a STEM-enthusiast means collaborating with people from across the globe. It is a chance to pave your own path while also following the footsteps of geniuses and building on their research. Wouldn’t you want to be the one who discovers another facet of gravity or finds the missing link in cancer treatment?

STEM is a spacecraft for selfless people who want to reach out and beyond, and inspiration is the rocket fuel!

“There’s a way to do it better – find it.” – Thomas Edison

We are the generation that has successfully persevered through a pandemic and emerged stronger than ever. Humanity has mastered the art of suppressing viruses and we were able to come up with vaccines for COVID in just a year! In the times of plagues and smallpox, this would’ve been unheard of! We have seen a flood of technological advancements in recent years from AI to biotechnology to Space explorations, which are renovating our atmospheres rapidly! STEM empowers us to find efficient and effective solutions and combat any problems that come our way. *Innovation* is the heart and soul of STEM and mastering it is like getting multiple power ups in a video game.

STEM teaches us the importance of being inquisitive and questioning everything around you. It can transform a timid introvert, to someone who has a fire in their belly to learn immensely and simultaneously apply those learnings to expand horizons. STEM is all about learning, processing, and innovating. It teaches one to be observant, creative and most of all be empathetic. In the age of Python and Arduino, anyone can make an invention which could potentially revolutionize the world. It is no more a thing of old Victorian bearded men, who smoke a pipe and write in fancy ink pens. Anyone, be it a five-year-old or a fifty-year-old, can come up with a version of ChatGPT that helps in diagnosing strokes, or a device that detects snakes! All it requires is an ideating mind, a diligent problem solver, and an ardent believer of STEM.

“Passion is energy. Feel the power that comes from focusing on what excites you.” – Oprah.

Allow me to get a bit philosophical here, but STEM is all about detaching yourself from materialistic wants and working towards the collective betterment of humanity. Once you understand how immense the universe is, how much we are yet to discover and how small we are, it really puts things into perspective. It fuels me with a sense of purpose that in the 13.7 billion years of the universe, on a tiny moat of dust resting on a sunbeam, we were formed after years and years of evolution, and have become sentient.

Humanity has developed the tools of Science and Mathematics over the years which have translated to various innovations that have continuously accelerated our intellectual growth. It is our language while speaking to the cosmos. It is starting to show us who we are.

When you *immerse* yourself in STEM, it truly feels like a divine calling.

We all need to do our part to ensure that the eternal flame of STEM and innovation keeps on burning. You too have already started your journey in STEM by picking up this book! And now, nurture it like a little baby. Feed it with facts about physics, biology, chemistry, math etc. Start tinkering with code and raspberry pi's. Reach out to people and find ways to better their lives. And of course, spread the passion and love for STEM. It can even be just telling a story to your cousins or starting a YouTube channel!

We are standing on the shoulders of Einstein, Newton, Curie, Tesla and many more. Let's remember to make them proud and work towards a brighter, greener, and STEM-filled future!

FROM UNDERWATER ARCHEOLOGY TO SPACE EXPLORATION

By: Abdullah Bin Tanweer

STEM education has shaped my incredible journey, transporting me from the captivating depths of underwater exploration to the boundless wonders of outer space. My story illustrates the power of STEM in fueling curiosity, driving innovation, and inspiring young minds. In this essay, I will share my personal experiences and advocate for the vital role of STEM education in our lives.

As a young explorer, I was always attracted by the wonders lying beneath the ocean's surface. Exploring shipwrecks and submerged civilizations became my obsession. I discovered how STEM was critical in solving history's mysteries through hands-on investigation. They gave me the tools I needed to study ancient cultures, decipher artifacts, and protect our common history. STEM education opened up a whole new realm of exploration and learning for me.

As I became engrossed in the ocean's beauty, I understood how crucial it was to safeguard its fragile ecosystems. Understanding the problems that marine life was facing and coming up with creative solutions depended heavily on STEM education. I worked with researchers and technologists to investigate marine life, monitor coral reefs, and create sustainable practices

using technology and scientific approaches. STEM gave me the tools I needed to have a positive environmental effect and to have an immense sense of responsibility for the natural treasures of our globe.

Inspired by the ocean's wonders, I set my sights beyond the Earth's surface and into the vastness of space. Underwater archaeology and space exploration may seem like vastly different fields, but STEM education reveals their surprising interconnectedness. STEM illustrates how these seemingly distinct fields are unified by the universal language of scientific inquiry and discovery, whether we explore the depths of our oceans or journey into the great expanse of space. It provided me with the knowledge to examine celestial bodies, and fantasize about interplanetary travel. STEM inspired my creativity and allowed me to picture a future where humans could explore the cosmos, from studying about space missions to imagining new technologies. The wonders of space sparked my curiosity and ignited a passion for scientific discovery.

STEM education is not just about personal achievements; it is about inspiring others to embark on their own scientific journeys. As a young STEM advocate, I am dedicated to sharing my experiences and encouraging my peers to follow their interests in these disciplines. I hope to kindle the spark of exploration and inspire a new generation of STEM enthusiasts through mentorship, outreach initiatives, and educational projects. We can nurture young brains and prepare them for future challenges and opportunities by making STEM education more accessible and interesting.

STEM education is integral because it teaches young brains to think critically, solve challenging issues, and adapt to a changing world. It promotes creativity, teamwork, and a desire to pursue learning for the rest of one's life. STEM gives the skills and information required to prosper in multiple enterprises and contribute to scientific progress in a world increasingly driven by technology. Furthermore, STEM education fosters diversity by embracing people with varied origins, opinions, and experiences. By embracing STEM, we are cultivating a generation of creative minds capable

of addressing the world's concerns.

My journey from discovering underwater mysteries to fantasizing about space travel demonstrates the transforming potential of STEM education. It has enabled me to discover the natural world's beauties, utilize technology for positive change, and to marvel at the stars with pure awe. Every young mind, in my opinion, has the potential to contribute to the world through STEM. We inspire future generations to explore, develop, and shape a brighter future for all by instilling a passion of science, technology, engineering, and maths.

Thinking Small? Thinking Big?

By: Jingjing Liang

When the gap widens between my score and that of my opponent, how should I fence? Knowing that we are both fighting fatigue, hesitancy, and luck, I am told not to think about the points to come, or predicting the steps ahead, but instead to think small about getting a single touch with singular focus and clarity. When dilemmas arose during investment competitions, my mentors always said to start by thinking big, where breakthroughs come from an idea of the overarching goal, strategy, or logic. Through my own experience, I unconsciously set up two ways of thinking. Ultimately, is thinking small or thinking big in STEM the winning strategy that powers the cycle of science innovation and allows each generation to contribute to society?

As I wandered down the isles at 2023 ISEF exhibition hall, I saw projects that scrutinized the small-scale subjects of life such as neurons in the human brain, brain cancer cell growth, and diagnosis based on cancerous cell types. I also saw projects that demonstrated the unending bounds of the universe: optimizing algorithms to find planets and the motion of the galaxies. Participants, viewers, and judges alike passionately discussed opportunities for improvement, application, and results from the smallest details to the large structural changes. At ISEF, it became clear to me that STEM education stitches all parts of the human experience together with small scale and large scale thought in curiosity, exploration, and discovery.

There will always be people with a burning curiosity to understand more. Starting at a young age, some may begin to wonder at the workings of human bodies: how can a group of individual cells create a sentient being? How have humans even evolved to perceive and follow the laws of light and sound? And still others will dream of the vast universe: how did it come to be? What rules govern it? Where are these rules bent? As a child, have you ever wondered how small of a piece of the universe we truly are? Out of the countless galaxies, unnumbered amounts of stars, and uncountable planets, somehow on Earth, life started. Even the smallest organisms and base blocks of life are so unique. STEM education is essential in not only maintaining but also building up this curiosity for the unknown that is so central to the human experience.

When there are questions to be answered, STEM education empowers people to explore both small scale and large scale through encouraging creativity, inspiring unorthodox ideas, and learning from failure. In 1957, Sputnik 2 took a dog named Laika to space, but she unfortunately died hours into the mission due to overheating and panic. However, just two years later, two monkeys named Able and Baker survived a trip to space, and another two years saw the first man in space. Though these trips didn't result in knowledge of the wider universe, they were the exploration steps that served as the foundations for the future.

Lastly, what would exploration be without discovery? At some point, it will feel like a field has hit a hard limit—maybe it feels like we've learned everything we possibly could about it, or perhaps we deem a subject too deep to keep exploring. One small discovery could spark another flame to continue the search for knowledge or redefine the information we already have. STEM education provides the resources, persistence, and critical thinking skills needed to expand our thinking in any field, from microbiology to astronomy. For example, in 1986, DNA was used in a criminal case for the first time. Suddenly other applications opened, such as pollen samples from clothing and tracing DNA based on relatives. Cold cases were solved after multiple

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decades, families were reunited, and missing people were identified.

Thus STEM education not only inspires curiosity, encourages exploration, and brings discovery individually, but also creates a never ending cycle where discoveries become the new foundation from which the next generation starts. STEM education provokes freedom between thinking big and thinking small within the curiosity, exploration, and discovery that is central to the human experience.

Revolutionizing STEM Education: The Key to Empowering Science Savvy Citizens

By: Shelley Wi

When classroom lights dim, and the projector flicks on, there's only one sound that never fails to hush a rowdy fifth grade class: the introductory theme song to an episode of Bill Nye the Science Guy. From volcanoes to atoms, earthquakes, and the moon, we could watch for as long as our teacher would let us. Each of Bill Nye's demonstrations unlocked a deeper understanding of the physical world. Even today, the science show that dominated the '90s still sweeps through American schools with its eye-catching experiments and a mission of fostering a next generation of scientifically literate citizens. It's a hope that our wide-eyed elementary schoolers would grow up to be adults who were curious about the world, who understood and cared about how it worked, who questioned what they were told, and who never stopped pushing for truth—not necessarily as scientists, but as responsible citizens of the world.

Yet in 2016, a NASA report revealed that only 28% of Americans are scientifically literate. According to the New York Times, less than a third can identify the function of DNA, and one in five believes the sun revolves around the Earth—an idea that has been outdated for hundreds of years. As the cutting edge of research is racing forward, the rest of society is lagging behind. Without a population with even basic knowledge of the most fundamental sciences, society cannot fully accept our technological

progress, nor can it help us optimize it in real world contexts. Even the most life changing innovations are futile if we cannot efficiently and effectively implement them at a societal scale. Science only works if everyone is willing to participate.

So where did we go wrong? If we want a scientifically literate population, we need an effective and equitable school system to reflect it. But over the years, the same school system that had once instilled in us a sense of wonder and curiosity for the world as kids, has slowly evolved to extinguish it. When we were little, science was easy. There weren't "science" or "non-science" people, we were all the same, digging holes in the ground and flipping over rocks to see what we could find. We picked up ants and held earthworms like they were the coolest things we ever saw. We recognized the world for what it was, not as equations or detailed mechanisms, but as a whole. It's a perspective many have lost—even our best scientists. In a society of increasing focus on specialized study, we're losing sight of the reason we study science altogether: how the world works as more than a sum of its parts. This is what is reflected in our education system.

As we make our way through the years of school, science is no longer taught as something you can recognize when you look out the window, but instead as a mesh of cycles, equations, big molecules and complex diagrams. Though there is elegance in the logic and beauty in the chaos, it's something one can only recognize when staring and thinking at it intently. It's simple to look at a tree outside and appreciate its place in the world, but less so when faced with the TCA Cycle in a thousand page textbook. Our childhood wonder for the world dampens and gradually, there comes a divide: those who "do science", and those who don't dare to touch it. The "science people" become our academics and engineers, while the "non-science people" are content to leave the complex and intimidating work to the scientists. To the average person, science is losing its relevance. This is the danger. Science propels us forward, yet most non-STEM people have no idea how it works. Without the rest of society, solely relying on our experts can only get us so far. If we want a population that understands science or is willing to learn, even at a basic level, we need a population that cares about science. This

starts with recognizing the relevance of it to our personal lives.

Not everyone that goes through our education systems will work in STEM, and that's okay. In fact, the majority probably will not. This means that general science education needs to be taught in a way that is oriented toward the general population. Though we have our science enthusiasts that relish in the increasingly intricate puzzle of our current science education, as the years progress, everyone else is turning away. But the essence of science is not the minute facts and equations that few care to memorize, the essence of science is the story that ties it all together. It's the logic of how things work and why they work. Most importantly, the essence of science, and a core of scientific literacy, is how to think like a scientist. General science education should be centered around investigation and problem solving; learning the logic that our world hinges on, how to ask the right questions, and how to piece together a story of our own. With that, the basic, most relevant aspects of science will naturally be woven in. Science is less about knowing the facts and more about knowing how to find the facts. It's about fostering a curiosity for the world, along with a healthy sense of skepticism. These are skills we need our citizens to take away from our schools—skills that last them a lifetime, help them navigate through a world of misinformation, and that form the foundation of a scientifically literate society. Five, ten, thirty years after high school, no one will remember how vaccines work unless you work in healthcare, and with the speed that science changes, it might not even matter if you do. What's important is that you always know how to find out with the most reliable up-to-date information.

Education equity, with a focus on encouraging lifelong curiosity from kindergarten to college will be the cornerstone of fostering a next generation of scientifically literate citizens. Our societal culture sees science as just a collection of big and scary concepts that only geniuses can decipher. Even for me, someone who's always been eccentric about science, reaching beyond the textbook and into the realm of research felt unapproachable in the beginning. I couldn't figure out how to get what scientists had—the thing that would let me do what they do. But all it really takes is a spark of curiosity and a willingness to do a little creative digging. We've all been scientists at

one point or another, even if our experiments were just poking beetles with sticks to see how they would react. Science is a mindset: the lens with which we peer at the world that matters more than what we see. It's just humanity learning new things and harnessing them to find new ways to make a better world. Those intimidating concepts are not so intimidating when you see their logic. Each, made up of their own simpler parts, is a piece of the story of how the world works, one that means we've learned a lot and we're still going, connecting the dots and building a bigger perspective. The future is now. It's time to close the gap between science and society.

Critical Thinking: The Often Overlooked Purpose for STEM Education

By: Jackson Doren

Critical Thinking: The Often Overlooked Purpose for STEM Education

Our own subjectivity is something that we often neglect to think about, despite the fact that it manifests itself considerably in many aspects of our lives. When we allow this influence to persist and never attempt to inhibit its negative effects, we remain unrealistic and jeopardize the veracity of our thoughts. So, it becomes relevant to consider how one might develop the skills necessary to analyze and evaluate information objectively; the answer, I believe, is an often overlooked effect of STEM education. My experiences coupled with a growing body of research have demonstrated how receiving an education in STEM effectively develops one of the most important skills for future generations to acquire: the ability to think critically. When well-developed, this skill enables one to more keenly examine varying ideas and perspectives, as well as make more informed decisions that can better benefit the world.

I remember anticipating the beginning of 6th grade; it was the first year in which we had an entire class dedicated to science, a subject that had ceaselessly and innately captured my interest. Upon beginning our very first unit of the year, this disposition became a mere precursor to my indelible love for scientific investigation that has continued to be an integral part of my life. Through STEM education, I was able to tackle real-world

problems that emphasized the importance of logical thinking, inspiring me to independently find solutions to relevant issues and bring those ideas to fruition through applied research. Consequently, STEM education very effectively developed my ability to think critically. In a sense, I felt that it had endowed me with a new array of mental tools which I could use to process information more rationally and open-mindedly; free from the subjective influences that I was once oblivious to. By solving problems pertinent to the real world, I felt that I had gained a new, more perceptive understanding of it. For example, instead of just having thoughts and ideas, I began to think about why I had those thoughts and ideas, and through this careful metacognition, I began to consider things much more thoroughly and objectively. Now, almost every thought I have and judgment I make is intentional, as I consciously attempt to make my thoughts and ideas more closely resemble the objective truth. That is to say, the tools I originally equipped and learned to effectively utilize through STEM education changed the way I thought and made judgments about things; I became a critical thinker. And this observation is not solely anecdotal, as studies from around the world have demonstrated the positive effects of STEM and project-based education on the critical thinking skills of students.

A case study conducted in Istanbul, Turkey found that STEM education enhanced student's tendency for truth-seeking and open-mindedness^[1]. The participants in the study had not yet been exposed to STEM education, so the simple addition of it resulted in them being more open-minded and objective; critical of their own ideas in an effort to seek truth. Another study conducted in Shizuoka, Japan that analyzed the effect of project-based learning noted that after conceiving a preliminary plan, participants had enough skill in critical thinking to pragmatically critique it^[2]. An example of this was seen when participants realized that boiling wastewater to clean it consumed too much energy and therefore was not the most efficient solution. They then proceeded to evaluate their own ideas and consider others; an indication of their natural desire to find the objectively optimal method when presented with a STEM-related project.

Critical thinking is truly an essential skill that has numerous benefits

on those adept. When we educate students in STEM, we not only endow them with the skills and independence necessary to succeed in the world of the future, but provide the world of the future the people necessary for it to succeed. If not for STEM education, our youth, that is, the people of the future would find it much more difficult to acquire the skill of critical thinking. A skill that truly surpasses mere usefulness and more appropriately finds itself within the realm of essentialness. An essentialness shared too by its optimal origin: STEM education.

Empowering Voices of Change: My Journey with STEM and Civic Engagement

By: Maxwell Love

The intersection of scientific inquiry and political discourse has never been more critical than it is today. Amid the growing cacophony of polarized debates, how do we discern the voices of reason, the arguments grounded in evidence, the calls for action anchored in fact rather than mere supposition or political convenience? In today's society, entrenched ideological stances often overshadow objective discourse and hinder effective problem-solving. This phenomenon highlights the importance of fostering open-mindedness and innovative thinking, a goal to which STEM education is uniquely suited. By promoting an evidence-based, rational approach to problem-solving, STEM education offers a powerful antidote to societal polarization and a pathway towards a more constructive public discourse.

As a student, my journey with STEM started when I felt powerless observing political debate in my community, contributing to what appeared to be an egregiously unscientific approach to policy discussion. For years, my city's elected officials did nothing to combat the rampant flavored tobacco consumption among minors that I saw every day; some justified its sale stating that its tax revenue outweighed the damages. As someone who lost a grandfather to smoke-induced lung injuries, the fundamental lack of reasoning felt deeply personal to me, ultimately driving me to leverage research as a method of effecting change where local politicians fell short. It

was through research and STEM education that I learned about how and why tobacco products are addictive and harmful. This led me to become a high school researcher, spending my high school summers conducting my own project in which I designed a low-cost therapeutic to alleviate the oxidative stresses of tobacco smoke, acquiring a rigorous framework for testing ideas and solving problems.

My journey in STEM culminated in a presentation to my city council. Working alongside local organizations, I testified to city council as a youth representative, advocating for the ban of flavored tobacco, citing evidence gathered through peer-reviewed scientific research. No longer did I feel powerless. Using evidence-based reasoning, I highlighted how intellectual discussions were tainted with political agenda, resulting in policies that made tax revenue a higher priority over public health. There was no greater thrill than watching the city councilmembers unanimously approve the ordinance amendment I had advocated for, which was soon followed by action at the federal level.

While critics may argue that STEM in education only benefits students who want to pursue a career in science, it is clear through my experiences that STEM serves a much broader purpose: to teach students how to think critically about circumstances in their communities, hold decisionmakers accountable, and ensure that impactful conclusions are based on fact. STEM, in its essence, nurtures a culture of curiosity, inquiry, and critical thinking. It encourages individuals to question, to analyze, and to innovate. Through the rigorous, evidence-based methodology inherent in STEM, learners are trained to place a high value on facts, data, and logical reasoning, minimizing the impact of biased opinions and emotions. This leads to an approach to problem-solving that transcends political, cultural, and geographical boundaries, creating a focus on solutions and innovation, rather than entrenched beliefs or divisive rhetoric. Overall, it is through my education in STEM that I felt empowered to rise above surface-level politics to create change in my community.

On the Necessary Intersection of Art and Science

By: Anna Mohanty

There was a time in my life where I defined myself by four letters: INFJ. I had taken a Meyers-Briggs Test in fifth grade and being labeled as the rarest personality type a much-needed source of confidence throughout middle school. More so, the long “guidebook” for INFJs that accompanied my results was my constant lifeline. It gave me answers on everything from how I would tend to react to stress to how people like me behave in friendships. I took none of it with a grain of salt, both good aspects of my assigned personality and flaws. This was enforced by it being a system that informed the gifted teaching at my school as a way to rapidly categorize learning types. I found any deviance from my INFJ role to be a mistake.

Furthermore, based on how I routinely adhered to the standard of being an INFJ, teachers began to box me as “a creative type”. I was comfortable with this because the handy list of INFJ characteristics I had said I was too. Subsequently, for all middle school I sunk myself into creative pursuits. Creative writing (sometimes creative ranting, to be honest) was my favorite outlet, and I spent every day after school in some sort of theatre rehearsal. In other words, I thought that to be a cohesive version of myself, I needed to pick a side: left-brain or right-brain.

While science seems to be a ubiquitous subject in school, only 15% of elementary school teachers, who can be considered the foundation

of academics, received formal scientific development training. More so, despite many neurologists having disproved the left-brain vs. right-brain idea, it is still regarded as a fact in most pedagogy. Not only is this a pseudo-psychological idea that is taught to students, it actually has a negative impact on STEM in schools because it creates a barrier between the arts and the sciences, despite the disciplines being innately intertwined.

Some may argue for the specialization of arts and science education based on the idea that in career paths they are separated. Not only is this wrong given that there is a growing industry at the intersection of art and science, especially with computer graphics and coding, but it can stunt student's development. Studies have consistently shown higher test scores in students who receive a fine arts education in conjunction (and conversation) with a science one.

However, we first need to define what these types of education mean. In almost every school curriculum guide, there is a version of science being a "students learning about the biological and physical aspects of the world", and art is in a separate category of "a creative approach to teaching, utilizing imagination". With this being the accepted denotation of a science curriculum, the fact that only 25% of students in the United States are proficient in science is almost defensible. Even though that 25% figure is the same as the percent of the workforce that is STEM-based, if science boils down to a list of facts about nature, these teachings will not be of great benefit to anyone who enters those careers. Rather, the idea of the innovation posed in the arts is far more appealing to any future.

This seems contradictory though: that a field of study filled with inventors, engineers, and researchers is not positioned in schools to focus on creativity. As I reached high school and allowed my passion in STEM to flourish (ironically through the INFJ category on the Meyers-Briggs test telling me that at transitions INFJs like to step out of their comfort zone), I have discovered the opposite. In my own personal science projects outside of the classroom, my creativity has never been more satisfied. In my sophomore year, I designed the cardiovascular disorder diagnostic system *Iambic* (yes, the name is a nod to Shakespeare). *Iambic* works as a type of EKG that

quantifies neuronal output and input in cardiac nerves to get a clear picture of heart disease risk even in early symptom onset. For this experiment, I needed to find evidence that overactive neurons would lead to a higher heart rate rather than underactive neurons, which I did. No matter how many scientific journals were used as a resource for this project, the heart of the project (pun-intended) was in finding new ways to rearrange the data from previous studies, which was an interpretive pursuit.

Another fundamental piece of this project was using the writing form of narrative medicine to communicate the role of medical bias in early onset heart disease symptoms going unnoticed. Without this artistic method to tie the experiment back into real communities, arguably the project lacks scientific impact.

At the end of the day, science cannot thrive without the inclusion of creativity because we simply do not know everything. It is best to incorporate the humility exercised in arts disciplines that comes with understanding there are different interpretations. In establishing new theories, there are different hypotheses that students should be taught not just to recognize, but to create for themselves. As segregated as my academic approach once was, arts and sciences form a cohesive bridge between the facts in front of you and rearranging them into something new. The school system is at a detriment to students with the half-hearted science approach. To advance true academic development in today's students, it is of the utmost importance that classrooms teach with the goal of breaking the binary between science and art, left-brain and right-brain, and rather allow students to think and invent with the whole of their minds.

Revitalizing STEM Education: It is Not Too Late

By: Ashley Chang

“I hate science,” I uttered, leaving my science class after sitting through a long lecture by my teacher. These three words reflected a sentiment shared by many of my fifth-grade peers, which fueled my dislike for the subject. Through tedious science and math classes, I was gradually introduced to the idea of STEM, an acronym standing for science, technology, engineering, and mathematics. Considering my prior distaste for both science and math, the concept of STEM wasn’t something I found riveting as a fifth-grader. My disdain was especially prominent since the only experience I had came from either my math or science classes, or from *Bill Nye the Science Guy*. From these classes, I was left with the impression that my ability to memorize the steps of photosynthesis or how to solve a word problem would define my success in STEM. I would later learn that my indifference for this field wasn’t the material itself but the unpleasant experiences I had associated it with in my adolescence. Traditional methods of education had led me to believe that STEM was only for students who excelled in math or science, when in reality its focus was on helping all students develop a wide range of skill sets that could go beyond the classroom in real-world applications. The matter of how schools approach teaching the concept of STEM is what will shape how future students view it, and therefore, enhancing the STEM curriculum in schools is of the utmost importance.

When you look around, STEM can be found everywhere, as it is a fundamental part of our society and how things operate, and if you're reading this, I'm sure you've caught onto the idea that the future is STEM. Which is evident in the fact that, according to the National Science Foundation, it's estimated that the number of workers employed in STEM-related occupations will grow due to an increase in jobs relating to STEM. Integrating STEM education into a school's curriculum would be a helpful way to guide students to the many career opportunities available in the expanding industry that is STEM, while also equipping them with the necessary skills needed to succeed in such fields. Using STEM education, teachers can instruct students in ways in which they can participate in developing the world around them while also preparing future generations for the many advancements that are coming.

STEM education gives students the opportunity to explore the variety of subjects within STEM while also showing them the relevance and importance these subjects have in the real world, which is something that traditional education rarely does. In fact, traditional education often builds a negative perspective for students about what STEM is. In my experience, STEM was introduced as a part of our math and science classes. However, nothing had changed in the curriculum, and the cycle of memorizing new material continued, which is something that would lose the interest of students immediately. Nonetheless, when STEM is properly introduced through STEM education, it focuses more on applying knowledge that has been learned to solve real-world problems. With STEM education, a different mindset is fostered for students to think more creatively and freely while still being taught fundamental principles. It also builds an environment that doesn't punish students for thinking differently in a more innovative style.

STEM education not only teaches students critical thinking skills but also the idea of accepting failure. This is something that is often overlooked in traditional education, which has taught students that if you fail, you lose, and it is something people often run from. Whereas in STEM, failure is something that can be essential to reaching success. In STEM failure

is inevitable, and from it come opportunities to learn from and improve from mistakes, which students wouldn't have been able to find without failing. Students who do nothing but excel in academics alone often find themselves under immense pressure and are left feeling distraught when they fail. They aren't sure how to pick themselves back up and continue on, which can make it challenging when facing failures in the real world. With STEM education, students are constantly exposed to the risk of failing and are given the chance to problem solve on their own, similar to how they may encounter failure later in life.

Despite having a challenging beginning in my personal STEM journey, I firmly believe that STEM education can have a positive influence on not only students' education but also their future. I am sure many students can relate to the experience of viewing the notion of STEM as difficult, especially when it is presented as challenging by many teachers. Unfortunately, this can deter many prospective students from pursuing an interest in STEM. This is why STEM education is essential; it can eliminate this assumption and spread the message that every student, regardless of background or intelligence, has a place in STEM. Ultimately, being able to realize that STEM doesn't have to be as complicated as it may seem from the outside. It is something I wish had been available to me when I was younger, especially now that I've had the chance to dive deeper into the field of STEM, which has enabled me to meet new people and learn so many new things. STEM has become a significant part of my life and is something I find genuinely fascinating. With STEM education, we can instill this same enthusiasm, passion, and interest in the students who are the future.

Revolutionizing Education through Mixed Reality

By: Ankur Rao

In today's rapidly evolving world, the education system finds itself constrained by outdated tools and methods that have persisted for over a century. Traditional textbooks, with their static pages and limited interactivity, fail to captivate and engage the minds of young learners. However, a new innovation emerges: Mixed Reality (MR). With its ability to cross the limitations of traditional learning, MR opens the door to a transformative educational experience where imagination becomes reality, and students are empowered to shape their learning journey. Welcome to a future where education transcends the boundaries of textbooks and propels our next generation forward.

In education, the concept of memory and its impact on learning becomes increasingly significant. Recent research on memory, such as the exploration of mnemonic transience in decision-making, reveals an important aspect of the learning process. It highlights that memory should not be seen solely as a means for transmission of information through time, but rather as a tool that guides intelligent decision-making. This perspective emphasizes the importance of flexible behavior and the ability to use past events to form new experiences. However, in traditional education, rote memorization often is prioritized, and the potential for students to fully embrace a concept

is always limited.

Consider the vast number of middle schools across the United States, with millions of students. Despite this large educational network, the question remains: How many middle schoolers truly grasp and apply what they learn? While concrete statistics on this specific aspect may be limited, the importance of addressing this issue cannot be understated. Without a comprehensive understanding and application of knowledge, students are forced to the cycle of memorization and constant regurgitation, rather than developing critical thinking skills and the ability to make informed decisions.

This is where Mixed Reality (MR) emerges as a potential game-changer in education. Mixed Reality is an advanced technology that seamlessly blends the virtual world with the real world. By using a headset and entering a digital environment, users can interact with and manipulate virtual objects as if they were part of their physical surroundings. MR offers an experiential approach to learning that goes beyond rote memorization. Instead of passively absorbing information, students actively engage in interactive experiences that require them to make decisions, solve problems, and apply their understanding in real-time scenarios. MR provides a platform for students to practice memory-guided decision-making in changing and noisy environments, fostering flexibility and adaptability.

Imagine a middle school history class where students wear VR headsets and find themselves transported back in time to pivotal moments in history. They can witness the signing of the Declaration of Independence, or even stand amidst the ancient ruins of Rome. By placing students in the middle of these historical events, MR content creates a sense of presence and authenticity that textbooks cannot replicate. Students can analyze situations, evaluate multiple perspectives, and make informed decisions based on the information presented to them. This hands-on approach to history enables a deeper understanding of the complexities of the past and

encourages critical thinking skills.

Similarly, in the realm of science education, MR content provides opportunities for students to engage in immersive experiments and simulations. They can explore the human body at the cellular level, venture into the depths of the ocean to study marine life, or even embark on a journey through the solar system. Through these virtual experiences, students can interact with 3D models, manipulate objects, and conduct experiments in a safe and controlled environment. This interactive nature of MR content encourages exploration, inquiry, and problem-solving, allowing students to make decisions, analyze outcomes, and learn from their mistakes.

Beyond history and science, MR content spans various subjects, including literature, art, and geography. Students can walk through the streets of ancient civilizations while studying literature from that time period, examine masterpieces from renowned artists in virtual art galleries, or embark on virtual field trips to explore different cultures and landscapes around the world. By experiencing these subjects firsthand through MR , students develop a deeper connection and appreciation for the content, making learning more engaging and memorable.

Moreover, the versatility of MR content allows for customization and adaptation to individual student needs. Teachers can tailor experiences to align with the curriculum, cater to different learning styles, and provide personalized challenges and assessments. With MR , students can actively participate in their own learning, creating a sense of ownership that empowers them to explore and discover knowledge in a way that suites them.

While the integration of Virtual Reality (VR) content in middle school education offers immense potential, it is essential to address ethical concerns surrounding teacher training, government funding and support, and safety. The training and preparedness of teachers to effectively utilize VR

content in the classroom is crucial, requiring comprehensive programs and ongoing support. Government funding and support are necessary to ensure widespread adoption, and collaborations with technology companies and grants can provide the necessary financial resources. Safety considerations include establishing guidelines for usage, safeguarding student data privacy, and ensuring secure network connections. By proactively addressing these concerns, we can ensure responsible and effective use of VR technology in education, unlocking its transformative benefits for students.

While these ethical concerns are valid, it is important to note that they are not impossible barriers. The rapid advancements in technology, along with the increasing accessibility and affordability of VR devices, are making it more feasible for schools to adopt this approach to education. Additionally, collaborations between technology companies, educational institutions, and governments can drive the necessary support and funding required for implementation.

In my three years of interning at a STEM-based educational center, I have witnessed the integration of Mixed Reality (MR) into middle school education. The center utilizes Virtual and Augmented Reality to teach the principles of STEM subjects, enabling students to delve into the “Why” behind fundamental concepts. I have seen how students genuinely enjoy the MR content, leading to increased collaboration among them. The interactive nature of MR sparks curiosity and engagement, as students actively seek answers, ask questions, and make connections between virtual experiences and the real world. Based on this experience, I am currently running a club at my high school to showcase different career paths using MR technologies, allowing middle schoolers to experience and learn about various professions through immersive “day in the life” VR simulations.

In conclusion, the education of today’s children is crucial as they are the leaders of tomorrow. With the rise of AI and the internet, students may be

discouraged from genuine learning, hindering their overall development. However, the integration of Mixed Reality (MR) in education offers a transformative solution. MR provides immersive and engaging experiences that go beyond traditional methods, sparking curiosity, fostering critical thinking, and embracing creativity. By implementing MR in education, we can empower our future leaders to embrace a love for learning, adapt to a rapidly evolving world, and drive innovation. Let us seize the advantages of MR to shape a future where our students thrive and make a lasting impact on society.

STEM Education: Empowering Minds, Changing the World

By: Arvind Indukuri

Imagine a world where STEM education doesn't exist, humanity would still be in the caveman era of history. Its importance is substantial, its applications are universal and humanity's reliance on it is inevitable. STEM education forms the fundamental knowledge and skills needed to thrive in the modern workforce and society. By employing the skills provided by STEM education, individuals of all age groups gain access to diverse career and extracurricular opportunities. It facilitates children to embrace their creativity in possibly world-changing ways. It equips children with the knowledge and expertise required to develop unique and innovative solutions to address global challenges. Altogether, without STEM education our world would lack the innovative solutions and advancements that will move humanity forward.

When taught STEM, children are prompted to explore and investigate more about their environment and world. When children are prompted to explore and investigate through STEM education, they are encouraged to ask questions, make observations, form hypotheses, conduct experiments, and analyse data. This hands-on, inquiry-based approach empowers children to become active participants in their learning, fostering a sense of curiosity and wonder more about the world they live in. This leads to the growth of their analytical skills, and cognitive skills and generally increases

their mental capacity. Without STEM education, children will never be able to understand how the machines and tools they use everyday work, therefore will never be able to innovate on the existing technologies to further humanity's development and solve global challenges. Hence, STEM education not only nurtures children's curiosity and analytical skills but also equips them with the knowledge and mindset necessary to understand, innovate, and make meaningful contributions to the ever-advancing fields of technology and society.

Moreover, STEM education can lead to a plethora of opportunities that will allow individuals to grow past their boundaries and learn more about the intricate universe. Through STEM education, school-going children can participate in various competitions, join specialised clubs, and get to participate in numerous prestigious STEM programs. Through being exposed to all of these activities and social groups, children get amazing opportunities to explore the latest in science and technology, socialise with like-minded individuals, and express their creativity and problem-solving skills by completing group science projects and academic exams. Moreover, having a good STEM education can open up many STEM-related career opportunities. STEM careers offer countless chances for innovation, problem-solving, and making significant contributions to society through advancements in fields such as medicine, renewable energy, artificial intelligence, and space exploration. Overall, having a good STEM education provides individuals with valuable opportunities to expand their knowledge and social barriers, while promising a world-changing career in the STEM industry.

When equipped with the knowledge and problem-solving proficiency that STEM education delivers, the next generation is ready to solve global challenges by inventing new technologies or improving current solutions. Issues such as climate change, lack of health treatments, and poverty can all only be solved with STEM education. Engineers and researchers are constantly working on solutions for climate challenges across the world, what would we do without them? Doctors and medical scientists are currently investigating and testing multiple potential treatments for life-

threatening diseases and illnesses which currently don't have a cure, what would we do without them? A clear result of good STEM education can be seen in the COVID-19 pandemic. Vaccine developers constructed the first COVID-19 vaccine in under a year which made it the fastest developed vaccine in human history as it normally takes numerous years for a vaccine to be made and complete proper testing. This was only possible due to the invention of RNA-based vaccines. This quick vaccine rollout saved countless lives and helped humanity evade a catastrophic crisis. These examples demonstrate the invaluable contributions of STEM professionals, emphasising the vital role that STEM education plays in shaping a brighter future for humanity.

In conclusion, STEM education is a vital factor in the education system that propels humanity forward, empowering individuals with the knowledge, skills, and mindset necessary to tackle global challenges and drive innovation. STEM education equips children with the tools to understand, question, and innovate by instilling curiosity, fostering analytical thinking, and promoting hands-on learning. It also opens doors to diverse career opportunities, encourages participation in competitions and programs, and nurtures creativity and problem-solving abilities. Moreover, STEM education fuels advancements in various fields, from climate change solutions to life-saving medical breakthroughs. The remarkable development and rapid deployment of COVID-19 vaccines testify to the incredible impact of STEM education, demonstrating its potential to save lives and avert catastrophic crises. Without STEM education, humanity would be deprived of the innovative solutions that push society forward. Therefore, investing in and promoting STEM education is crucial for individual growth and for the collective progress and well-being of humanity as a whole.

Building a Path to Success with STEM

By: Ryan Fernandez

“Let’s see if it runs,” I said.

I watched awestruck and proud as the fifth grader successfully ran their program that fellow students in my high school computer science class had struggled to complete. The lessons were working.

In an increasingly digital world, STEM continues to be an integral component of society as science and technology continually advance at a rapid pace each year. STEM education is undeniably an essential component of education for the next generation, which will grow up in this increasingly technological society.

Despite this, in many communities, access to STEM education is often extremely limited due to a multitude of issues, such as a lack of economic opportunities. Without an introduction to education regarding STEM early in their lives, those from lower-income households will continue to be at a disadvantage in both academic success and future careers, potentially perpetuating a cycle of economic hardship within communities. Thus, it is undoubtedly essential that access to opportunities for STEM and education regarding STEM-based skills be brought equitably to as many people as possible.

This issue is prevalent within my home school district, which has four elementary schools to which students are assigned based upon their residential address and established geographic boundaries. These four elementary schools feed into a single middle school and a single high school. There is a stark disparity among the familial financial circumstances of students at the elementary schools. In the 2020–2021 academic year, 41% of students at my former elementary school were eligible for free lunch, while a mere 3% of students were eligible for free lunch at another of the four elementary schools in my district.

Students who attend my former elementary school — the elementary school to which students are assigned from the least affluent areas in the district — are often at a disadvantage within the field of STEM as many have grown up without access to computers in their homes and without access to STEM-specific education available to others. For example, the primary extracurricular educational program for STEM available in my district is a commercially run program. Participation in STEM-focused programs such as this is often obstructed by a hefty price tag

Recently, empirical data regarding our school district has highlighted that this is a pressing issue, with one survey from a civic action group demonstrating that students from the least economically advantaged elementary school in the district are drastically underrepresented in club leadership at the high school level, including the Computer Science Club, the Robotics Club, and the Technology Student Association.

In an effort to increase equitable access to STEM activities and develop an appreciation for STEM early in students' learning careers, a hands-on educational program was established in 2022 to introduce basic principles of computer science and teach computer science skills to fifth graders at my former elementary school. As a by-product of the remote learning environment forced upon students due to the COVID pandemic, my school district provided a Chromebook to each student who requested one. This

dramatically increased many students' access to technology, and these Chromebooks were used in our new computer science education program.

Over the course of a ten-week session, myself and several other high school computer science students taught computer science skills using the scratch platform. Weekly lessons consisted of a 15-minute introduction or instruction period regarding a particular skill, followed by 45 minutes of work on the program that students were building, with the high school students answering any questions the elementary school students had. The dynamic between the high school students and the fifth graders was a key component to the success of the program.

Throughout the ten-week session, the participating elementary students built three programs, which helped introduce them to programming concepts such as iteration, conditionals, variables, and data structures. In the final lesson, the elementary school students presented their programs to each other and proudly showed off their newfound programming skills.

By ensuring access to STEM education through our computer science educational program, we've helped a great many children access educational opportunities and resources that have put them on the right track for success in STEM and fostered their interest in pursuing STEM educational and extracurricular opportunities at the middle school and high school levels.

Despite the early success, there is undoubtedly a vast amount of work to be done across other communities and in my community. Our computer science educational program is still a fledgling one; however, there are great opportunities for local expansion. As a leader of the program this year, I intend to expand computer science education efforts to other nearby elementary schools to increase access to early computer science education for elementary school students in our greater community.

We are also evaluating the practicality of expanding our program to third

and fourth graders within the elementary school we already work with. By reaching students at a younger age, we would have the potential to develop an even stronger computer science skill set for the kids taught in our program and build on that foundation by teaching more advanced skills to those who have participated year after year.

Based upon feedback from those who have participated as well as their parents, we know the curriculum has been engaging; however, with a more agile curriculum, we could improve the experience for those students who would have learned better with more extensive lessons as well as those who would have learned better from more simplistic ones. Over the summer of 2023, I will be working with several other high school students from the program to develop a more adaptable curriculum to fit the needs of all students.

Our computer science program is a great example of one way to address the lack of equitable STEM education. It is currently limited in that it provides STEM resources and opportunities to only a select group of students from a single elementary school. Even after further expansion to more schools and grade levels in the coming years, this will still only promote more equitable STEM education in one community. Therefore, by including this important success story of improving equitable access to STEM education, I hope that others may be inspired to do the same for their communities.

The Arts: an Augmentor of the Value and Effectiveness of STEM Education

By: Harouna Thiam

Attending an arts-focused high school, my education has had a large emphasis placed on the arts—music, theater, and dance—among other things. Science, technology, and mathematics are also part of the curriculum, no doubt. In fact, my education at such an establishment often intertwines interesting scientific and technological subjects like forensics, biology, coding, and others with the arts in a manner that yields enriching assignments as well as bolstering the love for STEM and the arts in myself and other students.

To preface, STEM education is essential for societal progress and innovation. Science research, such as health studies, contributes to improving well-being and prolonging human life. Technological advancements enhance our comfort and quality of life. From physics modeling to mechanical engineering, STEM endeavors play a crucial role in advancing our understanding of the natural world and improving our overall quality of life.

Similarly, the arts also provide comfort and quality of life. They evoke emotions, stimulate creativity, and offer a means of self-expression. Artistic mediums like paintings, sculptures, music, and dance bring joy, inspiration, and a sense of aesthetic pleasure. I believe that this is why the arts hold

such a dear place in my heart—and why they provide such an enriching experience as a tasteful undertone in STEM curricula at my school. When the arts and STEM converge in education, they create a powerful synergy. The inclusion of arts in STEM education can infuse a sense of soul into technical subjects, making them more engaging and relatable. By incorporating artistic elements into projects and learning experiences, students can develop a deeper appreciation for STEM disciplines and see their practical applications in a broader context.

The arts bring out the tasteful and aesthetic emotions of people and their endeavors that give life color. They offer enrichment in the lives of the bland and bleak; I assert that endeavors relating to science, technology, engineering, and mathematical disciplines, fundamentally, aim to achieve the same thing—which is an increase in quality of life. STEM endeavors aim to progress our societies in order to improve life quality, which is what we humans do best.

And so, the arts and STEM endeavors share a similar factor, in that they both aim to improve the lives of the people who embrace them. There is no doubt that countless STEM endeavors, not limited to health research, physics modeling, or mechanical engineering, help advance us as people in general well-being and comfort. Similarly, art can refer to countless mediums of pleasure that serve to benefit man's soul—from visual paintings to sculptures or the strum of a violin.

Together, the arts and STEM can serve as a powerful mix in education. The arts bring a level of soul and a tasteful undertone to STEM endeavors that can prove to be absolutely valuable in an education setting. And so, from my experience, the arts have definitely contributed to my love and passion for STEM, as it has made many projects and learning moments in core STEM subjects vastly interesting. This only adds to the assertion that STEM education is absolutely necessary in schools—it maintains that the arts have enforced the development of my love and passion for STEM,

and can for others, as well. By integrating the arts into STEM education, we enhance its merit further, fostering well-rounded individuals who possess both technical expertise and creative thinking abilities. In that same breath, it is reinforced that STEM education is absolutely imperative for the development of research and advancements in technology and knowledge of our natural world.

STEM Education: The Making of The Next Generation of Thinkers and Creators

By: Riya Sikand

Change can only happen if we acknowledge the need for it to occur. I believe that technology has a tremendous capacity to become an impetus for change. As teenagers with an insatiable curiosity, we are limited to making change happen. But with the power of education, we can be the force that makes a difference. I genuinely believe that every child should be encouraged to learn the basics of a STEM curriculum and be given the opportunity to be a productive member of a rapidly advancing technological society. STEM education fosters a sense of curiosity in children and encourages them to explore and question the world around them. It helps them develop analytical reasoning and problem-solving skills from an early age. Early exposure to STEM concepts provides children with a solid foundation in these subjects. It helps them grasp fundamental principles and develop a strong understanding of scientific and mathematical concepts, which can benefit them throughout their academic journey.

My love for technology started as a curious 2nd grader in my school's maker space , and by 6th grade I realized that numbers and algorithms were essential to ingenuity, fueling my desire to advance my mathematical knowledge. Fascinated by the ability to manipulate simple numbers to resolve intricate numerical dilemmas fueled my desire to learn higher-

level mathematics. The journey was not easy, but armed with an insatiable desire to learn beyond the predicted curriculum, I petitioned my Principal to advance my math studies, landing me (& my braces) in AP Calculus AB in 8th grade. Although being the only middle school girl in a 12th-grade class was daunting at first, being surrounded by students that were much older gave me the chance to advocate, collaborate, & learn from my peers. I became the first girl in my school to complete the entire math curriculum, subsequently taking Linear Algebra at Rutgers University as a Summer Scholar. As one of a few girls and the youngest among university students (now without dental hardware!) in my Linear Algebra class, my dedication to STEM strengthened. Being surrounded by students studying to be engineers & computer scientists gave me an invaluable glimpse at my future self. The lessons I learned from Linear Algebra were far more than just math: I discovered the depth of my determination and resolve to embrace the complex nuances of STEM, inspiring me to accept future academic challenges.

Indeed my critical thinking skills, ingenuity, and ability to foster meaningful discussions as a productive and collaborative member of a classroom were directly nurtured by my early STEM related experiences. Coding, data analysis, logical reasoning, and technological literacy are becoming increasingly essential in various industries, and by teaching STEM to young children, we equip them with the necessary knowledge to succeed in the future. But educators must realize that a STEM education is more than just memorizing facts and formulas; but rather they need to encourage creativity, innovation and originality. By engaging in hands-on research, experiments, and projects, children can learn to think critically, find unique solutions, and cultivate their creativity. It is remarkable how research transcends beyond any classroom wall and is a catalyst for change-fueling the desire to identify what is unknown and create solutions through ingenuity and collaboration. STEM research can empower impressionable students with the intellectual freedom to stretch their minds and become equipped with the ability to recognize problems that afflict us every day and create viable

solutions. Conducting independent computer science research for the past three years and being an ISEF Finalist has given me invaluable confidence in my abilities, solidified my deep passion for STEM, and fuelled my insatiable curiosity and zeal for scientific research. I've been fortunate to be supported by STEM mentors to pursue my passion, and it is this enthusiasm for science that I wish to impart on the next generation of thinkers and creators through equitable early childhood STEM education.

However, STEM fields continue to have a significant gender gap in education and industry. By advocating for more programs to introduce STEM to young girls, we can help bridge this gap and encourage more female participation in these fields. Early exposure to STEM can inspire girls to pursue careers in science, technology, engineering, and mathematics. As a minority in all of my STEM pursuits (whether being the only girl from my school to be an ISEF-Finalist or the youngest girl in my Linear-Algebra class at Rutgers last summer), I am deeply committed to helping mitigate the inequality in access to education. Two-years-ago, I co-founded AIadvocacy to help develop a globally accessible and equitable AI education program that offers free access to basic coding skills to underrepresented middle and high school students.

It is fascinating how science and technology are an integral part of multiple fields, and a strong foundation in STEM can actually foster interdisciplinary learning. As a result of my sincere passion for STEM and my dedication to the humanities, I was able to explore both of these interests as a Tech-Scholar at the New-York-Historical-Society. I researched important influential women in American-History, and applied my coding skills in HTML and CSS to create a website highlighting these female figures.

Although the world is evolving with advancements in technology, humanity must not lose sight of the characteristics and morals that define our existence. Understanding how we think, feel, respond and act are essential to developing the technology of human replacement. The future of being

human is at a crucial crossroads, it is important for our generation to maintain our autonomy, education, and social and emotional abilities, and yet simultaneously embrace innovation and entrepreneurship to improve the human condition. Undoubtedly the remarkable opportunity for young students to learn STEM from inspiring mentors in an inclusive, uplifting, and cohesive environment will empower them with the confidence, knowledge, & experience necessary to forge the trajectory of their own academic journey.

STEM Education: Transforming Barbie's Ideal into Real-Life Possibilities

By: Manjot Rai

Barbie. To most, she is simply a popularized doll or children's cartoon character. But, to my five-year-old self, she was the epitome of perfection and the source of my distorted self-esteem.

I could never see myself in the image of the Barbie I so desperately wished to be as an immigrant child from a low-income family, contradicted by her wealth and American Dream lifestyle. With her straight, blonde hair and glassy, blue eyes, she embodied a standard of beauty and excellence that made my frizzy, black hair and dark brown eyes inferior. In my childish thought, I concluded that anyone different from Barbie was somehow meaningless. By that definition, I felt that I, too, was consequently devoid of value.

There was, however, someone I could see myself in – my former doctor. She was Indian, like myself, and never failed to make me laugh through my fear of shots with a dad joke or rainbow-colored lollipop. Her kindness and capability challenged the narrative that Barbie was the sole measure of influence and success. While I had attributed my self-perceived inadequacy to the superficial brilliance of Barbie, I soon realized the difference between a two-dimensional character and a real-life doctor. This realization sparked an understanding of the importance of diversity and representation in STEM education, an awareness that I lacked at the time. My doctor, who had an

especially strong foundation in STEM education, profoundly transformed my understanding of myself and the world. She showed me that anyone, regardless of ethnicity or socioeconomic status, could excel in STEM and make a meaningful impact similar to, or greater, even, than the magnitude of Barbie. By exposing young people to diverse role models through STEM education, we can inspire scientific endeavors that reflect the rich diversity of humanity and contribute to the next generation of innovators.

Growing up, overall, I was a young, bright-eyed girl with big dreams and a toothy smile; no single art or discipline had ever satiated my childish curiosity until I was introduced to the realm of STEM. When I was in middle school, during the pandemic, I began to spend my free time familiarizing myself with platforms including Scratch and Roblox, changing the text on websites using “Inspect Element” to tease my brother — things that unfamiliarity with STEM education and first-generation ignorance would typically classify as a waste of time. It was always out of pure fun, but I nevertheless felt like it could be so much more than that.

Back then, I perceived mathematics as a subject that was futile outside of the walls of a classroom, and engineering was an industry that was entirely foreign to me. It was not until my older brother began to solidify his interest in computer engineering that my perspective on programming began to shift beyond a mindless pastime toward actual career potentiality. His passion inspired me to delve deeper into the world of engineering and STEM. I began to see mathematics as a powerful tool for understanding and solving real-world problems and engineering, which once seemed outlandish and distant, arose as a field that could transform childhood hypotheticals into a reality. The more I studied the term “STEM” and conducted my own research, the more I became enamored with the surreal possibility that there existed a field where individuals worked to bridge the gap between dreams and tangible accomplishments. It was then that I promised to commit myself to the everlasting pursuit of new discoveries within the world of STEM.

At the beginning of my sophomore year, I made the life-changing decision to join the Medical Careers Academy at my high school. Finally, I had access to the STEM education that I had been missing out on during

previous fourteen years of my life. I had the privilege to talk with medical professionals, participate in medical-related lectures, and actively engage in hands-on activities, including vitals and dissections.

Even so, the impact of the Medical Careers Academy went beyond technical skills and theoretical knowledge. It provided me with a platform to explore my interests in diversity, accessibility, and innovation within the field of medicine, leading me to recognize that medicine is not exclusive to diagnosing and treating illnesses. It is about understanding the varied needs of patients, supporting widespread access to healthcare, and embracing innovation to drive positive change. The skills and knowledge I gained from the Medical Careers Academy have become the infrastructure for my potential future in medicine, reinforcing that STEM education is not just about individual success, but how we serve others and contribute to the betterment of society.

STEM invigorates me. It gives me a reason to wake up every morning, filled with anticipation for the discoveries that await. For the younger generation, STEM education is major to experience that sense of excitement and possibility for the future. The significance of STEM education has prevailed in every stage of my life, from my days as a Barbie-obsessed kindergartener to my current position as a high school student preparing to enter the real world. STEM education cultivates the next generation of scientists and engineers and doctors, of whom will dictate the fate of over eight billion individuals. By providing young people with the knowledge, skills, and mindset necessary to address current global issues, STEM education can contribute to a more prosperous and equitable world for everyone.

In conclusion, let us disregard the “Barbies” in our lives, and embrace the power of STEM education to shape a future that is inclusive, dynamic, and full of promise.

Stem Looking Towards The Future

By: Siddharth Rawat

In today's high school environment, there is a prevalent misconception that engaging in STEM fields requires either full commitment or extensive knowledge in a specific subject. However, my personal experience in robotics challenges this assumption and offers an alternative perspective. When I joined the robotics club in 10th grade, I had no prior understanding of the subject matter. It was simply an enjoyable extracurricular activity that attracted many students. As I got involved, I realized that my programming and engineering skills were not exceptional. Instead of feeling discouraged, I decided to contribute to the club in other valuable ways.

I took on responsibilities such as securing sponsorships and managing the team. While my coding skills were initially limited, I dedicated myself to learning and gradually became an asset to the coding team. This personal journey highlights the importance of a multifaceted approach to STEM. In the real world, scientific progress is not solely accomplished by individual scientists. It relies on a robust support infrastructure that enables their work.

This support infrastructure encompasses various aspects, including securing funding from investors or the government. Moreover, professionals oversee and manage projects, ensuring that everyone adheres to reasonable timelines. These collaborative efforts allow us to explore uncharted territories and pave the way for a brighter future. By emphasizing the significance of diverse skill sets and contributions, we recognize that

each person, regardless of their specific expertise, plays a vital role in the collective pursuit of innovation and discovery.

STEM fields are not solely about individual expertise or complete commitment. They thrive through the collaboration of individuals with diverse talents and skills. While scientists and engineers are crucial, there are numerous other professionals who contribute to scientific progress. These include project managers, administrators, financial analysts, and more. They form the backbone of the support infrastructure that allows STEM professionals to focus on their core work.

By acknowledging the importance of a multifaceted approach to STEM, we empower individuals to contribute to scientific progress in various ways. This recognition not only encourages diverse participation but also cultivates an inclusive environment that values the unique contributions of each individual. It breaks down the notion that STEM is limited to a select few and opens doors for a wider range of students to engage and excel in these fields.

The prevalent misconception that engagement in STEM fields requires full commitment or extensive knowledge in a specific subject is far from the truth. My personal experience in robotics illustrates the importance of a multifaceted approach to STEM. Scientific progress relies on diverse skill sets and contributions, extending beyond individual expertise. By recognizing the crucial role of a support infrastructure and the various professionals involved, we can foster an inclusive environment that enables collective innovation and discovery. Each person, regardless of their specific expertise, has the potential to make valuable contributions to STEM and contribute to a brighter future.

STEM fields are crucial in shaping our future and driving progress, but it is equally important to acknowledge the significance of other disciplines like art, history, and the humanities. While STEM focuses on the future, these disciplines provide valuable insights from the past and present, helping us avoid repeating mistakes made by previous generations. STEM

disciplines are characterized by innovation, curiosity, and the pursuit of novel creations. They encourage us to explore uncharted territories and push the boundaries of knowledge. STEM empowers us to develop groundbreaking technologies, uncover new scientific theories, and engineer innovative solutions, ultimately contributing to a better world.

On the other hand, disciplines like art, history, and the humanities offer a broader perspective that complements STEM. By studying the experiences, achievements, and failures of the past, we gain insights into human behavior, cultural evolution, and societal patterns. The study of art allows us to appreciate and express the depths of human creativity and imagination. History provides us with a roadmap of our collective journey, highlighting both triumphs and tragedies that can serve as valuable lessons. The humanities enable us to explore complex questions of morality, ethics, and the human condition. By embracing both STEM and these disciplines, we foster a holistic approach to understanding and shaping our world.

The intersection of STEM with art, history, and the humanities brings a well-rounded perspective that enriches our lives and contributes to the betterment of society. It is through this interdisciplinary collaboration that we can effectively tackle the challenges of today while envisioning a brighter future. By recognizing the value of all fields of study and promoting their integration, we can work collectively towards a more inclusive, innovative, and sustainable future.

Ultimately, STEM is not solely about creating something new; it is about utilizing knowledge, creativity, and critical thinking to address complex problems, improve lives, and push the boundaries of what is possible. By embracing the integration of all fields of study, including STEM, art, history, and the humanities, we can develop a comprehensive understanding of the world and effectively address the challenges we face. By combining the forward-thinking nature of STEM with the insights and wisdom provided by other disciplines, we foster a more holistic and inclusive approach to progress and innovation.

In conclusion, while STEM plays a crucial role in shaping our future, it is essential to recognize the value of disciplines like art, history, and

the humanities. These fields provide us with valuable insights, lessons, and perspectives that complement STEM's focus on innovation and future-oriented thinking. By embracing the integration of all disciplines, we can work towards a more well-rounded, inclusive, and sustainable future for all.

STEMpowerment - Our Future

By: Rohith Lanka

Looking back on my younger years (not that I'm pretty old yet), I reflect on what got me into science. More spontaneous than others would think, from a young age I loved science and did many science-related activities. I had done programs such as *Kumon*, where I did both mathematics and reading, and Science Bowl, one of the most important and fun experiences I had in middle school. But throughout all of these experiences, one thing remained constant - my passion for STEM. STEM - or Science, Technology, Engineering, and Mathematics - was an opportunity for me to learn more about a career cluster that encompassed many essential aspects of life. In 2019 alone, the *National Science Foundation* reported more than 20% of all jobs in the United States workforce were STEM related. This means millions of people in the United States are involved in STEM, which as stated previously is one of the most important careers to work in. My parents, my friends' parents, and even my cousin's parents work in STEM, as engineers, doctors, and workers of the future. Every day, new advancements in STEM are made, whether it is through AI to find a solution for cancer, finding a proof for the Pythagorean Theorem using trig, advocating for climate change or even that friendly volcano at the science fair. Oh, and by the way, every single achievement I had just mentioned was accomplished by a teenager, the pioneers of the future generation. Well, maybe except for the volcano.

Even when I was a child, on projects that seemed fun I used STEM. I still remember the day I made a popsicle bridge and saw how many marshmallows it held, or when my elementary school had those crazy multiplication competitions, which I always seemed to lose... or how the scientific method is still in my head (and no, I will never forget it). The point I am trying to make is that STEM is profound in today's society, and it's never too early to start. STEM is from everywhere from civil engineers to computer scientists, to doctors and researchers. Innovation starts with STEM, and through innovation can we make the world a better place.

Let's examine a counterfactual - a world without STEM. What would we be able to do without doctors to help cure us, engineers to design bridges and critical infrastructure, computer scientists to keep financial institutions running, or researchers constantly working to further our understanding of natural phenomena. Would we be able to work efficiently, solve problems or create solutions for future generations? The answer is no, we would not be able to. People who devote their time to STEM devote their time to the betterment of the world as a whole, and this is why STEM is such an important career.

I would like to reference a quote provided by the US Deputy of Education Secretary, Cindy Marten, when asked about STEM initiatives. Marten stated, *“Today, we are saying unequivocally to all students and educators that they belong in STEM and that they deserve to have rigorous and relevant educational experiences that inspire and empower them to reach their full potential as productive, contributing members of our nation’s workforce”*. STEM education for the youth is a major goal for the US Department of Education because by educating the youth, we are preparing them for the future and what it holds in an ever-competitive world. Our world has experienced events, from pandemics, wars, global warming and diseases ever-growing. Many people, including you, can help make a difference in your communities and develop skills needed to solve problems and help improve our society.

STEM coursework can help students develop critical-thinking skills and mental habits meant to help them succeed wherever they go, so they can create solutions and a better world. By empowering the younger generation to achieve their goals, we are building citizens who can contribute to society and have the power to make a difference. When I grow up, I want to become a doctor who can save people. Since a young age, the activities I tried to do, like Science Bowl and Science Olympiad, were meant to emulate interest in the subjects. Those competitions have been the most fun I have had in my life (and no, I am not joking!)! I loved studying anatomy, the heart, earth science, and more. Everyone has a passion, and a goal to do something. STEM compromises 1 in every 5 jobs in the United States, and will continue to grow. A well-rounded education in STEM will help set up the youth for the future, empower them to make a change, and develop skill sets meant for us to innovate.

As Abraham Lincoln, the 16th president of the United States, stated, “*The best way to predict your future is to create it*”. STEM education, meant to educate young kids, helps students create their own future. That’s how I feel. Ethical thinking, critical thinking, rational thinking, thinking. Who knows, maybe one of you could be the one to find a cure for cancer. It will never be the same for me, as STEM helped me shape my dreams for the better. How will it shape yours?

Rohith is a sophomore in high school, and wants to further his dreams of becoming a doctor through contributing to research on genes and trying to fundraise for STEM initiatives. He will let you know if he has success with this! Remember, don't just empower kids, STEMpower!

Importance of STEM Education

By: Mathavan Arumugham

There were nearly 10 million workers in STEM occupations in 2021, and this total is projected to grow by almost 11% by 2031 – two times faster than the total for all occupations (Krutsch 1). In this day and age, STEM is becoming an increasingly prominent topic in the world. STEM stands for Science, Technology, Engineering, and Mathematics, and STEM activities and education foster creativity and critical thinking. In addition, they also improve inquisitiveness through hands-on learning and collaboration. However, it is sometimes difficult to provide STEM education due to factors like teacher qualification, standardized school curriculums, and funding issues. Regardless, STEM education is essential due to its crucial role in shaping the future of individuals, society, and the economy.

STEM education's most notable positive impact lies in its influence on students themselves. By significantly enhancing critical thinking, creativity, and curiosity, STEM education nurtures personal growth and a passion for learning. Additionally, it equips students with problem-solving, logical reasoning, and analytical thinking skills that hold immense value not just during childhood but also throughout adulthood. A 2017 U.S. Department of Education report revealed that 71% of students engaged in STEM programs demonstrated an enhanced ability to identify problems, analyze information, and propose solutions compared to their non-STEM counterparts. I have witnessed this self-improvement through my participation in various competitive programming activities. One such example is MIT Battlecode,

an annual competition where teams of up to 4 individuals vie against each other to develop the most effective AI for a virtual game. Working alongside friends strengthened our bond and compelled me to cultivate essential communication and collaborative skills necessary for efficiently and effectively creating superior AI. Another instance of personal development was my involvement in the USA Computing Olympiad, a monthly competition that presents participants with intricate programming challenges. Tackling these problems required significant refinement and application of my analytical thinking and problem-solving prowess. Evidently, the impact of STEM education on individuals is profound. Therefore, it is imperative for all students to have access to this type of education, enabling them to cultivate these invaluable life skills and forge meaningful connections with others.

STEM education enhances students' job readiness and expands their opportunities. The 21st century is witnessing a surge in lucrative career prospects within STEM fields. According to the U.S. Bureau of Labor Statistics (BLS), employment in STEM is projected to grow by 8% from 2019 to 2029, surpassing the average growth rate for all occupations. Furthermore, these fields demonstrate a high demand in the job market. The National Science Foundation reports that STEM graduates enjoy a higher overall employment rate than non-STEM graduates (74% vs. 65%), finding employment within 3-6 months instead of the typical 6-12 months. STEM education equips students with essential math and science skills required for success in these sought-after professions. I have personally benefitted from STEM education by acquiring invaluable real-world skills. I received training in SQL and databases through participating in the Los Angeles Computing Circle, facilitated by UCLA. Often overlooked in traditional educational settings, these skills have versatile applications across numerous career paths, including healthcare, social media, finance, marketing, and more. Additionally, many students gain access to intensive summer programs organized by esteemed universities like the UC System and others. As evidence of this, I was recently accepted into a paid apprenticeship at Purdue University through the Army Educational Outreach Program (AEOP),

where I will gain hands-on experience working in a laboratory environment while earning a salary. Granting students access to such valuable summer programs provides them with significant early work experience, enabling them to secure internships and jobs more swiftly in the future. Given these numerous advantages in terms of job security, it is crucial that students are provided with STEM education to safeguard their future.

On a grander scale, STEM also plays a significant role in shaping the world's future. STEM education plays a pivotal role in driving innovation and fostering economic growth. According to the Organization for Economic Co-operation and Development (OECD), countries prioritizing STEM education are more likely to experience economic prosperity by creating innovation-driven industries. This is because of the increasing demand for STEM careers and how dependent society is becoming on these specific skill sets. Furthermore, STEM profoundly impacts addressing global challenges such as hunger, poverty, and climate change. Applying STEM knowledge and principles is crucial in finding sustainable solutions to these pressing issues. For instance, developing sustainable energy sources and electric vehicles helps reduce reliance on fossil fuels, mitigating the harmful effects of climate change. Medical breakthroughs driven by STEM research enable advancements in healthcare, leading to improved treatments and better quality of life for individuals worldwide. Due to the significant impact that an education in STEM has on the world, students should be provided with these opportunities.

Some people may argue that STEM education is challenging to implement and inaccessible to disadvantaged students. While implementing STEM education programs and providing resources can be challenging, efforts are being made to make it more accessible to all students, regardless of their socioeconomic background. Many organizations, schools, and governments offer scholarships, grants, and funding opportunities specifically for STEM fields. Additionally, involving local communities and industries can help bridge the gap by providing mentorship programs, internships, and practical experiences for all students to access this type of education, regardless of the setting. Moreover, technological advancements have opened up

IMPORTANCE OF STEM EDUCATION

opportunities for online learning and virtual labs, further increasing the accessibility of STEM education.

STEM education is crucial for personal growth, job readiness, and shaping the future. It enhances critical thinking, creativity, and problem-solving skills and provides lucrative career opportunities. Additionally, STEM drives innovation, fosters economic growth, and helps address global challenges like climate change. Access to STEM education is essential for empowering individuals and securing a brighter future for the world, and efforts should continue to be made to improve access to this type of education.

The Crucial Significance of STEM Education in the Era of Technological Advancement

By: Avery Ernst

In the 21st century, we find ourselves immersed in an unprecedented era of rapid technological advancement. The increasing reliance on science, technology, engineering, and mathematics (STEM) has given rise to a pressing demand for a workforce equipped with the necessary skills to navigate this ever-evolving landscape. This piece delves into the vital importance of STEM education in light of the exponential growth in jobs revolving around technology and science.

1. The Expanding Scope of Technological Advancement:

As technology continues to permeate every aspect of our lives, it ushers in a multitude of new opportunities. Fields such as artificial intelligence, robotics, data science, cybersecurity, biotechnology, and renewable energy have witnessed significant growth, resulting in a projected increase in demand for skilled professionals. STEM education empowers individuals with the knowledge and skills required to capitalize on these emerging opportunities and remain relevant in the modern workforce.

The increasingly digital nature of our world necessitates a deep understanding of technology and its applications. STEM education equips students

with the necessary tools to navigate and thrive in this technologically driven environment, ensuring they can adapt to changing circumstances and contribute meaningfully to their fields.

1. Meeting the Demands of the Job Market:

The rapid growth of STEM-related industries has created a significant gap between job openings and the availability of qualified candidates. Consequently, pursuing STEM education becomes essential for individuals seeking lucrative careers in these fields. By cultivating a solid foundation in STEM disciplines, individuals position themselves advantageously in the job market, enhancing their employability and future-proofing their careers.

STEM education imparts not only technical skills but also nurtures important transferable skills such as problem-solving, critical thinking, collaboration, and creativity. These skills are highly sought-after in the job market, enabling individuals to adapt to changing circumstances, tackle complex challenges, and contribute effectively to their workplaces.

1. Driving Innovation and Economic Growth:

Scientific breakthroughs and technological advancements are often the driving forces behind economic growth. Countries that prioritize STEM education and produce a skilled workforce foster an environment conducive to innovation and technological progress. By investing in STEM education, nations can develop a competitive edge and attract technology-driven industries, ultimately leading to economic prosperity and societal development.

STEM education instills in students a mindset of curiosity, exploration, and innovation. By encouraging experimentation and problem-solving, it empowers individuals to think critically and develop groundbreaking solutions. These innovative ideas and discoveries have the potential to revolutionize industries, drive economic growth, and shape the future of society.

1. Tackling Global Challenges:

The world faces a myriad of complex challenges, ranging from climate change and healthcare to food security and sustainable development. Addressing these pressing issues requires interdisciplinary collaboration and scientific expertise. STEM education equips individuals with the necessary tools, knowledge, and skills to devise innovative solutions and contribute to a better future for humanity.

The interdisciplinary nature of STEM education fosters a holistic understanding of complex global issues. By integrating knowledge from various STEM disciplines, individuals can analyze problems from multiple angles and propose comprehensive, sustainable solutions. The ability to collaborate effectively with professionals from diverse backgrounds further enhances their capacity to tackle complex challenges.

1. Enhancing Digital Literacy and Critical Thinking:

In the digital age, the ability to navigate and comprehend rapidly advancing technologies is paramount. STEM education not only imparts technical skills but also promotes digital literacy, ensuring individuals are equipped to navigate the complexities of the digital world. Moreover, STEM education cultivates critical thinking skills, enabling individuals to analyze and evaluate information, make informed decisions, and adapt to a rapidly changing technological landscape.

Digital literacy encompasses more than just basic technical competence; it entails understanding the ethical, social, and economic implications of technology. STEM education equips individuals with the ability to evaluate and critically analyze the information they encounter in the digital realm. This includes assessing the credibility of sources, identifying biases, and understanding the potential consequences of technological advancements.

Moreover, STEM education fosters critical thinking skills, encouraging individuals to approach problems with logical reasoning and analytical thinking. By engaging in scientific inquiry, students learn to question

assumptions, propose hypotheses, and conduct experiments to validate their ideas. This ability to think critically enables individuals to navigate complex challenges, make informed decisions, and adapt to a rapidly changing technological landscape.

In a world increasingly dominated by technology and science, STEM education plays an indispensable role in preparing individuals for the future. It not only meets the growing demand for skilled professionals in technology and science-related industries but also drives innovation, economic growth, and the ability to tackle global challenges. By investing in STEM education, societies can empower individuals with the skills and knowledge needed to thrive in the 21st-century workforce and shape a better future for all.

Computer Science: The Core of Modern Society

By: Stefan Chirica

It is essentially impossible to walk into an American high school and not immediately notice the grip technology has on students' lives. Nearly every high schooler I've met has a smartphone, and even more have access to some kind of computer. However, few people understand what goes on behind their screens and how their technology is able to do what it does. Therefore, due to technology increasingly becoming a crucial part of students' lives across the country, it is my strong conviction that computer science is now a necessary aspect of every American high school's core curriculum, just like English, mathematics, history, and hard sciences.

For one, computer science is by far the most black-and-white discipline currently offered in many high schools, which is perfect for teaching teenagers the basic logic behind what they do. The first assignment in many introductory computer science classes, including my first computer science class, is to write instructions for the teacher to make a peanut butter and jelly sandwich. Simple enough, right? Except, on our first tries, most of us ended up with unopened jars of peanut butter and jelly between two loaves of bread, which is not ideal for human consumption. We eventually realize that we have to tell our teacher to open up the jar, dig in with a knife, spread the contents of the knife on the bread, and so on. The teacher acts completely oblivious to the process of making a peanut butter and

jelly sandwich to demonstrate the specific type of thinking required for computer programming. Giving a computer instructions is like feeding instructions to Stephen Hawking. It can do incredibly complicated tasks very quickly, but only if you tell it *exactly* what to do. The ability of breaking down instructions to the deepest possible level is incredibly useful in terms of being able to explain topics in casual conversation. To truly be an expert on something, one must be able to break that topic down into as simple terms as possible such that anybody can understand it, and having basic knowledge in computer science can allow students to do just that.

Moreover, having basic knowledge in computer science can be a significant help in understanding concepts related to other STEM subjects. Because much of STEM disciplines revolves around mathematical formulas, writing programs from scratch that solve complicated equations, specifically in higher-level math classes like statistics and calculus, can actually reinforce one's understanding of said topics. In fact, writing a program to do something for you with no outside sources actually demonstrates *mastery* in a topic, because, to do this, one must account for every possible case for a particular procedure. This shows a far deeper grasp on a topic than what the program's outward appearance may initially suggest. Ultimately, this means that computer programs can be considered a valid, but by no means mandatory, method of assessment in STEM classes. Instead of doing the same type of time-consuming math problem five times on a test to demonstrate all possible applications of a concept, students should also be allowed to write general instructions for applying that concept in as simple of terms necessary for anybody, even a ten-year-old, to be able to replicate the process.

It is worth noting that core computer science classes should be designed to be understood at the same level as other non-honors classes, should only be necessary for one semester, and should not require downloading any special programs. In my first computer science class, which was a regularly weighted one-semester elective course, my teacher used lessons on Code.org with block coding to teach the basic concepts behind computer science while staying general to every programming language before introducing us to

the basics of web development on a website called JSFiddle. Websites like these are sufficient for introductory computer science classes, because these classes should primarily serve to teach students how to think methodically and tailor their technology use to their own benefit. For more advanced computer science classes, dedicated programs such as Eclipse and Visual Studio Code are incredibly helpful for making more complicated programs through their autocomplete functions and inbuilt explanations of what certain code statements do. Not everybody wants to pursue a career in computer science, but the ability to break down large processes into hundreds of steps is something taught by studying computer science that no other discipline can replicate.

Furthermore, these introductory classes should give high school students a much better idea of not only how the technology they use on a daily basis works, but also how to more effectively use this technology to support their specific needs. With basic knowledge of computer programming, students have a safety net in knowing that if what they are looking for does not yet exist on the Internet, they have the ability to make it. Studying computer science in and of itself breeds students to be innovators by speeding up their daily tasks, solving problems in their local communities, or even simply making something to pass the time. So many online computer science courses and videos exist that students can learn how to make whatever they want, and every mandatory computer science class should send its students off with a list of videos that they could use to further their study of the technological world around them.

Ultimately, it is imperative to make introductory computer science classes part of every high school's core curriculum. By studying computer science and the process of coding, students will learn how to explain even the most complicated procedures in ways such that people with no background knowledge can understand them, which is an essential skill in every modern workplace. Additionally, the ability to make programs from scratch to speed up specific tasks, such as mathematical concepts, is wildly beneficial in terms of time management, and shows a similar level of understanding about a topic as passing a traditional assessment would. Finally, but perhaps

most importantly, studying computer science teaches students how to use technology to support their specific needs, giving students the all-important realization that anything is possible with the world of computing. With the power of the Internet and the technology that people already have at their fingertips, it is beyond time that students across the country are introduced to the inner workings of the core of modern society.

STEM Education Matters

By: Savannah Levack

It's 2023 and the world's top corporations are competing in another space race, all attempting to revolutionize the way we view space travel. In this same year, the creation and use of AI is at an all time high, with people all around the world integrating AI into their daily lives. The idea of 3D printing donor organs to be implanted into living human beings is becoming a reality that has begun to save countless lives. STEM is evolving so rapidly that our society is beginning to mirror an episode of *The Jetsons!* And yet, at the same time, over a billion people in today's population have received no formal education, especially not in STEM! STEM education in today's generation matters more than ever, as it is our generation that is positioned on the frontline of making decisions that could revolutionize or cataclysmically break our future!

STEM education is a necessity, which is even more essential to today's generation, as we are faced with so many issues that have major impacts on our future. There is, in fact, a huge correlation between socioeconomic status and education, which is one of the main barriers in receiving STEM education. And sadly, girls, in particular, often face many struggles and challenges when receiving an education in STEM! We must remove all barriers in STEM education, in order to create a future that we shape and not one that shapes us! In fact, STEM is supposed to encourage us to unleash our curiosity and pursue our passions, while striving to make the world a better place! By making STEM more accessible, we are able to guarantee a

safe and innovative future!

Today, our world also faces the imminent threat of climate change and its disastrous effect on our ecosystems and population! Now, more than ever, we can see how climate change and its aggravates, such as pollution, carbon emissions, and deforestation, are impacting our ecosystems and their inhabitants (including humans) in a negative way. Pollution and fossil fuels are destroying our planet, leaving our generation at a crossroads as to how to proceed in a sustainable and environmentally-friendly way. But without critical education, neither our generation nor future generations will be able to successfully find the desperately needed solution to climate change!

We live in an incredibly innovative society, where there seems to be a revolutionary invention all the time! Twenty years ago, the idea of using a mobile cell phone with internet seemed impossible! And last year, the idea of artificial intelligence appeared unthinkable, let alone the use of AI in our personal lives! AI has even reached the point where it is able to analyze images of unhealthy areas in coral reefs, allowing for the restoration of many natural habitats. But even in a world with artificial intelligence, we still need to focus on advancing the technology that dominates today's society. But in order to remain ahead as a society, we need to break down barriers in STEM education and make it accessible to the next generations, in order for them to master critical skills that will be beneficial for our planet's future!

There are so many problems that our generation is faced with, but there are also so many solutions that we create, once we prioritize STEM education! STEM surrounds every aspect of our lives and the moment that we begin to feed into our curiosity and make learning about these passions more accessible, we can begin to create a better and brighter future for many generations to come! By breaking down barriers, challenging societal norms, and creating an inclusive community for education, we, as the next generation, will be able to revolutionize all aspects of science, technology, engineering, and math!

STEM's Integration into our Daily Lives

By: Vignesh Nagarajan

In our technologically sophisticated world, technology is integrating itself into every aspect of our daily lives. Every industry that one can think of has some form of advancing technology that is constantly being updated and revised. From the medical equipment used by doctors and machines employed by manufacturing firms to widespread digital entertainment and software development in the rising technology sector, technology and innovation are more prevalent to our future now more than ever. Technology serves as a tool used to better our society as a whole. For example, advancing medical technology has increased the average life expectancy worldwide. However, these benefits should not only be enjoyed by the current generations, they should also be experienced by the future generations. The best way to ensure this is by bettering STEM education. This is crucial now more than ever, as technology rapidly weaves itself into every facet of our lives.

Regardless of what one does in their future, basic knowledge of STEM is vital to one's success, regardless of their profession. This is simply because almost all professions are gradually drifting towards technology in one way or another. For example, teachers had to get familiar with different softwares during remote learning. Basic knowledge about STEM demonstrates that one is planned for the future, and that one is able to keep up with the current technology trends; in other words, basic STEM

knowledge immediately places one in a favorable light in the job market, when compared to one's counterparts who lack this basic knowledge. Furthermore, firms prefer candidates who demonstrate that they can adapt to sudden changes in their digital workspace and are qualified to work with current technological tools like Google Workspace or the Microsoft Office Suite. With that in mind, it is extremely important that we ensure that everyone has access to STEM education, not only so that they can better prepare themselves for the future, but also so that society benefits as a whole as it progresses towards a more advanced community.

Another advantage of basic STEM education is ease of mind and comfort. Knowing that one is already prepared for the technology changes brought by the future ensures stability and removes the worry that comes with sudden change. Moreover, basic STEM knowledge ensures that one is comfortable with using technology more effectively and that one is more open to options that require a higher level of technological prowess. In my own experience, advanced STEM education from an early age has not only enabled me to help others understand new technology and softwares, but also to better my search for internships and career opportunities in the fascinating field of STEM and computer science.

From a financial perspective, STEM education is arguably the best investment out there. By bettering one's arsenal of technological skills right now, one will invariably be better suited to handle any sudden advancements in the future. Moreover, increased knowledge in STEM is more than likely to open oneself up to several opportunities that they would not have noticed before. A decade ago, basic knowledge about cryptocurrency and blockchain technology would have placed one in a great position. Financially, that individual would have been better off, as they would have identified cryptocurrency as a valuable asset with high potential. This would have also opened up several doors to other opportunities, such as mining rigs to mine cryptocurrency or different investment plans that also place a portion of the portfolio in cryptocurrency assets.

Another benefit of increased STEM education is that it fosters inclusion and diversity. Throughout history, certain groups such as women and underrepresented minorities have been underrepresented in STEM fields. However, this can be solved by emphasizing STEM education at an early age, which allows us to strive for greater diversity in STEM professions, leading to a more inclusive and equitable society. Promoting inclusion and diversity in STEM education is an important starting point to address underrepresentation and unlock the benefits of diverse perspectives. Encouraging early participation in STEM for students from underrepresented minorities aids in challenging stereotypes. Moreover, providing equal opportunities and resources helps overcome barriers and inspire students who may not have initially considered STEM-related careers. Promoting inclusion and diversity in STEM education leads to a more equitable society and enhances innovation. Diverse perspectives and ideas in STEM are the primary drive for creative solutions and breakthroughs. By embracing inclusion and diversity, we can not only cultivate a highly skilled, but also a diverse STEM workforce that contributes to scientific research, technological advancements, and societal progress to both benefit future generations and to combat global problems.

In conclusion, STEM education is critical because it not only empowers future generations to take control of their future, but it also opens up an array of opportunities in the digital realm. We need to ensure that STEM education is accessible by everyone, regardless of their socioeconomic backgrounds, so that the future is inclusive of everyone by assimilating existing stereotypes. Lastly, STEM education is an investment in oneself, as it arms one with the necessary knowledge to tackle sudden changes and arising problems in the future head-on. The best time to start is now; the sooner we establish STEM education as the standard, the better prepared future generations will be.

The Synergy of Art and Science: Forging a Limitless Future of Innovation

By: Dashel Myers

The world we inhabit today is an intricate tapestry of technology, creativity, and scientific exploration. As society moves forward, the lines between artistry and science blur, and the domains of creativity and innovation converge. In this dynamic landscape, STEM plays a pivotal role in forging a future where the amalgamation of these disciplines paves the way for boundless innovation.

STEM education serves as the cornerstone of progress in modern society. By integrating science, technology, engineering, and mathematics, it provides a comprehensive framework that nurtures critical thinking, problem-solving skills, and a deep understanding of the world around us. However, there has been a growing recognition in recent years that the arts, including visual arts, music, literature, and performing arts, are not merely complementary to STEM but rather integral to its success.

At first glance, the fields of STEM and the arts may appear divergent, with science emphasizing logic and empiricism, while art leans towards creativity and subjective expression. Yet, the truth is that both disciplines share a common core: human curiosity and the desire to explore and understand the world. Science seeks to unravel the mysteries of the universe, while art endeavors to capture its essence, evoke emotions, and provoke thought. By merging these two realms, we unlock the potential of human ingenuity.

One area where artistry and science unite with great impact is in design and aesthetics. The principles of mathematics and engineering underpin the structural integrity of architectural marvels, while artistic vision and creativity breathe life into their forms. Consider the Sydney Opera House, an architectural masterpiece that exemplifies the harmonious blend of engineering precision and creative brilliance. Its distinctive sail-like shells captivate the eye, while the structural engineering behind its construction ensures its longevity and functionality. The synergy between art and science in such projects results in iconic landmarks that inspire generations to come.

Advancements in technology have paved the way for unprecedented opportunities in fields where art and science meet. Digital art, for instance, has revolutionized the way we create and experience artistic expression. From digital painting and sculpture to interactive installations and virtual reality experiences, technology has provided creators with a new palette to manifest their ideas. This blending of art and technology not only pushes the frontiers of creativity but also opens up avenues for innovative collaborations between artists and scientists, fostering a rich cross-pollination of ideas and perspectives.

In addition to design and technology, the consolidation of artistry and science holds immense potential in fields such as medicine and healthcare. Medical illustrations, for example, bridge the gap between complex scientific concepts and their visual representation, making them more accessible to both healthcare professionals and patients. Similarly, music therapy utilizes the power of sound and rhythm to enhance healing processes and improve well-being. The union of art and science in these areas not only improves the efficacy of medical practices but also adds a humanistic touch, providing solace and comfort to individuals in need.

The merging of artistry and science also fosters innovation by encouraging interdisciplinary approaches to problem-solving. By transcending traditional disciplinary boundaries, STEM professionals and artists can collaborate on complex societal challenges, leveraging their unique perspectives and skill sets. This interdisciplinary synergy has the potential to yield groundbreaking solutions in areas such as sustainability, renewable energy,

climate change mitigation, and urban planning. The fusion of scientific expertise and artistic imagination can lead to innovative designs, products, and services that address pressing global issues while captivating the human spirit.

The integration of artistry and science in education fosters the development of well-rounded individuals equipped with a wide range of skills and competencies. The inclusion of arts in STEM curricula cultivates creativity, empathy, and a holistic understanding of the human experience. It encourages students to explore the intersection of art and science, think outside the box, envision novel solutions, and communicate complex ideas effectively. This multidimensional approach to education not only prepares individuals for the demands of a rapidly evolving world but also instills a deep appreciation for the beauty and wonder of the universe.

The benefits of joining craftsmanship and rational inquiry extend beyond individual development. They have far-reaching implications for economic growth and societal progress. Art-inspired technological advancements have revolutionized industries such as entertainment, advertising, and gaming. The visual effects in blockbuster movies, immersive virtual reality experiences, and interactive advertising campaigns are all products of the convergence of art and technology. These advancements not only captivate audiences but also create opportunities for businesses.

The bond between artistry and science promotes cultural enrichment and social cohesion. Artistic expressions have the power to transcend cultural boundaries, foster dialogue, and promote understanding. When combined with scientific advancements, they serve as catalysts for social change and transformation. Art and science collaborations can address societal challenges, raise awareness about environmental issues, and inspire collective action. Through art installations, exhibitions, and performances, complex scientific concepts can be communicated to diverse audiences, stimulating discussions and empathy.

STEM education provides the foundation for a future where artistry and science cooperate to propel boundless innovation. The integration of art and science in areas such as design, technology, medicine, and interdisciplinary

problem-solving holds the key to unlocking new realms of human potential. By nurturing the creative spirit alongside scientific inquiry, we create a fertile ground for imaginative exploration and groundbreaking discoveries. As we embrace the convergence of artistry and science, we embark on a journey of infinite possibilities, where the boundaries of innovation are continuously pushed, and the human experience is enriched in ways we have yet to imagine.

Unlocking Potential: The Imperative of STEM Education in Today's World

By: Jaden Cutinha

Introduction

STEM education has evolved as a vital component of a well-rounded education in today's fast-paced and technology-driven world. Science, Technology, Engineering, and Mathematics are the foundations of innovation and progress in a variety of fields. I want to examine the importance of STEM education in our culture, with a particular emphasis on its transformative power for underserved groups. I will describe the remarkable path of two students who overcome hurdles and discovered their passion for coding and mathematics, eventually designing their own applications, based on my experience with my non-profit organization dedicated to giving STEM education to disadvantaged children.

Empowering the Marginalized

STEM education has the ability to empower marginalized people by providing them with possibilities for personal and intellectual development. Many children from low-income families confront several challenges to their scholastic advancement. We can, however, break down these barriers and reveal their hidden potential by offering access to high-quality STEM education. We met two outstanding students at my non-profit organization (not named for privacy reasons) who had struggled with traditional learning

approaches. They struggled to engage with courses like literature and history that were taught in a traditional manner. We exposed them to STEM education after recognizing their special requirements, and their lives were forever changed. They were able to engage with the subjects on a deeper level since STEM instruction is interactive and hands-on. Through coding and math, they discovered a world where logic, problem-solving, and creativity seamlessly merged.

Nurturing Passion and Interest

One of the most important components of STEM education is its ability to arouse young minds' passion and interest. STEM education stimulates curiosity and a true love of learning by immersing students in hands-on activities, experiments, and projects. STEM became a vehicle for the two individuals to develop their natural abilities and pursue their interests. They were initially hesitant and worried, but they quickly became enthralled by the world of code and mathematics. They eagerly engaged themselves in the study of numerous programming languages and the complexities of complicated mathematical topics. The satisfaction they felt from writing their own programs and seeing their codes come to life was unrivaled. STEM education not only equipped them with essential skills but also fostered a love of science that would guide their academic and career journeys.

Developing Critical Skills

STEM education provides students with a variety of vital skills that are in high demand in today's workforce. Problem-solving, critical thinking, cooperation, and adaptability are all required for success in a continuously changing world. Our two students refined their problem-solving skills and were skilled at understanding difficult situations as they immersed themselves in STEM education. They learned to be resilient in the face of adversity and to see barriers as chances for progress. STEM education's collaborative aspect enabled them to work well in teams, improving their communication and interpersonal skills. These abilities are not only

necessary for academic success, but they are also applicable to a variety of real-world settings.

Fostering Innovation and Entrepreneurship

STEM education encourages students to think creatively and develop answers to real-world problems, fostering a culture of creativity and entrepreneurship. In an era where technical developments fuel economic progress, it is critical for cultivating a new generation of innovators and entrepreneurs. The two students, when introduced to STEM, begin investigating methods to apply their newfound knowledge to real-world issues, inspired by their newfound interest in coding and mathematics. They envisioned creating initiatives to solve social issues in their local town. Their unique ideas and determination inspired them to establish an educational platform targeted at offering STEM resources to impoverished children who did not have access to a decent education. Their entrepreneurial spirit illustrates how STEM education not only provides individuals with technical skills but also instills a sense of purpose and meaning in their lives.

Conclusion

STEM education is undeniably essential in today's world, especially for underprivileged communities. It has the power to transform lives, unlocking the potential of students who face various challenges in traditional learning environments. The journey of the students we met at our organization showcases the immense impact that STEM education can have on individuals, empowering them to discover their passions, develop critical skills, and become agents of change. To ensure a brighter future for all, it is crucial to prioritize and invest in accessible STEM education. By providing equal opportunities and resources to underprivileged students, we can bridge the educational gap and empower them to pursue careers in STEM fields. STEM education encourages individuals to become active contributors to their communities and the global landscape by creating a comprehensive understanding of scientific principles, technology applications, engineering procedures, and mathematical concepts. It fosters creativity, curiosity, and

resilience, allowing students to pursue their passions and vocations at the cutting edge of innovation. Additionally, STEM education is critical for generating economic growth and tackling societal challenges. STEM education helps countries remain competitive in a globalized world by training citizens for the professions of the future. It provides students with the knowledge and skills they need to address current issues including climate change, healthcare inequities, and sustainable development. As we move forward, it is critical to recognize the importance of STEM education and emphasize its inclusion in educational institutions around the world. Governments, educational institutions, and communities must work together to give STEM educators and students resources, training, and support. Partnerships with industry leaders and non-profit organizations can also assist bridge the gap between classroom learning and real-world applications, ensuring that students are prepared for the modern world's difficulties and opportunities. We can establish a society in which every individual has the opportunity to flourish, develop, and contribute to the advancement of our globe if we work together. Let us embrace STEM education's revolutionary power and work toward a future based on knowledge, equity, and limitless possibilities.

The Paradox of Progress: The Need for STEM Education in the Age of Artificial Intelligence

By: Veer Banwait

In this new era of technological progression, artificial intelligence (AI) has rapidly emerged as a dominant and transformative force. It is undeniably reshaping industries, societies, and everyday life in unprecedented ways. Yet, amidst the rising of AI applications, we encounter a paradox. While AI is regarded as a futuristic propeller, it also exposes a profound flaw: the perpetuation of biases.

An aspect of AI that often gets overlooked is its ability to inadvertently exacerbate existing biases. AI is not inherently objective as it's a product of human design and ingenuity. Therefore, AI can mirror the unconscious biases of those who design and program it. In the healthcare field, AI has been extensively researched and applied due to its perceived objective data analysis. However, a lot of that research used minimal or unrepresentative data effectively perpetuating biases. This paradox became evident in my own experience during a skin cancer research project. Intent on using AI to diagnose and provide potential solutions for this deadly disease, I found myself facing an unexpected challenge. The available open-source data consisted of mostly, if not all, lighter skin tones providing a misleading picture of the disease's actual manifestation. A research paper published

by the Journal of the American Academy of Dermatology (JAAD), titled 'Bias In, Bias Out: Underreporting and Underrepresentation of Diverse Skin Types in Machine Learning Research for Skin Cancer Detection - A Scoping Review', confirmed this bias. This review found that out of 1408 studies identified, only 6 disclosed the skin types of their image sources, and only 12 disclosed race or ethnicity. Moreover, studies including skin type VI or African American, American Indian, Alaska Native, or Hispanic patients were notably minimal. Images were predominantly of lighter skin types, and cohorts to train algorithms were most often derived from the United States, Europe, Australia, and East Asian countries. This lack of diverse representation can lead to an AI trained on these unrepresentative datasets providing a potentially life-threatening misdiagnosis for underrepresented communities.

In my own experience, growing up in America, I often encountered moments of limited representation. Although quite minor, these moments had a great impact on me. I remember going to a corner store and seeing keychains with pre-printed names. Scanning the display, I could not find my name among them. It was a small incident, yet it subtly communicated a message: this place wasn't made for people like me. The lack of my name on a keychain may seem trivial, but it was a representation of the broader issue of underrepresentation and exclusivity.

This issue isn't confined to the field of healthcare or small personal experiences like my own. It spreads across various sectors, such as in facial recognition technologies that struggle with ethnic diversity, or voice recognition software ill-equipped to understand a range of accents, each with its threat to humanity. The impact of bias in AI is much larger than we may initially perceive. The fact is, our societies are increasingly relying on these AI systems to carry out functions that have far-reaching implications, from law enforcement surveillance to customer service operations. As a result of limited AI regulation, biases that may have been previously confined to individual spheres are now being replicated on a larger scale,

sometimes even institutionalized. The lack of accountability can allow AI to become an agent of prejudice, reinforcing discriminatory patterns. It's a reminder that the story of AI is intertwined with our own, and biases in the digital realm can have far-reaching consequences in the real world.

The solution to this complex issue lies in fostering STEM (Science, Technology, Engineering, and Mathematics) education. The present and future demand a generation armed with the necessary skills to tackle these pressing challenges. By equipping our children with STEM knowledge, we prepare them to thrive in this evolving world and ensure AI developments reflect the diversity and complexity of our global population. To truly harness the transformative potential of STEM, however, it's not enough to simply introduce these subjects to our children. We must also work to cultivate a rich, inclusive environment that welcomes and nurtures diverse minds. Having relatable role models in STEM fields is a powerful component of this strategy. When children see individuals who look like them, share their experiences, and break through barriers in these fields, they are inspired. Such role models help them envision themselves as future scientists, technologists, engineers, or mathematicians, shaping the world with their contributions. It also dispels stereotypes and biases that might otherwise discourage them from pursuing these disciplines. Diversity in STEM leaders also encourages greater action towards mitigating biases and improving technologies' effect on minority groups. Therefore, let us not only focus on imparting STEM knowledge but also on creating a more diverse representation within STEM itself. By doing so, we can ensure that the power of STEM extends beyond classrooms and laboratories, sparking a cultural shift towards inclusivity and equity in our society.

STEM education is no longer a choice; it's an imperative. It has the power to inspire a generation of problem solvers, equipped to combat biases ingrained in our increasingly technology-dependent society. Early STEM exposure can instill the curiosity to question, the courage to innovate, and the compassion to ensure these innovations serve the entirety of humanity. Our future

with AI can be a world where technological advancement addresses global problems, but this is contingent upon our ability to rectify the biases present in our current systems. By encouraging STEM education, we give our children the tools they need to shape a more inclusive, equitable future and prepare them for creating technological advancements for the benefit of humanity.

In this narrative of AI's future, the paradox of progress is only the beginning. The coming chapters will be written by those children who, equipped with STEM education, will grow to become the architects of technological advancements including AI's destiny. By teaching them to be the creators and critical evaluators of technology, we ensure that technology serves all of humanity. Theirs will be a story of hope, inclusivity, and progress, turning the paradox of AI's evolution into a testament to human potential and resilience.

STEM Is Everywhere

By: Alexander W. Zhai

When my mother was asked when math would ever be used in real life, she always responded with “math is everywhere.” To the mind of a naive child, the statement was absolutely ludicrous. How could something that seemed so intangible like math be everywhere? Was math present in a building? A car? A kitchen? My very basic understanding as a child was, if there weren’t addition, subtraction, multiplication and division signs plastered all over something, then math and STEM certainly played no part in its creation. It took me an embarrassingly long time to realize how wrong I was. A building without STEM would teeter and collapse at the slightest wind current. A car without STEM would have no safety features, radio, or built in GPS. Even a kitchen without STEM wouldn’t serve any purpose. Every part of STEM, science, technology, engineering, and mathematics, plays a major part in our lives, whether you realize it or not. Without a STEM education, the world as we know it would not exist.

STEM saves lives.

In 1346, the Black Death ravaged Europe, ultimately wiping out sixty percent of its population. In 2020, the COVID-19 pandemic shut down the world. Yet, 674 years of improvements in science and medicine led to a vaccine being developed in record time. The progress in science allowed humanity to respond to COVID-19 with remarkable speed. Advancements in drones brought supplies and relief to victims of Hurricane Harvey

where rescuers couldn't. Advanced cameras equipped on these drones located those stranded in the flood, guiding rescue teams to their location. Earthquake resistant buildings saved countless lives and mitigated damage during the Great East Japan earthquake of 2011. It isn't just scientists with years of experience and new technologies that save lives through STEM. In 2004, 10 year old Tilly Smith recognized the signs of a tsunami on Mai Khao beach, Thailand, from her geography class at school. The knowledge from her STEM class saved all 100 tourists on Mai Khao beach. My mother was able to be cured from her thoracic cancer from treatments made possible by scientists and administered by her doctors, and I am forever grateful.

Perhaps in the future, we will have cures to crippling diseases like cancer. Perhaps in the future, we will design structures impervious to any earthquake. Perhaps in the future, all people will be aware of the early signs of an impending tsunami.

However, with a STEM education, it is not a matter of "if", but "when" we will find that cure, design that structure, and inform the world.

STEM encourages critical thinking and curiosity.

In 1666, an apple fell on Issac Newton's head, leading to him discovering gravitational force. While the exact details of the story have been debated, it was this curiosity to figure out why such events happen that led to the discovery of gravity.

STEM education teaches concepts such as the scientific method, instilling a desire for students to find answers to their own questions. An education that emphasizes creative problem solving and tackling challenges is essential for all grade levels, and makes students capable, independent future adults. When I was in elementary school, my school hosted an "egg dropping event". Determined to make the best container, I tested styrofoam, cardboard, and even light paper boxes for their durability and weight. For the insulation, I found toilet paper and bubble wrap to be the lightest yet softest material. Finally, for the parachute, I chose Ralphs plastic bags, as my experience playing with these already proved to me their ability to float.

The usefulness of the strongest egg protection container is debatable, but

the experience of discovering the best materials and design fostered my critical thinking skills, and, beyond school, used them in my personal life as well.

In 1960, the possibility of a human entering space seemed impossible. Just a year later, the first human successfully orbited the Earth, and the rest is history. It is the curiosity and ambition of humanity to discover what we don't know that drives us to discover and achieve what we previously thought was unachievable.

STEM revolutionizes the way we live.

Throughout our recent history, the methods of communication have undergone rapid transformations, from the introduction of the telegraph in the 1830s and the telephone in the 1870s to the emergence of pagers in the 1990s and our present-day reliance on text messages and emails. Our method of travel has changed from horses and railroads to subways, cars, and airplanes. Even fast food restaurants have implemented robot chefs and online ordering. These advancements are quickly making human interaction and society more efficient. An education in STEM is needed more than ever to keep up with the ever changing world. When I was in elementary school, we changed from practicing cursive to practicing typing in the blink of an eye. Beyond simply adapting to the changing world, a STEM education prepares the next generation to tackle the challenges of climate change, renewable energy, cybersecurity, and even another potential global pandemic.

While I didn't see it as a child, a STEM education for children is critical. As I entered high school, I began volunteering as a teacher's assistant and teacher at my local after school. If we are to do our due diligence for the future of humanity, properly equipping people with an education in STEM to solve the problems of today will make a better planet for the people of tomorrow.

The Heart and Mind of STEM: A Symphony of Intellectual and Emotional Growth

By: Sanaa Ashwin Karkera

In the realm of science, technology, engineering, and mathematics (STEM), an extraordinary and transformative journey unfolds—a journey that engages both our hearts and minds. STEM education transcends the boundaries of mere knowledge acquisition, reaching deep into the recesses of our emotions and serving as a catalyst for personal growth and transformation. It weaves together the power of reason and the profound emotional connections we form with the world, creating a harmonious symphony that enriches our lives in ways that are both tangible and intangible.

At its core, STEM education is driven by an insatiable curiosity—a relentless hunger for knowledge expanding our understanding of the world and stirring the deepest fibers of our emotional being. As we delve into the complexities of scientific inquiry, mathematics, and technological advancements, we are captivated by the inherent beauty that exists within every discovery, equation, and innovation. This beauty becomes a source of solace, wonder, and an indescribable sense of awe that resonates with our souls and fuels our passion for exploration.

STEM education provides us with a framework for intellectual exploration, daring us to push the boundaries of what is known, challenge conventional wisdom, and fearlessly embrace the unknown. It compels us to think critically, analyze information, and seek answers based on evidence. Yet,

beneath the surface of these cognitive processes lies an emotional tapestry woven from the threads of passion and inspiration. This emotional tapestry adds vibrancy and color to our pursuit of knowledge, fueling our desire to uncover truths and make meaningful contributions to society.

In the world of STEM, each breakthrough, scientific discovery, and technological advancement carries with it an emotional weight—a resonance that reverberates within us. The validation of a hypothesis, the resolution of a long-standing puzzle, or the transformative impact of an innovation elicit a symphony of emotions within us. Elation, triumph, and a profound sense of accomplishment surge through our veins, reaffirming our purpose and kindling an unshakable belief in the power of human ingenuity. STEM education offers us the opportunity to contribute to this symphony, to add our voices to the collective knowledge, and to witness firsthand the profound impact it has on the world.

Furthermore, STEM education is not an individual endeavor, but rather a collaborative pursuit that fosters meaningful connections with others. Through collaborative environments such as experimentation, project, and discovery – we are exposed to the art of collaboration, effective communication, and empathy. As we navigate the complexities of teamwork, we develop emotional intelligence—the ability to understand and connect with others on a deeper level. This emotional intelligence extends beyond the confines of the classroom, nurturing empathy and compassion that are essential in an interconnected world. STEM education thus becomes a catalyst for emotional growth, fostering the bonds that unite us as humans and nurturing a shared vision for a better future.

Additionally, STEM education instills within us the invaluable gift of resilience—a tenacious determination to overcome challenges and persevere in the face of adversity. The process of experimentation and problem-solving often entails multiple attempts, failures, and recalibrations. It is in these moments of struggle that we cultivate emotional strength, resilience, and a profound understanding that setbacks are not synonymous with failure but rather serve as stepping stones towards growth. Within the nurturing environment of STEM education, we learn to embrace failures

as opportunities for learning and personal development, reinforcing our emotional resilience and preparing us for the intricacies and challenges of life.

In essence, the journey of STEM education is a profound and multifaceted one that engages not only our intellect but also our emotions. It ignites our passions, evokes a sense of wonder, and forges lasting emotional connections with the knowledge we acquire. STEM education molds us into resilient, empathetic individuals, empowering us to contribute meaningfully to the world and make a positive difference in the lives of others. It equips us with the tools and mindset needed to tackle the complex challenges of our time, fostering innovative solutions and nurturing a sense of responsibility towards the betterment of society. This symphony of intellectual and emotional growth resonates within us, shaping our perspectives, values, and aspirations, and ultimately guiding us towards a future that is both intellectually enlightened and emotionally fulfilling.

The Importance of Minorities and Diversity for Enhancing the Future of STEM

By: Sophia Klima

As I walk down the streets of downtown Toronto, I observe the flurry of people, buildings, and noises around me. A car makes a late turn, resulting in a few honks at each other. A mother carefully holds her daughter's hand as they cross the street, speaking what I presume to be Arabic. A teenage girl and her friend laugh together, when one of them picks up her phone and suddenly switches to speaking a completely different language. Over my lifetime of living in this beautiful city, I have come to recognize the benefits of a functioning diverse community. But how can diversity enhance the STEM field? What important roles do minorities have in the enhancement of humankind's progress in technology and innovation? In my segment of this book, I will focus on why people from diverse backgrounds are essential to the improvement and enhancement of the future of STEM.

Multiculturalism is proven to better communities, cities, and workplaces through having a greater variety of perspectives. People coming from different ethnic origins approach problem solving with different personal values and opinions. Cultural practices, traditions, and religion can also hold a significant importance in an individual's identity, which then impacts their contributions to their field of work. Toronto, being the second city

in the world for the highest percentages of cultural diversity, is at a higher advantage. People from different countries around the world immigrate to Toronto and collaborate together in the workforce. An observation I have found is that within the media, minority groups tend to be the leading group that makes up the future of innovations. Allow me to explain. A large portion of these world-leading innovations is showcased in The Economist Magazine. While observing the many creative ideas people have innovated, I have noted that many of the scientists who are publishing papers of leading discoveries are of non-white background. A story from April 15th 2023, highlighted a non-profit organization's actions to solve a community crisis. Gaibandha, a rural district of northern Bangladesh was in a crisis to solve the seasonal floods that would destroy the fields and homes of villagers. Architects Runa Khan and Kashef Mahboob Chowdhury designed an innovative layout in the shape of a boat that would allow water to pass without damaging the village. As one learned from another, the bio-landscaping concept has spread to other communities struggling with similar circumstances, creating an impact that would last for generations.

Though this celebration of discoveries is a great step towards a more diverse STEM future, we come across a critical issue. Minorities in STEM are vastly underrepresented. A statistic from the Canadian Science Policy Center states that women represent only 12% of full time STEM professions in Canada, and are given less pay. According to the National Science Foundation, across the United States the STEM workforce is 89% of white racial background and 72% male.

In conclusion, After examining The Economist Magazine and Toronto's communities, minorities are the leading future of STEM. Though there is a lack of these minorities, we as a society have hope in the future that this lack will only improve for the better. If we strive for diversity, equity, and inclusion in our workforce environments, innovation and creativity would excel at a rapid rate. We must continue to educate and encourage more minorities in the STEM field to showcase their creativity. As the chemist,

biologist, and first African American woman astronaut in space quoted, “Don’t let anyone rob you of your imagination, creativity, or curiosity. It’s your place in the world; it’s your life. Go on and do all you can with it, and make it the life you want to live.” – Mae Jemison.

The Indispensability of STEM: The Catalytic Substance of Human Progress

By: Aaryan Kushwah

In our dynamic and ever-developing world, STEM (Science, Technology, Engineering, and Mathematics) stands as the cornerstone of innovation, modernization and advancement. With its interdisciplinary nature, holistic approach and unwavering pursuit of knowledge, STEM empowers humanity to leap across hurdles and unravel the mysteries of the universe. This essay explores the profound significance of STEM, highlighting its pivotal role in shaping our past, present and future.

In the realm of elementary education, few grades rival the imaginative potency of grade four. It is a stage where youthful minds, unburdened by the weight of extensive knowledge, are free to unleash their boundless creativity. It was during this formative period that I embarked on a path that would shape my journey, I emerged as a budding visionary, conceiving inventions that ignited curiosity and sparked change. One such creation was an automated waste segregator seamlessly integrated into a common dustbin. This simple yet innovative solution aimed to relieve consumers of the burden of waste segregation, ensuring proper disposal without the need for conscious thought. It was an early testament to my restless spirit and passion for problem-solving.

Undeterred by my previous accomplishment, I ventured into an even grander endeavor—an imagined personal assistant that would faithfully

accompany its owner. This concept sought to blend technology with companionship, offering assistance and easing mundane tasks. With every stride, I embraced the notion of a future shaped by innovation, where my creations evolved alongside my own growth.

As the years progressed, my passion for transformative ideas harmoniously merged with my reverence for knowledge and social impact. Today, I find myself engaged in a noble pursuit—an undertaking to establish a legal literacy foundation. Guided by the power of artificial intelligence, I develop a curriculum for engineering and science, aimed at empowering minds with an understanding of the legal aspects that govern these fields. Through this endeavor, I hope to demystify the complexities of the legal realm and foster accessibility for all aspiring STEM enthusiasts.

It was during those formative years that the seeds of invention were sown, gradually maturing into a fruitful landscape of creativity. Driven by a desire for autonomy, I established my own publishing agency, providing a platform for diverse writers from various corners of the world. Together, we explore narratives that transcend borders, inspiring imaginations and fostering enlightenment.

STEM, like a guiding force, has permeated every facet of my existence, reshaping my perspectives and igniting a lifelong thirst for discovery. It has nurtured within me an unwavering curiosity, a steadfast commitment to innovation, and a resolute dedication to creating a world enriched by knowledge. Through the transformative power of STEM, I have come to recognize the boundless potential within and the capacity to make a meaningful contribution to the tapestry of human progress.

The experiences of grade four served as a transformative crucible, shaping the foundations of my future endeavors. From the inception of an automatic waste segregator to the formation of a legal literacy foundation and a publishing agency, STEM has weaved a tapestry of profound change in my life. It has endowed me with purpose, emboldening me to transcend boundaries and embrace the vast realm of human possibility.

1. Igniting the Spark of Exploration:

STEM serves as a catalyst that ignites the flame of curiosity and discovery

within individuals. By nurturing inquisitiveness and equipping them with analytical tools, STEM creates fertile ground for ground-breaking research and innovation. Through scientific inquiry, technological advancements, engineering marvels, and mathematical insights, STEM propels us forward in unravelling the mysteries of the natural world.

2. Driving Economic Prosperity:

The connection between STEM and economic growth cannot be overstated. Nations that embrace STEM education and invest in research and development become engines of progress. Technological breakthroughs create new industries, generate employment opportunities, and spur economic advancement. STEM-driven innovations foster entrepreneurial ecosystems, attracting investment and propelling economic prosperity.

3. Addressing Global Challenges:

Humanity faces numerous global challenges, from climate change to public health crises. STEM plays a pivotal role in understanding, mitigating, and resolving these issues. Through scientific inquiry, technological innovations, engineering solutions, and mathematical modelling, STEM equips us to address complex problems and create a sustainable future.

4. Enhancing Quality of Life:

Advancements in STEM significantly enhance the quality of life for individuals and societies. Medical breakthroughs save lives, improve health outcomes, and extend lifespans. Technological innovations revolutionize communication, transportation, and access to information. Engineering feats improve infrastructure, water supply, and urban development. Mathematical models optimize processes, enhancing efficiency and resource allocation. Collectively, STEM disciplines elevate human well-being and lay the foundation for a better future.

5. Cultivating Critical Thinking and Problem-Solving Skills:

STEM education fosters critical thinking, analytical reasoning, and problem-solving skills necessary for navigating the complexities of the modern world. STEM disciplines teach individuals to approach challenges with logic, evidence, and creativity. These skills are transferable across various domains, empowering individuals to make informed decisions and

contribute to a dynamic society.

6. Advancing Sustainability:

STEM plays a vital role in promoting sustainable development. Through scientific research, technological advancements, and engineering expertise, STEM offers innovative solutions to reduce carbon emissions, conserve resources, and embrace eco-friendly technologies. STEM leads the way in creating a greener and more sustainable future, with a focus on renewable energy systems and waste management strategies.

7. Fostering Global Collaboration:

STEM transcends geographical boundaries, fostering global collaboration. In an interconnected world, scientific discoveries and technological advancements are shared, fuelling progress on a global scale. Collaborative efforts between scientists, engineers, and mathematicians from different regions lead to synergistic outcomes, enabling the exchange of knowledge and resources. STEM serves as a universal language, uniting nations in the pursuit of shared goals, such as eradicating diseases, addressing climate change, and advancing space exploration.

6. Advancing Technological Innovation:

STEM plays a pivotal role in driving technological innovation, pushing the boundaries of what is possible. Through scientific research and development, STEM disciplines pave the way for transformative technologies that revolutionize industries and improve our daily lives. From advancements in artificial intelligence and robotics to breakthroughs in nanotechnology and biotechnology, STEM fuels a constant stream of innovation, enhancing our capabilities and opening new frontiers of possibility.

7. Promoting Global Competitiveness:

STEM education and expertise are essential for maintaining a competitive edge in the global arena. Nations that prioritize STEM education and foster a skilled workforce gain a significant advantage in the global economy. STEM-driven industries and technologies are at the forefront of global competitiveness, driving innovation, attracting investment, and generating high-quality jobs. By investing in STEM, countries position themselves as leaders in science, technology, and innovation, enhancing their overall

competitiveness on the world stage.

STEM, as the catalyst for human progress and innovation, plays an irreplaceable role in shaping our present and future. It sparks curiosity, drives economic growth, addresses global challenges, enhances quality of life, cultivates essential skills, advances sustainability, promotes global collaboration, fosters technological innovation, and fuels global competitiveness. To fully leverage the transformative potential of STEM, it is crucial to invest in education, foster interdisciplinary collaboration, and ensure equitable access for all. By harnessing the power of STEM, we pave the way for a prosperous and thriving future for humanity.

The Transformative Power of STEM in Preserving Humanity

By: Kishan Kumar Namburi

Imagine a world that, day by day, becomes harder and harder to see. A world where finding the smallest of items is an arduous task. This is the world that many individuals with retinitis pigmentosa (RP) have to live as a pigment covers their retina killing off their peripheral vision slowly taking away the gift of sight. This is a world that is lived by millions of individuals around the world, including my mother. But the list of life changing conditions doesn't stop there. Thousands of conditions impairing people from all five of their senses exist along with a multitude of conditions that plague many parts of the body, and there is only one apparent solution in order to assist those in need. That solution is the continual integration of STEM (Science, Technology, Engineering, Math) education into the world in order to provide more information, create experience, and ultimately foster youth who can solve these problems in the future.

STEM fields already contribute largely to medical innovation. Through the provision of modern, cutting edge technologies, treatments, and other life-saving interventions, STEM fields already attempt at solving the vast majority of problems that are present today. The field of biomedical engineering for example merges principles of human biology and engineering in order to create assistive technologies such as prosthetics or different meters to measure a variety of things in the human body. But we have merely

scratched the surface. The potential of fields such as biomedical engineering span far past what is available in the modern day. The incorporation of STEM education is what builds interest regarding these topics and is ultimately what allows for fields such as these to be furthered. The potential impact of these technologies and research goes far beyond creating assistance to those with certain impairments. Even problems such as those that have happened in recent times, for example the COVID-19 pandemic, can be solved at a much quicker rate with newer technology.

STEM disciplines are also on the forefront of developing technology to further disease prevention. The ultimate goal is not just to find a vaccine or a cure for every major disease or virus out there, but to create a set of things meant solely for the purpose of preserving health and humanity. With growing numbers of discoveries, STEM education is necessary not only to fix existing health complications, but also to make sure that more problems do not form in the future. We, in recent years, have been able to see the massive impact that a singular virus could have on the world, and in order to stop similar things from replicating, STEM education is almost imperative.

In my life, I have been able to see first hand how a condition can affect someone's day to day life, and how a simple task can become all the more difficult. To prevent these problems along with preventing ensuing problems, the continued pedagogy of STEM in schools and programs around the world is essential. For the sake of preservation of humanity, and the improved quality of life for hundreds of million around the world who face a variety of different health issues and complications, STEM is necessary. For people in the future who are born with conditions that will change the course of their life, STEM is necessary. And that change is only possible with years of work starting now from our youth. From medical research and breakthroughs to advanced diagnostics, telemedicine, and biomedical engineering, STEM disciplines continue to drive innovation, improving patient outcomes, and transforming the healthcare landscape, and the youth of today are the people who will continue this in the future, and so STEM education is necessary.

The Indispensable Role of STEM Education

By: Garret Richter

STEM education, encompassing science, technology, engineering, and mathematics, is not merely a collection of subjects, but a transformative force that nurtures curiosity, builds critical skills and strengthens cognitive abilities. It catalyzes intellectual growth, stimulating the brain and enhancing thinking, reading, and learning processes. In this essay, I will delve deeper into why STEM education is essential, drawing upon my experiences in the Honors Physics and Engineering VEX Robot Manufacturing course and the Model Rocketry Club. Through these experiences, I discovered the myriad benefits of STEM education, from developing problem-solving skills and fostering creativity to strengthening cognitive abilities.

STEM education encourages hands-on learning experiences and real-world applications which pique students' interest and drive them to ask questions, seek answers, and unravel the world's mysteries. Through my involvement in the Honors Physics and Engineering VEX Robot Manufacturing course, I was constantly challenged to think critically, experiment, and push the boundaries of my knowledge. STEM education offers a dynamic learning environment that fosters curiosity by presenting students with engaging and interactive opportunities to explore scientific phenomena and engineering concepts. The practical applications of STEM subjects help bridge the gap between theory and practice, igniting a desire to uncover the underlying principles governing the natural and technological world. By engaging in activities such as building robots or conducting experiments,

students are not passive recipients of information but active participants in the learning process. This hands-on approach empowers them to take ownership of their education, motivating them to delve deeper into STEM subjects and pursue further exploration. Moreover, STEM education equips students with a diverse range of skills that are vital for success in today's technologically driven world. Through my participation and formation of the Model Rocketry Club, I realized that STEM learning is not limited to theoretical knowledge but also encompasses practical skills such as teamwork, communication, and project management. Designing, building, and launching rockets required collaboration, effective communication, and meticulous planning. Each team member brought their unique strengths and perspectives, fostering a sense of collective responsibility and encouraging the exchange of ideas. This collaborative environment allowed us to capitalize on each other's strengths and work towards a common goal. These experiences honed my ability to work effectively in teams, express ideas clearly, and manage time and resources efficiently.

Furthermore, STEM education fosters problem-solving skills, analytical thinking, and the ability to adapt and innovate in the face of challenges. The nature of STEM subjects inherently involves encountering complex problems that demand critical thinking and creative solutions. As a founder of the Model Rocketry Club, I encountered numerous obstacles during the design and construction process. From troubleshooting technical issues to optimizing rocket performance, each hurdle required a systematic and analytical approach. Through these experiences, I developed the ability to identify problems, break them down into manageable components, and devise innovative strategies to overcome them. This resilience, adaptability, and creative thinking mindset have proven invaluable in various aspects of my life beyond STEM. STEM education transcends the classroom, nurturing a passion for lifelong learning and inspiring students to contribute actively to scientific and technological advancements. By providing students with the tools to think critically, collaborate effectively, and tackle complex problems, STEM education equips them with highly sought-after skills in today's workforce. The interdisciplinary nature of STEM subjects enables

students to develop a broad skill set that can be applied across various fields and industries, ensuring their readiness to meet the challenges and opportunities of the future. In addition, STEM education stimulates and strengthens cognitive abilities, enhancing thinking, reading, and learning processes. Engaging in STEM activities activates different regions of the brain, fostering neural connections and improving cognitive functions. Through hands-on experiments and projects, I experienced firsthand how STEM learning challenges the brain, encouraging it to analyze, synthesize, and integrate information. This active learning process helps improve memory retention, critical thinking, and problem-solving abilities. The iterative nature of STEM projects, where solutions are refined and improved upon, also promotes resilience and perseverance, which are essential for lifelong learning. Like a muscle, the brain can be exercised and strengthened through STEM education, expanding its capacity to process and comprehend information.

Ultimately, STEM education is indispensable as it ignites curiosity, builds essential skills, and strengthens cognitive abilities. My experiences in the Honors Physics Engineering VEX Robot Manufacturing course and the Model Rocketry Club have demonstrated the transformative power of STEM learning. It goes beyond acquiring knowledge and empowers students to become active learners, critical thinkers, and problem solvers. Engaging in STEM education, students develop the necessary skills for success in a rapidly evolving world and unlock their innate creativity and curiosity. Through STEM education, we empower individuals and pave the way for societal progress and advancements in science, technology, engineering, and mathematics.

STEM Education: A Future of Innovation and Progress

By: Aryan Mudliar

STEM education is not just important; it is absolutely crucial in today's world. It forms the foundation for progress, innovation, and advancement in all the aspects of our lives. STEM education is the pathway to the future, equipping individuals with the essential knowledge, skills, and mindset needed to thrive in our ever changing world of technology and scientific advancements.

As technology continues to evolve at a rapid pace, STEM education helps people to adapt, innovate, and lead in fields that are shaping the future, such as artificial intelligence, renewable energy, biotechnology, computational biology, and more. By encouraging critical thinking, problem-solving, and scientific literacy, education within STEM assists individuals to develop advancements, make informed decisions, and address harmful global issues, ultimately creating a pathway for a more sustainable and successful future for all.

My passion for STEM began as I took advantage of opportunities to engage in academic clubs. Specifically, I joined my school's STEM club which focused on addressing the challenges of STEM usage in our generation, as well as conducting experiments. Through this, I began to realize the importance of

STEM education in our modern day society.

First, STEM education develops critical thinking skills and problem-solving abilities. In our rapidly evolving world driven by technology and scientific discoveries, those who have strong STEM backgrounds possess abilities to analyze complex problems, think critically, and develop solutions. Initiatives such as the FIRST robotics competition and others display the practical applications of STEM education in fostering these skills, in this case to build robots and complete tasks. If it's finding sustainable energy sources, addressing climate change, tackling medical breakthroughs, and more, STEM education allows individuals to approach these challenges with confidence and expertise.

Furthermore, STEM education promotes scientific literacy and encourages curiosity and exploration of many topics. In a time where misinformation spreads rapidly, especially on social media, having a solid understanding of scientific principles and methods is crucial. STEM education equips individuals with the tools to be able to compare fact from fiction, evaluate information effectively, and make informed decisions. It boosts curiosity and the pursuit of knowledge, and helps individuals to ask meaningful questions, conduct research, and contribute to the community.

In the medical field, STEM education plays a crucial role in developing innovative technologies and techniques which revolutionize patient care. From robot assisted surgeries to medical imaging, STEM-driven innovations have significantly improved the precision, effectiveness, and safety of medical procedures. For example, robotic-assisted surgeries enable surgeons to perform minimally invasive procedures with enhanced precision and control, leading to faster recovery times and reduced risks for patients. Similarly, advanced medical imaging techniques, such as MRI and CT scans, provide detailed looks into the human body, allowing for accurate diagnoses and personalized treatment plans. These advancements have not only transformed the field of medicine but have also enhanced the quality of

life for patients. With the integration of STEM education, the possibilities for further innovation are boundless, promising even more discoveries in diagnosis, treatment, and overall healthcare outcomes. As STEM education continues to drive progress in the medical field, it holds potential to add to the landscape of healthcare, making it more accessible, precise, and patient-centered.

In conclusion, the importance of STEM education cannot be underestimated. It empowers individuals with critical thinking skills, scientific literacy, and problem-solving abilities. It drives economic growth, fosters innovation, and addresses societal challenges. STEM education is the base of progress and the key to unlocking a greater future for individuals, communities, and the world as a whole. Embracing STEM education is not just essential; it is our pathway to a more prosperous, sustainable, and successful tomorrow.

The Need for STEM Education

By: Mahathi Srivatsan

STEM, an acronym for Science, Technology, Engineering, and Math encompasses crucial fields that are driving our world forward in this age. As our world faces an increasing number of problems, many of which have solutions in STEM research, it is essential to educate our children about STEM from an early age. The benefits of early exposure to STEM education cannot be overstated.

By engaging with STEM subjects at a young age, children learn to develop critical thinking, creativity, and collaboration skills that prove useful throughout their lives. Collaboration skills enable effective communication and teamwork, facilitating the development of solutions and sharing of ideas. Critical thinking helps children approach problems from multiple perspectives, identify inconsistencies, and find innovative solutions. These skills not only enhance problem-solving abilities but also deepen their understanding of fundamental concepts and systems, enabling informed decision-making and future breakthroughs.

STEM education empowers future generations to drive progress in the world. The innovative skills they acquire enable them to create new technologies, develop medicines, and contribute to scientific achievements across STEM disciplines. For instance, advances in medicine can lead to improved therapies for life-threatening disease, and gene analysis can help prevent genetic disorders before they occur. STEM education also plays a vital role in creating renewable energy sources and fuel-efficient

technologies, making the Earth a better place to live.

Even if a child does not pursue a STEM career, the skills acquired through STEM education equip them to become problem-solving, collaborative, and informed decision-making citizens. These skills are valuable in any field or profession.

The demand for STEM-related jobs is currently high, with an expected increase of nearly 800,000 jobs by 2031, according to a SmartAsset study. Careers in healthcare, polymer sciences, biological sciences, astronomy, mechanical engineering, and computational and mathematical fields are projected to experience significant growth. To meet this demand and ensure future generations are prepared for their future jobs, STEM education is crucial. It equips individuals with the necessary skills to thrive in a technologically dependent world, maintains competitiveness in the job market, fosters innovation, and leads to more breakthroughs.

STEM education also plays a vital role in promoting inclusivity and diversity within the field. Currently, women and underrepresented minorities have limited representation in STEM careers. For example, while women are well-represented in health careers, they are underrepresented in the physical sciences. Additionally, Black, Hispanic, Indigenous, and disabled individuals face significant underrepresentation and pay disparities within STEM. By encouraging and supporting more diversity in STEM, we can inspire younger generations from these groups to pursue STEM careers. Increased representation also provides role models for aspiring individuals, fostering a more inclusive and diverse environment. Embracing multiple perspectives and experiences enhances problem-solving abilities and better equips us to tackle future challenges. Efforts and programs like Girls Who Code, Scientista, and I-Stem, among others, aim to address these disparities and promote equality and inclusivity in STEM.

STEM education plays a crucial role in our evolving career landscape and technological innovations. It prepares future generations for the demands of the job market, fosters innovation, and contributes to breakthroughs. Moreover, it promotes inclusivity and diversity, empowering underrepresented groups and bridging the pay gap within STEM. By embracing

THE NEED FOR STEM EDUCATION

STEM education, we can create a more diverse and equitable society while advancing the frontiers of science, technology, engineering, and math.

The Synergy of STEM and Financial Literacy: Empowering Individuals for a Prosperous Future

By: Manan Mittal

Introduction:

STEM (Science, Technology, Engineering, and Mathematics) education holds immense significance in shaping our society and driving progress across various fields. In this essay, I have explored the profound importance of STEM subjects, particularly mathematics and economics, and their interplay with financial literacy. Through a combination of personal experiences and in-depth research on financial literacy, I will highlight how STEM education can empower individuals, enabling them to make informed financial decisions and thrive in today's complex world.

Financial literacy, the knowledge and understanding of financial concepts and practices, is crucial for every individual, regardless of their background. Extensive research, exemplified by my paper published in the esteemed International Journal of Social Science and Economic Research (IJSER), underscores the pressing need for financial literacy in contemporary society.

My personal journey exposed me to the challenges society faced due to a lack of financial knowledge. This fueled my determination to delve into the realms of economics and finance, with a vision to equip myself and others with the necessary tools for making informed financial decisions and securing a stable future.

Mathematics forms the bedrock of STEM education and serves as a critical component of financial literacy. By studying mathematics, individuals cultivate skills such as critical thinking, logical reasoning, and numerical competence, which are vital for making sound financial choices. My exploration of mathematics equipped me with a deep understanding of budgeting, compound interest, and statistical analysis. Applying mathematical principles to personal finance, I developed effective strategies for prudent money management, ensuring long-term financial stability.

Economics, a social science exploring the production, distribution, and consumption of goods and services, plays a pivotal role in financial literacy. Grasping economic principles allows individuals to comprehend market dynamics, financial systems, and the impact of policies on personal and global economies. As I delved deeper into economics, I gained insights into economic theories, fiscal policies, and market forces. This knowledge enabled me to analyze and anticipate financial trends, empowering me to make informed decisions regarding investments, savings, and financial planning.

Key benefits of STEM education:

- Enhanced Decision-Making Skills:

STEM education nurtures critical thinking and problem-solving abilities, which are essential for analyzing financial scenarios, evaluating risks, and making well-informed decisions. By integrating STEM subjects into financial education, individuals develop a comprehensive understanding of money management.

- Long-Term Financial Security:

A strong foundation in STEM subjects equips individuals with the skills necessary to navigate the complexities of the modern financial landscape. Proficiency in concepts such as compound interest, investment strategies, and economic indicators empowers individuals to save, invest, and plan for long-term financial security.

- Expanding Career Opportunities:

STEM education opens up a plethora of career paths in finance, economics, data analysis, and technology. By pursuing STEM subjects and comple-

menting them with financial literacy, individuals gain a competitive edge in the job market, positioning themselves for rewarding and intellectually stimulating careers.

Therefore in conclusion, STEM education, particularly mathematics and economics, forms an indispensable foundation for financial literacy. By integrating STEM subjects into financial education, individuals will be able to acquire the skills necessary to make informed financial decisions, secure their future, and contribute to the overall economic growth of society. Personal experiences, such as my research on financial literacy and its impact on individuals, reinforce the vital role of STEM in empowering individuals to navigate the complex world of finance with confidence and success. Embracing STEM education paves the way for a financially literate society that flourishes in an increasingly interconnected and technologically advanced world.

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Part 2 - STEM Comets: How STEM Projects and Advocacy Trail the Sparks of Creativity and Impact

“Things become easy once you learn them. The monster of complex STEM problems can be tamed with experiments and trying again one more time!” – Rishab Jain, 2018

Kangaroos, Mops, and Modeling: a Journey Through Math

By: Laura Zhang

When I stepped into the Math Kangaroo testing room in first grade, my seven-year-old self had no idea this would be the start of my decade-long journey in math competitions. Over the next few years, I would devote countless hours to competition math, participating in the American Mathematics Competitions, MathCounts, Math Prize for Girls, Harvard-MIT Math Tournament, Canadian Open Mathematics Challenge, and many other contests.

My efforts culminated in an invitation to the Math Olympiad Program (MOP), the United States training camp for the International Math Olympiad. Going into MOP, I was exhilarated but also full of insecurity at the prospect of being surrounded by the best high school math students in the country. But when I actually began to experience MOP, my worries vanished almost instantly. For me, MOP was pure magic. It was the perfect combination of invigorating math problems, the best of friendships, and profound self-discovery.

At first, it was exhausting to be spending over seven hours a day on math, but as I fell into a daily routine, I quickly grew to love the intellectual challenge it brought. Every time I got an “aha” moment when solving a particularly challenging problem, my confidence in my math abilities grew a little more.

MOP showed me that in order to tackle difficult problems, I had to believe in myself first and keep persevering even when my previous approaches had failed. Witnessing my problem-solving skills expand throughout MOP reminded me of how far I have come in my math journey. Every moment that I have dedicated to math, from weekends spent pouring over practice problems to nights spent at school for math team lectures, has contributed to who I am today as both a mathematician and a person.

After experiencing the transformative benefits of math competitions at MOP, I began engaging in outreach to encourage other students to pursue math competitions. Because math contests are naturally competitive, it is easy to be consumed by scores and rankings rather than the people behind these accomplishments. My YouTube channel combats this disconnect by highlighting how math competitions are more than just taking tests. On my channel, I document my experiences at various math competitions and programs in order to provide a more human side to math. Instead, my videos emphasize the friendships, laughter, and feeling of community that math can create. I want to make math contests more approachable by providing a candid and first-hand account of my own math experiences. By illustrating my journey in math through my YouTube videos, I hope to encourage younger students to continue or start their own math journeys. My videos have amassed tens of thousands of views and an international audience from Indonesia to Hong Kong.

Furthermore, I am focused on math outreach on a more individual and local scale. As the captain of my high school's nationally-ranked math team, I have worked tirelessly to change the long-standing competitive culture of our club. My efforts have helped our math team expand to over 230 attendees, an unprecedented increase from last year. However, the true impact of my efforts can not be understood just with a number, but through the people this number represents. My emphasis on community-building and inclusivity has contributed to a profound cultural shift within my school's math team. We are now a club that values friendship and supporting each other over

winning and prestige. The grade divide has vanished, with friendships blossoming between underclassmen and upperclassmen. We have active group chats and meetups outside of school, filled with students talking about anything from a cool math problem to random inside jokes. Even when students feel like they performed poorly on a practice test, they continue to come back the next week, fueled by the prospect of learning and connection.

I am also committed to encouraging the next generation of aspiring mathletes. I single-handedly raised over a thousand dollars for the local middle school math contest my school's math team hosts, which allowed us to maintain a low registration cost and provide attendees with free math classes and books. I also served as a guest speaker for the InteGirls Competition, where I spoke about my journey in math to an audience of 80 students. My hope is that when these students become high schoolers themselves, they will also encourage younger students to pursue math, creating an ever-growing community of math lovers. By bringing in activities not traditionally associated with math, such as content creation and public speaking, I hope to highlight the community aspect of math. I want to show students that anyone, regardless of their background, can love and excel in math.

Along with outreach, I have combined my passions for math and creating positive change through math modeling. Even though I have participated in dozens of math competitions throughout my life, the MathWorks Math Modeling (M3) Challenge stands out as an especially impactful experience. The M3 Challenge is a fourteen-hour contest by the Society for Industrial and Applied Mathematics where teams of five students create a twenty-page paper addressing a real-world issue. As one of the top six finalist teams, my team earned an all-expenses paid trip to New York City, where we presented our findings to a panel of judges. My team won first place out of 650 total submissions and was also the Technical Computing Award Runner-Up and Outstanding Communications Award Winner. At the finals event, I had the opportunity to network with passionate high school students from all

over the country as well as professional applied mathematicians. The M3 Challenge showed me firsthand how math can transform complicated data into clear conclusions and predictions. There is so much untouched data just waiting to be analyzed, and I plan on using my skills from the M3 Challenge to continue addressing real-world problems through math modeling.

A few months ago, I decided to return to my Math Kangaroo roots and participate again for the first time in years. But I return to Math Kangaroo not just as a competitor, but also as a leader, advocate, community-builder, and YouTuber. This year, Math Kangaroo selected my t-shirt design, which consists of a lightbulb symbolizing how Math Kangaroo sparked my interest in STEM, for next year's competition. I hope that the tens of thousands of students competing in Math Kangaroo next year will be inspired by my design and one day find their own spark in STEM. Math competitions are where my STEM journey began, but it is most certainly not where my journey will end.

DrinkBot

By: Evan Huang

1. Introduction

I have had a fascination with robotics from a young age. It is why I chose to attend Lynfield College, as it is known for its outstanding robotics program. As soon as I was able to, I joined the robotics club to learn as much as I could and further pursue my passion.

Six years ago, my grandfather moved to a retired hospital to live. He had weak limbs and always needed help from others to eat and drink. I often visited him, where I noticed many people with different disabilities. It led me to ask myself, “What can I do to help?” It is a question that has been on my mind ever since.

There are many individuals, such as the elderly, disabled, sick, and injured people, who are unable to walk and hold objects for themselves. They are situated in homes, retirement centres, and hospitals. Simple tasks like enjoying a drink may be difficult due to their mobility issues. With this problem in mind, I researched all kinds of robots and potential solutions. Following my research, I came up with the idea of DrinkBot. DrinkBot is a robot that can move, grab, lift, hold, and deliver cups and bottles to users.

2. Design

DrinkBot was developed using the CAD Software development environment Autodesk Fusion 360. The 3D modelling of DrinkBot includes VEX V5 parts and some self-made parts. The project also has 3D animations of DrinkBot. I spent two months learning this myself during the school

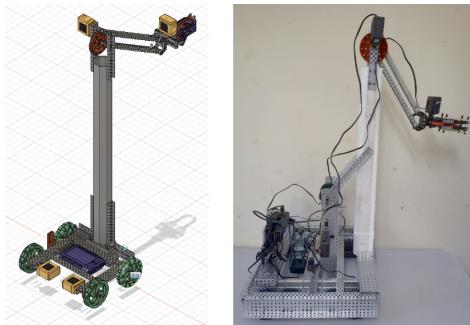
holidays.

There were three major models throughout development:

Version 1. Small robot with the claw facing inward

Version 2. Small robot with the claw facing outward for more space

Version 3. Tall robot with a hexagonal body to reach tables



3. Prototype

The hardware used in this project uses a mix of materials, including the VEX robotics V5 kit, some 3D printed parts, and a DIY part. The leg of a PVC plastic table was used for the robot's body. DrinkBot went through three major physical versions:

Version 1. Small robot with the claw facing outward

Version 2. Tall robot with a hexagonal plastic body to reach tables

Version 3. Tall robot with counterweight and braces for stability

The idea for the first version was a small robot that moved on a table. However, after some thought, a ground-moving robot would be far more practical. Not only would the robot be able to move around more freely, but it would be less prone to damage if it fell. For this change, I needed to raise the arm, which led me to choose an 80cm plastic body. After considering various shapes, I decided on a hexagonal prism, which provided flat surfaces while still resembling a cylinder. A cylindrical shape is important for uniform pressure, while flat surfaces are important for screws to tighten easier. To

make the robot more robust and able to withstand more damage, I made the sides taller during the building process.

The program was written in C++ in VEXcode environment. DrinkBot has both manual control and autonomous control. The programs control the smart motors and smart sensors to move and process information. The auto-program utilises sensors to navigate and deliver cups.

4. Testing and Conclusion

After visiting some elderly and disabled people, they gave mostly positive feedback, commenting on how helpful it could be in their daily lives. They also provided valuable suggestions for improvement, like making the robot taller and adding more sensors.



In the future, I am committed to improving my knowledge and ability in programming, robotics, and the sciences. I consider attending a top university as one of the best ways to achieve this goal, as it will give me access to a vast amount of incredible knowledge and resources. Ultimately, I hope to use my skills to create more advanced robots that help even more people. Whether I become an engineer or an inventor, I know I have the drive and passion to make a real difference in robotics. It has been an amazing experience, and I cannot wait to see where my robotics journey takes me.

next.

Electric Dreams: “Young Builders Unleash the Spark”

By: Sergio Emiliano Pérez López

Have you ever heard of Tesla coils? They are incredible inventions that can generate powerful electric arcs in the air, creating impressive displays of lights and sounds.

I was fascinated by how electricity could move things, light up bulbs, and make all sorts of devices work. That's how I got into the exciting world of Tesla coils. As I researched and learned more about them, I discovered the incredible legacy of Nikola Tesla, a visionary genius whose inventions revolutionized the field of electricity. His creativity and determination inspired me to keep going and explore my own abilities.

In my school, there is a fascinating physics laboratory that became my creative haven. In that magical place, a wide variety of devices and materials are lined up, waiting to be used to create the most amazing electronic prototypes you can imagine. In that small space, filled with tools and cables that seemed to be in chaos, I embarked on the exciting challenge of building my first Tesla coil. However, as in any great adventure, the first attempts don't always turn out as expected. Despite my best efforts, my creation didn't come to “life” initially.

Nevertheless, this initial setback didn't discourage me. Instead, I took it as an opportunity to learn and improve. I approached my physics teacher for guidance and shared my concerns. With his wisdom and experience, he provided valuable advice and encouraged me to persevere in my quest for knowledge and experimentation.

With new knowledge and renewed determination, I returned to the laboratory ready to overcome the obstacles that lay ahead. I learned how to adjust the connections, handle voltages with precision, and comprehend the mysteries of electromagnetic induction. After weeks of research and planning, the time had come to give it another try. I gathered all the necessary materials: copper wire, a PVC pipe, a power supply, switches, and other electrical components. I made sure to have adult supervision as electricity can be dangerous if not handled carefully.

With patience and enthusiasm, I began winding the copper wire around the PVC pipe. With each turn, I could feel the excitement building inside me. I knew I was creating something special, something that would ignite curiosity and fascination in others. Once I finished winding the wire, I connected the cables to the power supply and adjusted the switches. With a little nervousness, I turned on the main switch. And there it was! An electric spark started dancing at the top of the coil, forming beautiful, small bursts of light.

Many days passed since that astonishing event, and something wonderful began to happen. My peers and teachers, intrigued by the small devices I had created, started showing increasing interest. At first, they simply asked questions about how that "weird thing" produced amazing sparks out of nowhere. However, over time, the interest spread like a fire fueled by curiosity and the desire to learn.

It was at that moment that I had a brilliant idea: Why not create a school club dedicated to the fascinating construction and operation of Tesla coils? I wanted to share my passion with everyone, and thus the idea of our Tesla Coil Club was born, which would meet after school. In our meetings, we delved into the world of electricity, physics, and engineering. We learned about the fundamental principles behind Tesla coils, but we didn't just limit ourselves to theorizing; we also immersed ourselves in practice. We took tools, wires, and electronic components to improve our prototypes. Every week, our projects came to life, filling the air with electric sparks and creating a symphony of light and sound.

Our club became an inspiring force within the school. Not only did we spark interest in science and technology among our peers, but we also participated in science fairs and community events, showcasing the power of experimentation and inventiveness. It became a testament to how a single idea can generate a positive impact in the community. Together, we learned that shared knowledge is more powerful and that our individual passions can merge to create a better and more innovative world.

By the way, if you had to give our club a name, what would it be? Creating inventions like Tesla coils isn't as difficult when working as a team, but choosing an appropriate name is trickier than it seems.

The initiative to create a club that inspires others to create interesting inventions opened my eyes to the powerful ability that young people have to change our environment. As I explored news online, I came across inspiring stories of people my age developing innovative projects in the field of technology and science, with the goal of helping their communities and inspiring the world.

That's when I realized that in my beloved country, Mexico, there were scarce opportunities to improve society as we know it. As I spent more time reading and informing myself about the challenges we face today, I increasingly

realized the potential I had to make a difference. It was at that moment that I discovered the AFS Global STEM Academies scholarship program, a new opportunity focused on the development of sustainable energies in various international contexts.

Without hesitation, I decided to apply, and to my great joy, I was accepted among a large number of applicants from over 18 countries around the world. Securing one of the limited 180 available spots was a true honor and a once-in-a-lifetime opportunity.

I knew that a transformative learning journey awaited me, where I would have the chance to collaborate with bright and passionate young individuals from different cultures and backgrounds. Together, we would explore the field of sustainable energies, sharing innovative ideas and seeking practical solutions to global challenges.

It's fascinating how a small initiative can take you far in the pursuit of positive change, don't you think? It's also remarkable to be curious about the world, to research, and to engage with other people.

In our club, we find ourselves immersed in an exciting stage where we are expanding our horizons beyond Tesla coils. One of our projects focuses on building innovative devices to illuminate the streets surrounding our school. We recognized that poor lighting can impact the safety and quality of life for people in our area.

Furthermore, my participation in the AFS Global STEM Academies has provided me with the opportunity to collaborate with students from all parts of the world, working on sustainable invention prototypes aimed at addressing global challenges such as climate change and resource scarcity. It's inspiring to see how individuals like you, who have identified issues in their own communities, strive to generate ideas and seek innovative solutions.

From Inspiration to Impact: Harnessing STEM for Meaningful Change

By: Ananya Subramanyam

In the months that followed my participation in MIT's BeaverWorks Summer Institute (BWSI) Program, I received an email inviting me to apply to their new "CRE[AT]E Challenge," with the "AT" representing Assistive Technology. This was a challenge where "teams of 2-5 high school students work with a coach and member of their community with a disability (the codesigner), to learn to design, build, and test a product to help with a disability-related difficulty." Additionally, based on what the team presented in the program application, the program staff decided on select teams that would gain project funding, as well as additional mentorship and support. The challenge of working closely with a codesigner and designing a product that could potentially better their life was incredibly interesting and novel for me.

Within the collaborative realm of this challenge, I had the incredible opportunity to evangelize and build a team across my high school district to create something truly meaningful for my grandfather, who both loves to go on walks and deals with age-associated memory impairment; this being a big source of anxiety for my family, his caregivers, if he would feel lost. As we collaborated with my grandfather, we pinpointed tangible solutions, developing concrete plans. Furthermore, we were able to find a coach who worked at Google, and his knowledge was incredibly useful in product

validation. Pitching our idea to the MIT team in the program application, and becoming a financially supported team was amazing; knowing that others believed in our idea, and the resources they provided to enable our success, was even more amazing.

We developed an Android application that would enable mobility independence for my grandfather. One of the standout features of this app was its ability to provide him with designated safe walking paths, allowing him to take short walks with confidence, free from the constant anxiety of getting lost or disoriented. It was a simple yet profound way for him to reconnect with the joy of leisurely walks around the neighborhood while having the freedom to do so at his convenience. Additionally, we integrated an alert mechanism into the application. This system promptly notified his caretakers whenever he deviated from the prescribed path, ensuring that they could provide assistance whenever needed, as well as giving information on his ETA. It became a safety net, offering comfort not only to my grandfather but also to our entire family.

From there, my team presented our product, as well as shared our iterations and what it took to get where we did in the Final Event on April 29th 2023. It was a crazy experience pitching our idea to the MIT team, becoming a financially supported team, and ultimately winning a prize in the “Technical Innovation” category; knowing that others believed in our idea, as well as the resources and support they provided to enable our success, was amazing.

Being a part of the CRE[AT]E Challenge has been an incredible learning experience for me; through the challenge, I’ve had the opportunity to envision and deliver a product idea that made a real difference to a member of my community, as well as gain hands-on skills in design, development, and comprehensive documentation experience. But what was especially gratifying was seeing our product make a difference in another individual’s life. Being able to work on an app that could improve my codesigner’s sense of security and independence has been a deeply fulfilling experience for me. It reminds me of the power of technology as it can have a human touch and make a difference in people’s lives beyond just generating profits. Through

this project, I realized that even as a high school student, I had the ability to leverage my knowledge of STEM to make a tangible difference in the lives of others. It invoked a passion to continue exploring the possibilities of STEM, as well as how it can be harnessed to address real-world challenges. As I reflect on this experience, I am humbled by the impact that a group of passionate individuals can have when they unite behind a meaningful cause. It is a testament to the power of empathy, creativity, and a genuine desire to make a difference.

Empowering Through STEM: From Curiosity to Contribution

By: Sabrina Huang

I find some comfort in untangling knots in tangled cables. That sounds pretty ironic, right? Personally, there's a certain satisfaction that I feel when I sort through intricate patterns, separating jumbles of wires, and bringing order to chaos. It's a task that calls for persistence, focus on the small things, and a deliberate approach. Strangely enough, I can't help but make comparisons between this seemingly tedious action and my love and passion for STEM.

Just as carefully as I untangle cords, I've always been interested in the wonders of science, ranging from molecular polarity, genetic editing, to strange quantum mechanics. I couldn't help but be pulled to learning how things worked and searching for answers.. Today, STEM enables us to turn confusion into clarity, much as untangling knots create a sense of tranquility for me.

My journey in STEM has been shaped by personal experiences that gave me a deep appreciation for the incredible advancements in scientific research. Specifically, my grandfather has type 2 diabetes, my mother has suffered from stage 2 breast cancer, and many of my friends have asthma and anxiety. When I learned about treatments and medication that people around me had taken, it made me immensely grateful to be alive in an era where people had access to cutting-edge medical technology and support.

These experiences motivated me to advocate for equal access to STEM opportunities, especially in the field of science. However, when I requested to take classes like AP Biology or AP Chemistry, which were classes only reserved for juniors and seniors, I was met with resistance. I was very passionate about these subjects, but I was told that I was too young to take it, wouldn't be able to handle it, and that they couldn't spare a seat for me. This setback only fueled my determination to challenge the notion that certain opportunities are reserved for a specific age group.

I embarked on a self-learning journey, utilizing free online platforms such as Khan Academy and EdX to broaden my knowledge in biology and chemistry. Along this path, I realized the importance of accessible resources for students worldwide. That realization led me to found Project CLERIS, aimed at cultivating passions in science and providing teens with accessible resources to do so.

We not only strive to share knowledge, but also create a supportive community and a sense of belonging for all ages. Through our weekly articles, we demystify complex scientific concepts and make science approachable and relatable. We strive to inspire teens to ask questions, seek answers, and develop a lifelong love for scientific exploration.

Currently, we are in the beta mode of launching a program that provides teenagers with free research software, removing financial barriers that can hinder them. Personally, I had been trying to conduct my own research at home and roadblocks due to pricey software to analyze data have been a constant struggle. Many of my online friends didn't have the resources that they needed because their age had been a barrier to working in labs. By CLERIS partnering with software companies with simulations and data analysis tools, we aim to give teens the resources they need to excel in their research endeavors.

Since our launch in January of 2023, we have reached over 10,000 people in 19+ countries, bringing people together to collaborate and further their potential for science. We hope to offer more ways of serving a community of science fanatics in the summer and winter of 2023.

However, our journey is far from over. One of our goals is to reach

50,000 teenagers globally within the next two years, ensuring that more teenagers have access to valuable resources in science. We are committed to growing our effort and doing so through more partnerships, outreach, and continuous improvement.

Furthermore, participating in this project has expanded my interest in STEM and emphasized the influence it can have on individuals and communities. Working with my team has provided me with motivation and encouragement throughout this project. I'm thankful for all of them because I don't have many classmates that have the same interests as me. Collaborating with like-minded individuals who share the same passion for STEM, specifically science, has been truly rewarding.

We envision exciting possibilities for future expansion. Our goal of providing free access to research tools and materials is just the beginning. We are committed to refining and enhancing our initiatives, gathering user feedback, and forging partnerships to better meet the needs of our target audience.

STEM is not just a topic or a career option for me; it is a mentality that encourages us to inquire, investigate, and come up with answers to challenging issues. It provides a unique blend of imagination, critical thinking, and real-world application that ignites my enthusiasm.

As I continue to embark on my journey in STEM, I am often reminded of the need for perseverance and the benefits of cutting through complexity. Although an online chemistry lesson may be difficult, it fuels your knowledge and gives rise to a potential that will pay off in the end. Just like how each knot I unwind moves me one step closer to uncovering the greater picture, scientific discovery moves us one step closer to comprehending the world's mysteries with our STEM potential.

Empowering Lives Through Innovation: My Journey in STEM and Entrepreneurship

By: Insar Tungushbayev

Introduction

In a world teeming with challenges, I have embarked on a relentless pursuit of leveraging technology and entrepreneurship to solve pressing social issues. My name is Insar, and I am an entrepreneur and project manager with a passion for tackling problems through innovative solutions in STEM. Over the years, I have honed my skills and knowledge in various domains, aiming to make a positive impact on society. In this personal statement essay, I will recount my journey, highlighting the transformative projects I have undertaken and my unwavering commitment to revolutionize healthcare through NeuroDetect, an AI-powered startup aimed at detecting and combating neurological diseases.

Venturing into STEM:

My journey in STEM began during my time as a scholarship student at Spectrum International School in Kazakhstan. Fueled by a genuine curiosity for cutting-edge technologies, I immersed myself in learning and exploring the possibilities offered by fields like AI, WEB3, and AR/VR. My participation in Innovation and Entrepreneurship summer courses conducted by Stanford and MIT Universities further expanded my horizons, providing me with a solid foundation to translate my ideas into reality.

The Birth of NeuroDetect:

Driven by a desire to address the devastating impact of neurological diseases on individuals and families, I embarked on a mission to create a tangible solution. Inspired by personal experiences, such as my grandfather's diagnosis of Alzheimer's and my mother and sister's battle with tumor growth and epilepsy, I recognized the urgent need for accurate and timely detection of these conditions. Witnessing the life-altering consequences firsthand, I resolved to develop NeuroDetect, an AI-powered software aimed at revolutionizing the diagnosis and treatment of neurological diseases.

From Research Project to Startup:

Building on my expertise and passion for AI and machine learning, I channeled my efforts into creating a research project during my 8th grade. Focusing on developing and evaluating a diagnostic tool for schizophrenia and Alzheimer's, I poured countless hours into training recurrent and convolutional neural networks. This project became a stepping stone towards my vision for NeuroDetect, instilling in me a profound understanding of the potential of technology in healthcare.

The Turning Point:

A pivotal moment in my life arrived when my sister was diagnosed with epilepsy, and the urgency of accessing qualified medical care became alarmingly apparent. The successful surgery conducted abroad highlighted the stark contrast between healthcare systems. This experience galvanized me to channel my skills, knowledge, and entrepreneurial spirit towards bridging the gap in the healthcare sector. I became resolute in my mission to develop NeuroDetect as a comprehensive, fast, and accurate tool that could save lives and prevent the onset of disabilities caused by neurological diseases.

Creating an Impact:

With a team of eight diverse individuals, each bringing unique perspectives and experiences, we joined forces to establish NeuroDetect. Our startup has garnered recognition and support from prestigious programs such as

Microsoft for Startups Founder Hub, StartUp Heart International startups program, and the NURIS Deep Tech program. Furthermore, we had the opportunity to present our innovative solution to Chevron investors, solidifying our commitment to revolutionize neurological disease detection.

Future Aspirations:

Looking ahead, my team and I are dedicated to launching our first demo for beta testing in the upcoming academic year. Our ultimate aim is to scale NeuroDetect globally, empowering medical professionals and patients alike by providing faster and more accurate diagnoses. By reducing disabilities and deaths caused by neurological diseases, we hope to contribute significantly to the improvement of healthcare systems worldwide.

Conclusion:

My journey as an entrepreneur and project manager in STEM has been defined by my unwavering commitment to leveraging technology for the betterment of society. From humble beginnings as a school research project, NeuroDetect has evolved into an ambitious startup aimed at revolutionizing the detection and treatment of neurological diseases. Through our innovation and dedication, we strive to ensure that no one has to endure the pain and suffering caused by delayed or inaccurate diagnoses. I am proud to have played a role in shaping this transformative venture and look forward to the impact we will make on a global scale.

STEM in Healthcare

By: Kaushik Sivakumar

Healthcare is a service that utilizes science, technology, engineering, and mathematics - all the components of STEM - to provide high-quality care, treatment, and recovery for people. STEM fields shape and guide modern-day healthcare and, without a doubt, will bring about countless revolutionary advancements. This is why STEM education is so vital: it helps educate youth on the interconnectivity of these fields, the applications of these fields in healthcare, and how these fields can help solve critical public health issues, motivating youth to be activists for the safety of their peers.

As a 16-year-old junior fueled by a passion for serving in healthcare and attending a school centered around STEM, STEM fields and subjects have been my life for the past three years. My journey through school and extracurricular experiences have shown me in various ways how collaboration among STEM fields is vital to the understanding of the sciences behind healthcare. This collaboration allows scientists and youth to understand bodily functions and processes better.

I appreciated the importance of STEM in understanding the sciences when I recently conducted research in school to investigate how varying temperatures could affect the gas exchange in the lungs' alveoli, which essentially distributes oxygen to all the organs and tissues in the body. My investigation involved utilizing my scientific knowledge in biology to understand the

physiological processes, technology such as incubators – devices developed by engineering – to control temperatures, and mathematics to calculate the right concentration of reagents used in the experiment.

While these STEM fields play a significant role in understanding the science behind human anatomy and physiology, they also significantly guide the treatments and interventions done by healthcare professionals, particularly in emergency medicine. As an emergency medical technician(EMT), I applied firsthand a combination of these STEM fields to treat every patient I have received.

One specific emergency call I received was for chest pains. The other providers and I had to utilize our medical science knowledge to discover what was wrong with the patient while using technologically engineered devices and mathematics to assist us. Mainly for this call, the technological advancement we used was the EKG, which records the electrical signals from the heart to check for different heart conditions. And to correctly interpret and analyze the readings this device provides, the paramedic must use mathematical concepts such as sine waves to diagnose the specific type of cardiac event that the patient is experiencing, in this case, ventricular hypertrophy.

Such implementations of the STEM fields make emergency medicine highly efficient and effective, ensuring high-quality care and treatments for the patient. And being an EMT as a 16-year-old has helped me make correlations between my high school STEM courses, such as biology, to the symptoms some of my patients are enduring, helping me comprehend the effect on their bodily processes.

While STEM education has helped me better understand what I witness as an EMT, it also united me with other young minds to address a significant public health problem: sudden cardiac arrest. Sudden cardiac arrest is the #1 cause of death on school property and the #1 killer of student-athletes,

making it a crucial problem to resolve. I volunteer with the Aidan's Heart Foundation(AHF), which aims to raise awareness about sudden cardiac arrest and mandate AEDs on school properties.

To ensure the safety and revival of a person in sudden cardiac arrest, a combination of the STEM fields must be effectively used: Cardiopulmonary Resuscitation(CPR), Automated External Defibrillator (AED), and emergency care. CPR is a life-saving procedure whereby a person presses on and pumps a person's heart since the heart stops in a person in cardiac arrest. Simple mathematics ensures that these pumps, called compressions, are performed at 100–120 beats/minute and a ratio of 30:2, where the 2 in the ratio represents breaths being given, ensuring high-quality CPR is being performed. Immediate high-quality CPR has been scientifically proven to double or even triple a person's chance of survival.

AEDs are technologically engineered devices vital to saving a person's life in cardiac arrest. It delivers a shock to the patient, meant to re-establish the heart's effective rhythm. This device has been developed with new additions as modern technology is used to engineer such machines in temperature-controlled pods in outdoor settings to protect their longevity.

Although these devices and scientific methods are available and accessible to the general public, most people are uneducated regarding the execution of CPR, AED use, and what to do in such an unfortunate emergency. To ensure the community's education on the measures to take, I, along with elementary, middle, and high school students in this foundation, lead and advocate for implementing emergency procedures and laws for cardiac arrest and the mandates of AEDs on school property throughout Pennsylvania.

We have worked with Pennsylvania state senators to form Senate Bills 512 & 513, which will mandate all schools across the state to have a working AED on school grounds and a team of CPR-trained teachers who will act in an

emergency. To promote this bill and gain the support of other legislators, we lobbied at the Pennsylvania State Congress, demonstrating to them how simple it is to do CPR and use an AED to save a life.

Without the combination of the STEM fields that helped create the procedure of CPR and technologically engineered devices such as AEDs, any attempts made to save a person in cardiac arrest would be futile, thus reducing the effectiveness of our efforts to implement laws that ensure safety and resolution to a significant public health crisis. This demonstrates the importance of STEM and its support to those seeking to positively impact their community's health and well-being, particularly to youth.

And to positively impact the community's well-being, youth don't need to be EMTs or physicians; they could simply use their STEM education. They could use their engineering and technological skills to 3D print masks to protect people in a global pandemic and, on larger scales, produce artificial organs that could assist those in need of organ transplants. They could use their scientific skills to explore disease processes and their effects to provide a better understanding of them to physicians and pharmaceutical companies. And they could use their math skills to analyze and interpret data collected by biomedical research and experiments, determining the effectiveness of vaccines and treatments. Like this, youth have countless opportunities in the STEM fields to impact and advance healthcare.

So I encourage everyone, particularly young people, to explore STEM and its various opportunities. STEM education, serving as the basis of this exploration, provides a better understanding of real-world applications and the positive impacts STEM can have on not just healthcare but also the infrastructure and technologies of the World. And youth will be the driving force for advancing the sciences, technology, engineering, and mathematics, bringing about countless revolutionary developments and heightening our knowledge. Now the only thing left to do is let the youth explore, indulge, and learn because the future is STEM.

Reshaping STEM Through My Whiteboard

By: Zander Vaux

My first video was sparked by a simple question: Why are hexagons everywhere, from honeycombs at my local nature center to molecules in my chemistry homework? When I ran out of space on my paper trying to draw honeycomb patterns, I turned to my whiteboard. It felt natural the way I could visualize and connect the dots between hexagonal patterns on one glossy plane. Frame by frame, I filmed myself drawing pictures and diagrams to explain why hexagons are the most geometrically efficient packing shape in nature. With some editing and narration, I tied together my story and released it on YouTube. I wanted others to marvel at the mathematical beauty of hexagons in their surroundings and pursue their own curiosities. I felt comfortable in my own world talking about the prevalence of hexagons in nature, or applications of origami in the International Space Station. But I was also beginning to notice that other people didn't have the resources to pursue their interests like I did.

I started working as a graphic designer under a youth organization spreading awareness about social and environmental injustice. I was simplifying complex global issues through pictures and explanations, much like the concepts on my whiteboard. There was a sense of empowerment in advocating for global change as part of a team connected by shared passions, a feeling I couldn't gain from just me and my whiteboard. I was inspired to start my own youth organization that combined my love for STEAM with global changemaking. "The Markerboard," based on the whiteboard that

started this all, was born.

My goal was to give future generations the support and confidence to pursue their own STEAM queries. In the beginning, I felt powerless from behind my computer screen to bring this mission to life. I was publishing DIY science challenges on social media and crowdfunding to bring coding classes to underserved elementary schools. But it felt like the days of my solitary intellectual whiteboard diaries, with my efforts disappearing into the ether. I decided to build a platform where people could connect and share their stories. Slowly, one member became sixteen directors. We were neuroscience geeks, coders, artists, and aspiring astronomists from the UAE to Hong Kong. Our differences made for a chaotic mixture, but together we were able to accomplish what none of us could on our own.

An aspiring software developer from a school in New York City without the infrastructure to support a quality STEAM program helped develop our website. A passionate coder who was intimidated from entering STEAM gained confidence and helped publish a problem-of-the-week series on concepts from circuits to coding. A robotics professor I interviewed who experienced misogyny, racism, and ageism working in technology now brings STEM to underprivileged youth. Connecting with these people taught me that diversity of thought is essential to progress. Each individual story of success made me feel like real change was within reach.

Our mission sharpened. We now aspire to help close the socio-economic, racial and gender gaps in STEAM and create a space where students from all backgrounds can shed the notion that STEAM is not for them. Through custom graphics, I told the story of how a dying rose, symbolizing the effect of microaggressions in STEAM, can be transformed into a rainbow of diversity through allyship programs and outreach. It's only a start, but The Markerboard has become a platform for youth to take intellectual risks and find their voice as leaders in STEAM.

I will always be the kid behind the whiteboard and quirky STEAM endeavors. But starting The Markerboard gave me a chance to turn these aspects of my identity into a vision. I want to create the environment of inclusivity in STEAM that I want to work in one day. My vision is to not only inspire

others, but to push the bounds of creativity and curiosity in myself.

Unleashing the Potential: “Exploring the Intersection of AI and Medicine for Neurodegenerative Disease Diagnosis”

By: Vaibhav Mishra

From my earliest foray into STEM research, I embarked on a transformative journey that kindled my passion for exploring the intersection of artificial intelligence and medicine. As a rising sophomore, I joined a computational neuroscience research program at Stony Brook, where I delved into the exciting realm of AI-based diagnosis systems for Parkinson’s Disease using MRI images. Although the project itself was not groundbreaking, it provided me with invaluable insights into the technical and computational aspects of this burgeoning field, while igniting my curiosity for AI-driven medical innovations.

Eager to expand my knowledge, I subsequently undertook an individual research project in bioinformatics and genomics, delving deeper into the intricate biological aspects that underpin neuroscience. This exploration broadened my understanding, allowing me to grasp the interconnectedness between computational techniques and biological phenomena.

During my early research experiences, I recognized the importance of starting with lab-affiliated group projects. These collaborative endeavors provided a solid foundation, equipping me with fundamental research techniques and methods. Immersing myself in such projects first, before pursuing more complex individual endeavors, was pivotal in establishing a

strong research foundation to build upon. Therefore, I decided to challenge myself further by embarking on a more complex individual project.

Driven by the desire to tackle significant problems, I devoted considerable time to identifying the right issue to solve—a problem that remained unsolved, posed a substantial obstacle in the field, and had the potential to make a tangible impact on individuals' lives. Drawing on my prior experience in AI research for neurological disorders, I focused on the challenging task of disease diagnosis using MRI scans for neurodegenerative diseases. The similarity between these diseases in MRI scans made accurate diagnosis elusive, demanding an innovative solution.

Immersed in a sea of research papers and scientific discussions, I emerged with a newfound understanding of the critical need for a multiclass automated diagnostic system that leveraged machine learning. Integrating this system with genomics-based drug discovery presented an opportunity to revolutionize the field. Armed with my previous AI research experience, I embarked on the arduous journey of developing a computational model that could analyze MRI scans and assist in the diagnosis of neurodegenerative diseases using a novel technique.

Securing the appropriate datasets was the next crucial step in this research endeavor. Fortunately, my prior work in computational neuroscience research had acquainted me with specific large-scale MRI datasets, such as ADNI and PPMI, which I could leverage for my project. With these datasets in hand, I spent months tirelessly training my machine learning model. Countless hours were dedicated to learning, coding, creating, and iterating until the model achieved exceptional accuracy in multiclass diagnosis. To add even greater complexity, I integrated AI-based diagnosis with genomics-based approaches, augmenting my computational model with a drug discovery pipeline.

Upon completing my research project, I eagerly shared my findings with the scientific community through publications and presentations at prestigious science research conferences. The recognition I received as an STS Scholar, ISEF Finalist, and Pacific-Asia Science Olympiad Gold Medalist further affirmed my commitment to pursuing scientific research in the

future. Inspired by my journey and cognizant of the challenges faced by aspiring young researchers, I founded the International Youth Research Initiative (IYRI). This international organization aims to empower and support young researchers, particularly those in underrepresented communities, by providing resources and opportunities that mitigate obstacles such as cost, location, confidence, and lack of initiative. Through IYRI, I have had the privilege of leading events, workshops, summer programs, research journals, and research conferences, enabling aspiring young researchers worldwide to engage in original projects in drug discovery, machine learning, and computational biology, resulting in numerous publications and fostering a vibrant community of young scientists and innovators worldwide.

Currently, I am involved in computational neuroscience and bioinformatics research and am also currently building RespAI, a lung-imaging startup that harnesses the power of AI to aid radiologists in respiratory disease diagnosis to democratize high-quality healthcare in developing countries. Reflecting on my journey thus far, I have realized the profound impact of my early involvement in STEM research in exposing me to remarkable ideas, concepts, and techniques that continue to shape my trajectory and fuel my aspirations in hopes of using scientific innovation to foster beneficial transformations in the world.

Remotely Monitoring California's Fragile Ecosystems

By: Vedant Janapaty

Vedant Janapaty had visited Elkhorn Slough, an estuary almost fifty miles south of his home in San Jose, several times before he started noticing signs of environmental degradation. As a Boy Scout, he enjoyed kayaking in the expansive waters of the Slough with his troop, where he learned that the slough is the home of several endangered species, like the southern sea otter and the California least tern.

The grim statistics—90% of California estuaries have been lost and estuarine habitat loss is as high as 60%—compelled Vedant to consider what an ordinary citizen scientist like himself could do to reverse the estuarine crisis.

Dedicated to learning more about what he could do to reverse eutrophication, Vedant joined the Elkhorn Slough docent training program in January 2022. In this two month course under the instruction of Ms. Ariel Hunter of the Elkhorn Slough Foundation, Vedant learned that only four stations collected water quality and nutrient data across the slough. This meant that several locations did not measure critical eutrophication parameters. With guidance from researchers at the Elkhorn Slough Research Reserve, he determined that satellite indices (SIs), collected by Landsat 7 could be correlated to in

situ parameters (OPs).

Selecting various SIs—including the normalized Difference Vegetation Index—Vedant performed a linear correlation between the SIs and OPs. The results were decisively poor, and Vedant spent two months considering how to improve his procedure.

The breakthrough came when he created a time series plot and found that the SIs followed a periodic trend. To decompose the dominant frequencies for each SI, Vedant employed the Discrete Fourier Transform, modeling SI parameters with dominant frequencies and corresponding amplitudes.

To reduce the significant overlap of raw satellite bands, he correlated raw band data directly to the OPs. Now, using five different machine learning algorithms, the correlations were excellent, with R-squared values over 90% for all the OPs! He also expanded this project to five different west coast estuaries, including Tijuana Bay, Elkhorn Slough, San Francisco Bay, South Slough, and Padilla Bay.

Vedant's technique proved that augmenting in situ data with satellite data is a much more powerful tool than in situ data alone. This approach could allow for monitoring recovery efforts, historic perspectives, and causes and effects of estuarine health decline.

However, this method of monitoring eutrophication was cumbersome and required the use of extracting shapefiles, large geospatial datasets, for each individual estuary. Furthermore, such a technique could not be scaled to all twenty eight U.S. estuaries or even international estuaries. Vedant also began to wonder about the natural and anthropogenic factors that drive eutrophication.

To find answers, Vedant created math models to represent seasons, tides, sea level rise, and fertilizer usage (represented by spring and fall runoffs)

and once again correlated them with in situ parameters, now collected at the 28 major U.S. coastal estuaries using five different machine learning algorithms (Convolutional Neural Network, K Nearest Neighbors, Decision Tree, Extreme Gradient Boost, and Random Forest). While all the algorithms yielded good results, Random Forest had the best results, with R squared values over 90% for almost all the parameters.

This simple, low cost, and fast method can be scaled to estuaries that lack the tools and resources to monitor eutrophication. Vedant hopes that the method will be used to predict nutrient intake and inform conservation efforts in estuaries.

Aside from modeling estuarine eutrophication, Vedant holds another issue close to his heart: California native plant rehabilitation.

Growing up in the mountains of Almaden, Vedant saw the damage of California wildfires firsthand. In 2020, Vedant and his family received an evacuation warning and the local Quicksilver trail was partially razed. Determined to find a way for citizen scientists to actively mitigate wildfire damage through preemptive action, Vedant began to analyze factors that fueled wildfire damage. Previous mathematical fire models to predict the rate of spread and intensity included the Huygen's principle and Rothermel's surface fire spread model. Both required specialized equipment available to firefighters, and did not take the vegetation and surface temperature into consideration. Furthermore, a low cost, simple, and fast tool for citizen scientists to monitor wildfire was not available. In 2021, through his research, he created a heat map of locations in California with the highest propensity for wildfires and found that the spread of dry invasive plant species fueled the fire crisis. Additionally, because native plants were much better adapted to the local environmental conditions, they did not require as much water.

As a result, Vedant seeks to promote the use of native plant species in his

community. Through his nonprofit, Youth Planet Stewards (YPS), he has created brochures detailing the detrimental effects of invasive species, such as the eucalyptus tree, which drinks nearly 200 gallons of water a day in California estuaries!

YPS has also helped inform the local community about the importance of California native plant species by building a native plant garden at Vedant's high school, Silver Creek High School. Purchasing a wide selection of native species from the Watershed Nursery, YPS successfully completed the native plant garden in May 2022. Through YPS, Vedant hopes to foster a deeper appreciation for California's diverse native chaparral.

For his Boy Scout Eagle Project, Vedant and YPS partnered with the Grass-roots Ecology, a local environmental agency, to expedite their invasive plant removal process by removing rocks from planting grounds. To accomplish this goal, Vedant built multiple rock sifters for the agency. After several blueprints and feedback from adults in his troop, Vedant finalized his project's design. He and the Boy Scout then built fourteen rock sifters in the summer of 2022.

While organizing several native plant seed distributions in libraries and schools, YPS also interviews unsung heroes of the climate movement. Vedant hopes that YPS can be a platform through which youth will be inspired to tackle their own climate issues and perhaps ensure a sustainable future for generations to come.

Vedant credits his mentors, Ms. Ariel Hunter and physics teacher Mr. Bich Nguyen, for teaching him how to conduct scientific research and for empowering him to ask bold questions. He encourages kids interested in science to participate in science fairs, where he had the privilege of making lifelong friends and joining a community of like-minded student researchers. In all, he urges youth to be pollinators of change through research and advocacy.

Empowering The Future Of Healthcare

By: Krrisha Patel

My propensity to positively influence those around me provided motivation to found Passion4Med, a startup dedicated to empowering healthcare professionals. With hopes of alleviating COVID-19's impact on learning, I connected with schools to promote our initiative and educate students through tutoring, mentoring, and providing resources. Receiving messages from students illustrating where they could find free college and medical school resources filled me with an overwhelming sense of self-worth. The dots were finally connecting. Taking the initiative sparked a realization that I was no longer a kid playing with dolls, but I was now an adult with the capability to better the lives of others. However, my experiences prompted more than just realizations. They demonstrated my ability to step up in times of need. To found this initiative, it required hours of research and leadership within my team and community. The skills obtained have definitely prepared me for countless responsibilities. We have a community discord server with around 3,000 members and around 90 interns. We also organized shadowing events, offering our members the chance to connect with healthcare professionals firsthand. Additionally, our podcast series became a valuable resource, shedding light on important topics in the medical field. We have also had shadowing events for members to connect with healthcare professionals, and have a podcast series. The lessons I learned from these experiences showed me that I have the ability to step up and take action when needed. These experiences have strengthened my

belief in the power of proactive engagement and caring for others. Seeing the gratitude and positive outcomes that resulted from our initiatives has further fueled my commitment to making a lasting difference in people's lives. Additionally, the obstacles I faced along the way have developed my resilience, adaptability, and understanding of the complexities involved in healthcare and community-driven projects. Moving forward, my goal is to continue empowering aspiring healthcare professionals, raising awareness about important medical issues, and advocating for policies that promote positive public health outcomes. By combining my medical knowledge with my passion for community involvement, I aspire to create a lasting global impact on the field of healthcare.

Furthermore, I created MetaHealth, an initiative focused on raising awareness about metabolic syndromes and advocating for the prevention of eating disorders. Deeply believing in the significance of education and proactive measures, I organized over 20 cooking and nutrition workshops. These workshops served as platforms to educate individuals about the importance of making healthier lifestyle choices. By leveraging social media platforms, I reached a wide audience and accumulated over 3,000 views on content related to metabolic syndromes. The growth of MetaHealth was remarkable, expanding its membership to over 50 individuals who shared a common vision of promoting better health practices. My motivation lies in my dedication to improving the well-being of individuals and society as a whole. Witnessing the transformative power of education, awareness, and support in combating health disparities, I became even more determined to pursue a career in medicine and public health. My ultimate goal is to merge my medical expertise with my passion for community engagement and policy advocacy. I aim to one day contribute to a healthcare system that prioritizes preventive measures, fosters holistic well-being, and ensures equitable access to resources for all individuals.

My involvement in the Harvard T.H. Chan School of Public Health Strategic Training Initiative for the Prevention of Eating Disorders further solidified my commitment to public health advocacy. As a Policy Advocate and Research Trainee, I actively participated in drafting the A3512 bill, which

aimed to protect individuals under 18 years of age from the sale of certain diet pills and dietary supplements for weight loss or muscle building. Engaging in productive discussions with numerous senators, health committee chairs, and assembly members, I advocated for the bill's co-sponsorship. Simultaneously, I rallied support from over 100 teens, organizations, and retailers, persuading them to endorse the bill. Through written testimonies submitted to lawmakers and social media outreach, I aimed to raise awareness about body image issues and promote a positive cultural mindset. Additionally, I recognized the significance of advocacy in creating lasting change. Engaging in meaningful conversations with teenagers, organizations, and retailers, I focused on raising awareness about the potential risks associated with unregulated diet pills and supplements. By sharing personal stories and distributing educational materials, I aimed to empower individuals to prioritize their well-being and make informed choices about their health. Witnessing the positive outcomes of preventive measures and policy changes on individuals and communities further fueled my determination to advocate for strategies that prioritize health and well-being.

During my time as an International Public Health Intern and Team Lead, I had the privilege of working closely with officials from the Nigeria Department of Public Health. Leading a dedicated team of four students, we collaborated to develop crucial public health guidelines and policies aimed at enhancing community well-being. We also organized community workshops on topics such as postpartum depression, immunization, reproductive health, and malaria. These workshops were designed to educate and empower individuals to make informed decisions about their health. Through this internship, I gained a deeper understanding of the challenges associated with protecting and exercising human rights in Nigeria. Additionally, I took the initiative to raise funds for public health initiatives in Bauchi, Nigeria, with a specific focus on typhoid fever and women's health. Through successful fundraising efforts, we collected over \$1000, which allowed us to support sustainable projects that positively impacted the health and well-being of the local population. These experiences broadened

my perspective on global health disparities and reinforced my commitment to advocating for equal access to healthcare and sustainable solutions that improve lives. Witnessing the consequences of limited access to resources and the importance of culturally sensitive approaches motivated me to pursue a career in medicine and public health. By participating in community workshops, I witnessed firsthand the empowering effect of knowledge to make informed decisions about their health and well-being.

My journey in STEM has been due to my unwavering passion for medicine, advocacy, and research. Through initiatives like Passion4Med and Meta-Health, as well as my involvement in legislative efforts, I have empowered aspiring healthcare professionals, provided educational resources, raised awareness about metabolic syndromes, and advocated for healthier practices. The skills and experiences I have gained along the way have prepared me for the countless responsibilities that lie ahead. As I continue to make a positive impact, I am inspired by the realization that I am capable of improving the lives of others through my work in STEM. My ultimate aspiration is to become a physician and public health advocate. I envision a future where healthcare is accessible, equitable, and patient-centered. By sharing my knowledge, experiences, and unwavering determination, I aim to inspire the next generation of healthcare professionals to pursue their dreams and contribute to a healthier and more equitable world. I know that if we work together, we can create meaningful change and build a brighter future for healthcare.

STEM Fun: Igniting Curiosity and Innovation!

By Rohil Agarwal

STEM education is truly the future. Connecting the realms of imagination and reality, it empowers individuals to shape a future that is blooming with innovation, discovery, and solutions to the challenges that not only individuals face, but humanity as a whole. It's been ingrained into students that training in STEM disciplines is the foundation upon which technological marvels are built; it equips us with the skills to craft software, design algorithms, and harness the power of machine learning and artificial intelligence. But the less tangible aspects of STEM education are often overlooked, even though they are just as important, if not more!

Creativity. Collaboration. *Fun*. Amongst many other things, what makes STEM so intriguing is that you can always dig deeper into any subject (your imagination is the limit!) and the counterintuitive use cases of various technologies and ideas. It is innate human behavior to constantly be questioning why specific phenomena are found in our world, and STEM education digs deep into this thirst and evolves into a desire within students to keep learning.

Let me take you way back to 2015:

My community had started a robotics team. The moment young Rohil

witnessed his computer functioning independently from the EV3 LEGO® brick, uploading a basic drive forward program to his robot, his eyes lit up and he was hooked! It was the inherent magic about data being transferred over thin air that intrigued him. It was the intricacy of the color sensors and touch sensors conveying information that bewildered him. It was the fact that his computer code could dictate the movement of this robot that made him stare at the board in absolute awe.

That was me! But at the time I wasn't thinking about the practical uses of robotics. I was discovering a new love, and really, you shouldn't think of love purely rationally! And that's what I think STEM education has the ability to do for any student: it can make learning fun and fire our curiosity.

This love of little Rohil wasn't short lived either. I have consistently stuck with robotics since fourth grade up until now, going into my final year of high school. Many things have changed since then: our small LEGO® robot has since evolved into a huge, 18" x 18" metal beast, our code has progressed from visual block coding to the robust programming language of Java, and I have become the lead programmer on my team! But the same fire that lit inside my eyes 8 years ago still ignites when I am training image recognition models with exciting technologies like TensorFlow or when the autonomous program I've been working on for weeks finally meets success.

That love, once impractical, has now brought me to new heights and has fueled my career aspirations in physics, computer science, and most importantly, edTech. It was practical after all!

It's not just robotics, though. The visual nature of STEM education in general is so captivating. Whether that be in the form of physics labs, biology dissections, or chemistry experiments, the hands-on aspect of STEM education allows the principles and phenomena that students learn about in textbooks to come to life before their eyes. And who knows, that one fun lab that a student had in their second grade science class, just

like robotics for me, may help them unlock their passion and life-purpose. This transformative potential can only be realized if students are given the opportunity to embrace the wonders of STEM education from a young age.

Part 2: It's more than just fun

As Uncle Ben famously said, “With great power comes great responsibility.” When it comes to STEM education, this can’t be overstated. Especially with new technologies like artificial intelligence revolutionizing the digital world, now more than ever, STEM education is not just a 100% empirical force, but rather one dealing with proper data use and ethics as well (which is so important in today’s digital age!). By taking these considerations into account, STEM education is working to turn our youth into active leaders.

Growing up, I was captivated by the potential of technology and increasingly its ability to shape the world. My fascination with STEM subjects led me to delve deeper into robotics, programming, and AI as previously mentioned. However, as I learned more about these realms, I naturally became increasingly aware of the ethical implications associated with these advancements.

As the Co-President of the DataEthics4All AI Youth Council, I have helped in developing a platform to inspire youth around the world to not only understand the ethical use of technologies such as AI, but even to become better citizens/leaders in the community. Our mission is to build the next generation of tech leaders with an ethics-first mindset. This has been accomplished through various ways such as most recently, our challenges for students to detect bias in data collection and think of ways to fix them through different case studies. (Check out dataethics4all.org for more information on our work!)

As can be seen, STEM education is not solely about technical skills or theo-

retical knowledge; it is also about fostering critical thinking, collaboration, empathy, and ethical awareness. These skills extend far beyond the confines of the STEM disciplines and are highly sought after in various industries.

Overall, STEM education is essential in building a brighter, funner (I know that may not be a word, but who cares!), and ethically conscious future for all. It allows students to be on the cutting edge of technology, revolutionizing the world as we know it. It is what empowers students to not just become, but *want* to become active leaders, innovators, and problem solvers in their communities and in the world.

Illuminating Paths, Transforming Lives: The Power of STEM Education

By: Vinay Devarakonda

This argument explores the profound impact of STEM education on underrepresented communities, drawing from my personal experiences in Allampally, India.

As I embarked on a cultural exchange program sponsored by VT SEVA, a volunteering service program, my journey to India became a turning point in my understanding of the transformative power of STEM education. Stepping out of the Hyderabad Airport, I was immediately struck by the pollution-choked atmosphere and the sight of hundreds of homeless individuals seeking shelter on the sidewalks. These initial impressions set the stage for my arrival in Allampally, a village nestled in the damp forests, where the abysmal living conditions and the absence of access to technology or STEM education compelled me to make a difference.

Chapter 1: Unveiling the Shadows

As I got off the plane and first journeyed through the streets of India, the stark reality of inequality became apparent. The pollution and homelessness that marred the area painted a grim picture of societal neglect. After a short but challenging drive through mud-splashed roads and pouring rain,

I was confronted with the harsh reality of the lives of the lives led by one underrepresented village : Allampally. In the midst of damp forests, devoid of access to technology or educational resources, I discovered a community yearning for empowerment. All throughout my travel to India - the plane, long drives - I was unsure what my experience would be like. However the sight of the village became a catalyst for change indeed, motivating me and my fellow volunteers in VT Seva to bring STEM education to the youth of Allampally.

Chapter 2: Unleashing Potential through Knowledge

STEM education is a catalyst for empowerment, offering underrepresented communities the tools to shape their own destinies. In this small village of Allampally, I had the privilege of teaching the children a range of subjects, including cubing, mathematics, coding, computer literacy, language arts, and science experiments. I witnessed their eager engagement and the spark of curiosity that ignited within them, and I soon realized the immense power of knowledge to transform lives. STEM education equips individuals with the skills needed to navigate an increasingly technological world, opening doors to new opportunities and empowering them to envision a brighter future.

Chapter 3: Cultivating Local Leaders

After a couple of days spent in Allampally, I noticed that STEM education not only empowers individuals but also cultivates local leaders who can drive change within their communities. Through my interaction with the tribal kids, I saw their flourishing leadership qualities and their growing determination to uplift their own village. The field genuinely nurtures responsibility and establishes the belief that people have the power to make a difference.

Chapter 4: Igniting Innovation and Productivity in the Face of Adversity

Innovation flourishes in the face of adversity. As I guided the children of Allampally through STEM activities, their innate creativity blossomed. They began to approach problems with fresh perspectives, thinking critically and collaborating with their peers. STEM education fosters an environment where innovative thinking thrives, providing individuals with the tools to tackle complex challenges. The newfound confidence I witnessed in the children inspired me, reinforcing the importance of STEM education in nurturing a generation of future innovators. India, primarily a developing nation, has the capability to grow economically through the power of STEM and the bright minds that would serve as a strong foundation for the country. I take great pride in my home nation, and know that STEM will provide the best future for its upcoming generations of youth. This is my experience.

Revolutionizing Medicine with Artificial Intelligence: A Story of Dedication and Impact

By: Yashvir Sabharwal

In a world increasingly shaped by technological advancements, my passion for STEM has led me on a remarkable journey at the intersection of artificial intelligence and medical applications. As a highly motivated and innovative student researcher, I have dedicated my efforts to exploring groundbreaking solutions for renal cell carcinoma and biomedical engineering. Through this, I aim to highlight the incredible projects, research, and advocacy work I have undertaken, shedding light on the power and importance of STEM education for students, parents, educators, and dreamers alike.

My journey began as a researcher and contributor at Stanford MedARC (Medical AI Research Center). Collaborating with esteemed medical professionals from around the world, I immersed myself in cutting-edge research on medical advances, particularly focusing on brain fMRI analysis. Through this experience, I was able to show my research and receive verification by medical doctors, deepening my understanding of the potential of artificial intelligence in healthcare. My research was cross-checked and commended by members there.

One of the significant contributions I am immensely proud of is my impactful

research on renal cell carcinoma (RCC). Renal cell carcinoma, the most common and deadly type of kidney cancer in adults, presents various challenges in diagnosis and treatment. To address these challenges, I developed an artificial intelligence model using a convolutional neural network. This model aimed to classify different subtypes of RCC accurately. Training the model on a dataset of RCC histopathology images, I worked meticulously to shade the RCC by its various subtypes. The performance of the trained model was evaluated using various metrics, including accuracy.

Additionally, I developed a groundbreaking and novel synthetic image generation tool called NephroNet. Leveraging diffusion models, NephroNet synthesized original images of RCC surgical resection slides within seconds. These images were visually realistic and had immense potential for creating new training datasets, testing image analysis algorithms, and training medical professionals.

The implications of my research are far-reaching and hold immense promise for the field of healthcare. By assisting doctors in diagnosing and classifying RCC subtypes, the AI model minimizes human error, increases accuracy, and reduces doctor workload, leading to improved efficiency. Moreover, the tool can be employed in telemedicine settings, aiding in remote diagnosis and treatment of RCC patients in underserved areas. It also opens avenues for personalized treatment approaches through the development of targeted therapies.

Furthermore, the generation of new datasets comprising thousands of anonymous whole-slide images of RCC enhances research on RCC subtypes, fosters the development of new diagnostic tools, and facilitates investigations into the efficacy of various treatments. The flexibility of the model extends beyond RCC, as it can be tuned to other medical areas such as chest x-rays, pancreatic cancer, or shin fractures, enhancing diagnostics and treatment across multiple domains in the medical industry. At just 16 years old, I was able to publish my research in a preprint journal.

Throughout my journey, I have strived to inspire and empower the next generation of STEM enthusiasts. As a member of the Samyak Science Society, I have worked alongside like-minded individuals to spread STEAM awareness, ignite curiosity, and teach workshops in technology and science. Additionally, I helped to establish relationships with schools in neighboring countries in southern Africa, teaching robotics curricula, and donating supplies, resulting in a local robotics team winning a national competition.

My STEM journey has been defined by passion, innovation, and a commitment to excellence. Through my groundbreaking research in artificial intelligence and medical applications, particularly in the field of renal cell carcinoma, I have witnessed the transformative potential of STEM education. As I look toward the future, I am eager to continue my pursuit of knowledge and further contribute to the realms of STEM and computer science. By sharing my story, I hope to inspire students, inform stakeholders about the importance of STEM education, and bring closure to my formative experiences in this extraordinary field. You can learn more about me and what I'm up to at linkedin.com/in/yashvir-s!

From Filament to Healing - The Story of Chariz and 3D Printing

By: Panav Kalra and Fergus Chung

About us:

At the core of our mission is the belief that 3D printing technology can be a powerful tool for creating positive change in the world.

We've made this belief a reality by supporting medical aid efforts in the Ukraine war, leveraging our 3D printing prowess to manufacture much-needed medical supplies. The tale of our study with orthopedic traumatology professors at The Hong Kong University to deliver aid to civilians and soldiers involves twists and turns.

Against the backdrop of continually worsening mental health statistics year after year in Hong Kong, our organization has partnered with leading psychologists like Dr. Candice Powell and the top 5 mental health organizations in Hong Kong to develop more than 19 3D printed exhibitions aimed at raising awareness of the mental health complications. This story details how we blended seemingly disparate disciplines toward one goal: reducing stigma. You'll gain insight into our journey combining 3D printing expertise with mental health knowledge to help those in need.

From filament to printer:

The Chariz engineering team utilized open-source control software and fabricated customized hardware to construct several fused filament fabrication 3D printers. We employed high-precision 3D printing in itself to manufacture parts for the frame. We integrated high-torque stepper motors, precision lead screws, and linear guides for precise motion control in the X, Y, and Z axes.

An open-source microcontroller coordinated the stepper motors. We developed a heated build platform and hot end nozzle assembly to extrude thermoplastic filament, with real-time control of extruder and build plate temperatures to facilitate layer adhesion. Optical endstops aligned the print bed to ensure dimensional accuracy and repeatability across builds.

The complexity of integrating over several bespoke parts and subassemblies into a functional 3D printer that could produce parts with sub-millimeter precision required developing a modular assembly system and optimized workflow to enable volunteer technicians with varied technical skills to participate in the build. Production protocols detailing part geometries, assembly sequences, wiring, and calibration methodologies were created to enable future technicians to replicate and service the 3D printers.

Our open-source 3D printers have proven capable of additively fabricating geometrically complex parts from ABS, PLA and nylon filaments with feature resolutions as fine as 0.1mm. Having so many localized build sites allow for distributed digital fabrication of parts across our global organization.

Mental Health Organisation Support:

Dr. Candice Powell was fascinated by the potential of 3D printing to create tangible aids for explaining complex mental health issues. When her

organization, Mind HK, partnered with Chariz, it opened up new possibilities for raising awareness through interactive exhibits.

The first collaborative project was several 3D printed models of the brain showing areas associated with depression, anxiety and trauma. Dr. Powell found that patients responded positively to being able to physically point to where they felt sensations in their bodies. The exhibit debuted at a Mind HK awareness event and generated significant interest from attendees. Playing a key role in the shift of Hong Kong's declining mental health state, we worked with renowned artists across Hong Kong to achieve the 3D printed artwork.

This began our fruitful partnership where Chariz first ever leveraged its 3D printing expertise to create exhibits that complemented Dr. Powell's guidance on effective mental health messaging.

Over time, your collaborative exhibits have educated thousands in Hong Kong about mental health issues. Dr. Powell notes that Chariz acts as a "mental health advocate with innovative ideas using modern technology". Our work together shows how fields as different as psychology and 3D printing can come together to promote awareness and understanding.

Ukraine Support:

In May 2023, the Chariz Team made the decision to broaden its areas of expertise and provide assistance to those affected by crises and conflicts. Specifically, we felt compelled to assist those impacted by the ongoing Russo-Ukrainian conflict, which began in 2014 and has resulted in the widespread destruction of homes and families.

Recognizing the urgent need for aid, we knew that it was crucial to utilize our skills and resources to help in any way we could. As a team, we are committed to doing all that we can to assist those impacted by this devastating conflict

and other crises around the world.

We did not want to acquire supplies; we aspired to design and produce. The team began by conducting mass research and explored 3D-printing possibilities that would allow us to design, model, fabricate, and ship various medical gear to the country in the midst of the crisis. We specifically conducted lab research with Orthopedics and Traumatology professor Dr. Weichen, Qi an der Hong Kong University.

Our organization, which specializes in 3D printing medical supplies, has been honored to support Ukraine with our expertise in fracture casts. We have worked closely with Dr. Qi and his lab to conduct groundbreaking research into the effects of mechanical micromotion on osteogenic cells at the fracture site. This research has allowed us to gain a deep understanding of how casts and splints can aid in fracture healing at the cellular level. By combining our interdisciplinary teams' efforts, we were able to apply this research to CAD and develop 3D printed casts that are more effective than traditional methods. Our rigorous testing over several months, which compared data from our finite element analysis to expected data in literature and our knowledge from Dr. Qi, has proven the efficacy of our 3D printed casts. We are proud to support Ukraine in this way and believe that our 3D printed medical supplies will continue to make a positive impact on patients' lives.

One of our primary 3D-printed medical supplies is the finger cast and splint, which serves to stabilize fractured fingers and prevent further damage to the injured area. The cast is designed to bend around the finger by applying heat to the template. Using CAD (Computer-Aided Design) software, we were able to create detailed and accurate models for the casts. Thanks to our efficient manufacturing process, we were able to produce more than 300 finger splints in just one week.

With the use of 3D printing technology, we can create medical supplies

quickly and with high precision, ensuring that patients receive the best possible care. Our finger cast and splint is just one example of how 3D printing can revolutionize the way we approach medical treatment.

Following our shipment to Ukraine, our efforts to support those affected by conflict have not stopped. The Chariz Team rallied over 60 volunteers from local schools to organize a donation drive for students to contribute medical equipment, non-perishable food, hygiene products, and sleep accessories. More than 200 students participated in the movement, resulting in the collection of over 500 supplies. These supplies will be shipped to the “Help Ukraine Center” in Poland to aid those in need.

If you are interested in learning more about our work visit our website at charizhk.org

Inclusive Medicine: Advocating for AAPI Health Equity

By: Chloe Y. Wang

The day my grandmother was diagnosed with dementia, it was as if life itself had been sucked out of my soul. She was 5,560 miles away and oceans apart from my family. She lived in France, a country where she struggled to communicate in the language and lacked companionship. Our family had no choice but to place her in a care center—leaving us feeling lost and hopeless.

I decided to begin researching more about Alzheimer's and dementia to better understand the significance of this disease. I came across an overwhelming fact: According to the Alzheimer's Disease International, there are over 10 million new cases of dementia each year worldwide, implying one new case every 3.2 seconds. Navigating this unfamiliar process proved to be extremely challenging for my family. Could you imagine, over 10 million families experiencing this annually? My family and I were torn. We had no idea what to do, how to care for her, or how to manage her condition.

I was determined to find a way to help my grandmother, and in the process, I found out about the disparities in clinical research and caregiving for AAPI communities, particularly in ADRD. It was an eye-opening experience to learn about how AAPI individuals, families, and caregivers were not being adequately represented in clinical research and caregiving. Little did I know,

this would become the start of my journey in advocacy. This eye-opening revelation marked the beginning of my advocacy journey, as I delved deeper into the disparities in clinical research and caregiving for AAPI communities, particularly in the context of ADRD.

As an Asian American, there are multiple facets our community was severely underrepresented in—and for one, it was AAPI participation in clinical research. Specifically, research in Alzheimer's Disease and Related Dementia (ADRD) and Caregiving. AAPI is an acronym that stands for Asian American and Pacific Islander, a racial group that makes up about 7.5% of the US Population. According to the Alzheimer's Association, almost roughly 45% of Asian Americans believe medical research is biased against people of color. Racial and ethnic disparities in health and health care, such as those observed during the pandemic, extend to dementia care. These disparities reach beyond clinical care to include uneven representation of Asian Americans in Alzheimer's research in clinical trials. To provide perspective, clinical research projects focusing on AANPI participants funded by the National Institutes of Health (NIH) between 1992 and 2018 represented less than 1%, a mere 0.17%.

After extensive searching, I discovered a research registry aimed at addressing these disparities—the UCSF CARE Registry, funded by multiple global healthcare and AAPI organizations. CARE's goal is to pave the way for meaningful inclusion of AANHPI in clinical and caregiving research across the lifespan. With innovative recruitment strategies, CARE aims to enroll over 10,000 AAPI individuals into its research registry, allowing researchers to reach out for potential participation in their studies.

I had always had an interest in STEM, specifically the medical and healthcare track. Inspired by my grandmother's journey, I redirected my focus to advocacy for healthcare equity, solidifying my role as an ambassador for the CARE Registry. Collaborating tirelessly with healthcare and research professionals, I presented our mission to various organizations and communities,

speaking at conferences and events to promote CARE. Surpassing our goal of 10,000 participants was a significant milestone, but it marked only the beginning of our ongoing mission.

I am forever grateful to my grandmother for teaching me the importance of advocacy and equity in healthcare, and for inspiring me to make a change in the world. She has ignited an inextinguishable fire that has given me the motivation to continue to work towards a more equitable future for AAPI communities and to forge a more equitable future for AAPI communities—ensuring equitable access to care and resources. Advocacy serves as an unwavering voice, amplifying silent struggles, igniting hope, and leading us toward a future where no one is left behind. In the words of former NASA astronaut Mae Jemison, “We have the opportunity to create the future and decide what that’s like”. So, to all the young changemakers, what legacy will you leave behind?

The power of clarity in astrophysics

By: Karma Lokhi Bridgman

Astronomy both inspires and thrills me as a subject and field for research, As I became more knowledgeable and began combining the singular field of astronomy with other subjects and concepts, I experienced the power of clarity.

I am currently working on a research project on the astrophysics of general relativity and quantum electrodynamics - I admit a rather elaborate title, but for such an interesting project. In this research, I am using my own coding skills in Python and Matlab to present equations, such as the Taylor Expansion series, to be graphically visualized with an online algorithm. This is a great personal learning experience working on not only furthering my own knowledge of general and special relativity, but can also be massively helpful to anyone who wishes to learn or understand basic fundamental concepts in astrophysics. According to a research paper by the Social Science Research Network, 65% of the world are visual learners to some extent, meaning that visual aids, such as graphs or infographics, will help their processing or understanding of information given to them. Everyone deserves a chance to understand why our universe is expanding or how electromagnetic fields interact with electrons, and in the future I hope to continue this with a wider range of concepts.

My love for astrophysics and all things related doesn't end there. As-

trophysics, like all other STEM fields, are incredibly versatile and can be combined, to create truly interesting and specific niches that can be applied to solve world life thoughts. Imagine legos – you can build the most complex, architecturally beautiful structure but the foundations that lie beneath are irrevocably the most crucial. I realized this when researching for a written dissertation on quantum physics' applications in the research for theories regarding the Universe's expansion. I became interested in a completely opposite and often understated view of astrophysics – the philosophy of it. This fusion of STEM with humanities subjects should not be a new concept though – an overwhelming majority of well known figures from Ancient Greece and Rome mathematicians, or philosophers, or astronomers, were all of those at once. Astrophysics and philosophy are not opposing entities, represented by a thesis and antithesis, but rather a synthesis. For example, although Ptolemy's idea that the Earth was at the center of our universe was disproved, one could still say that while standing on Earth, we are observing from the center of our observable universe. This new standpoint ultimately propelled me into deeper and more complex astrophysics, delving into niches of quantum physics.

Now another application of the lego blocks metaphor – with a strong foundation, lets add some more complex and different structures on top. Or even be daring, and add some different coloured blocks, lets say. In the near future, I will present a Tedx Talk on using seismic technology to investigate caves underground on foreign planets in hopes of finding vital resources, such as water in Mars. Similarly, I wish to combine my existing engineering knowledge to create sustainable resistant materials to survive high risk environments such as outer space and areas suffering from drought.

What is the point of all these incredible scientific breakthroughs and knowledge is everyone is not able to understand or enjoy it? Not only advocacy, but sharing ideas in a clear manner is key to presenting these ideas. One of the biggest issues when entering the STEM field as a career, field of study or even out of interest, is its common universal barrier or being

difficult. All humans have this built in system to prefer comfort. Its how we stayed alive thousands of years ago, by evolving to prefer areas of comfort and safety. Now in a time where learning is not going to kill you despite being hard, our brains process difficult information like this:

Step one: tasks are presented.

Step two: tasks are identified as uncomfortable.

Step 3: avoid tasks.

Of course, this is extremely simplified but pretty much, humans are psychologically built to avoid challenge and prefer comfort. If you ask someone to read a research paper when they have no previous knowledge of the field, they are likely to believe its as complicated as being written in Ancient Greek. Surprisingly, they would not technically be wrong if it involved mathematical equations, most use the Greek alphabet as substitutes. Moreover, the power to explain concepts in a simple, yet not basic way can not only make an individual seem more well spoken, but in fact much more understanding of the topic they are trying to present. Therefore, the power of clear advocacy and presentations for new research is key, and an extremely useful skill for young scientists to develop.

I learnt this skill best when preparing for my presentation in front of four hundred people at a school event on Dark Matter, a scientific concept I found extremely interesting despite its complexities, and eventually led to the several research projects I had completed afterwards. I practiced in front of an array of different audiences: friends who both understood dark matter thoroughly and some not at all. I knew that the content I was explaining was scientifically accurate and relevant so the most important part of this for me was one question: 'Can you explain this back to me?'. This simple question proved whether my words were formulated correctly so that they had a viable impact on my audience. I imagined it similar to formulating tests on your code with specific input to test different types of errors. If you had an empty input or boundary error data, what would happen and how would your algorithm handle it? I applied the same method to myself, and in

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reaps great rewards. In the end I believe that if I could manage to use this to explain the complexities of the scientific discoveries to everyone, no matter their background, to ultimately cause even more change and understanding.

Generating electricity using anything and everything

By: Kimaya Vijay Deshpande

“Wait, what?”, said the panel of judges.

“This is too unrealistic.”

I firmly believe in the notion that energy can neither be created, nor destroyed.

Everything in our surroundings can be considered as energy. This is because everything that exists has electrons (electron clouds to be exact), that move around continuously to ensure stability.

If we are surrounded by this much of energy, can we really say that we are utilizing our energy resources to its maximum potential? Of course not.

Every atom expends a lot of energy to just hold itself together. This energy never escapes the atom under normal conditions, and keeps circulating in an infinite continuous loop. This energy is exactly what's released during nuclear fission. In most nuclear power plants, the production of energy is a one-time cycle – meaning that one single flow of steam drives one (or sometimes multiple) turbine(s) only. While there have been numerous innovations to improve the quality of these turbines, how can we make sure that any type of energy is used to its maximum potential? Every movement of steam, water and air has to be utilized whenever possible.

This idea is exactly what my research project centers around. For my research from Harvard University under the Research Scholars Program, I

delved deeper into potential improvements to improve thermal and energy efficiency in nuclear power plants. I started with determining a suitable location for water turbines to be present, as interfering with the primary or secondary cycle of the extremely hot fluid would be hazardous. After going through all possible locations, I determined the best location to be in the pipes which carry the coolant water, due to relatively stable conditions. Later, I conducted experiments using CFD (Computational Fluid Dynamics) to determine the best location for a water turbine to be present inside the pipe by comparing the pressure, velocity and temperature of water at all points. These turbines could then be connected to a generator which would then generate electricity that would be either stored in batteries, UPS or supplied to consumers. I also came up with another innovation that could utilize byproducts of nuclear energy generation such as steam and hot water. I developed a system which could capture this waste and use it for other purposes such as sterilization, cooling down, or even a second cycle of energy generation!

Nuclear energy is still considered unsafe and non-eco friendly by many, even though it is one of the most promising sources of energy for the future. In fact, I started advocating for nuclear energy even before I realized it! It all started with educating my classmates and friends about the advantages of nuclear energy and lessening the suspicion towards the same. However, I believe that there is always room for improvement and broadening one's horizons.

Well, if you thought that this was crazy, there's more!

I come up with at least 3 new ideas every day to generate electricity. Anyways, I recently came up with an idea to generate electricity from the flow of water and air in water pipelines and air vents respectively in buildings. This innovation of mine involved calculations on cost, approximate energy generation, placement, maintenance, and more. Unfortunately, my idea was rejected by the panel of judges for being too unrealistic. I placed 4th out of 35+ entries. Nevertheless, I did not give up on the possibility of the same and implemented my idea to increase energy production by a power plant.

As I am currently learning high-level Physics, Chemistry and Mathemat-

ics, I am more than inspired to take my projects to the next level and come up with better, more efficient prototypes to generate electricity.

Although I do not believe that the future will be fully automated, I am sure of the fact that AI and Robotics is going to replace some, if not most of today's monotonous tasks. This perspective of mine led me to undertake numerous robotics related projects to increase sustainability.

One of my most remarkable achievements was being a semifinalist at Harvard University's Sustainable Innovation competition, where I came up with an idea to use robotic drones to perform artificial pollination on flowers.

I, along with my classmates, came up with the idea of a robot that can check the pH of a soil sample and suggest appropriate fertilizers to combat an imbalance in the pH level. Another project of mine involved using a robot that can clean frequently touched surfaces in our school, while providing necessary equipment such as sanitizers, gloves and masks to those in need. This project required precise calculations about reaction time, area coverage of the ultrasonic PIR sensor, and regarding the structure to ensure stability of the robot.

In order to reduce the consumption of electricity at my school, I designed a circuit prototype using Arduino Uno, that can appropriately switch on/off electrical appliances upon detecting movement.

While I may have a lot of ideas, I consider it to be important to inspire others and the coming generations about sustainability and innovation. This belief of mine has led me to becoming a tutor of all subjects in my class. Whenever I get time, I always make sure to make others' concepts in science clear, as I believe that science is not something that can simply be memorized. Instead, it is something that doesn't just have to be understood, but also continuously and critically thought about.

To spark an interest in 9th graders in physics, I designed 3 gravity simulations using python. These simulations gave an in-depth view on various topics of gravity, forces, mass, weight, and the gravity on different planets in the solar system.

My list of innovations is still not over. I believe that with the right re-

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sources, skills, and guidance, anyone can come up with amazing prototypes and innovations to benefit humanity as a whole.

III

Part 3 - STEM Nebulae: How STEM Learning Forms the Clouds of Discovery and Achievement

“Education is not the filling of a pail, but the lighting of a fire.” -

W.B. Yeats

Do not bring shame upon us!

By: Titilope Olotu

Growing up in Nigeria, I was never anything other than a woman—this was my marginalized identity. Things like Female Genital Mutilation and Boko Haram were the boogeyman of my childhood. I shared similarities with Elmo, as our strings were pulled to our audience’s amusement. But I wasn’t a made-up character with a happy ending.

As I spent every day attempting to please Nigerian society, I—along with every other woman in my life—became responsible for the action of my perpetrators, on the basis of what I wore or how I acted.

As an eight-year-old, I was afraid and discouraged from displaying grief or mourning from seeing self-induced abortion with an iron rod by young “wayward” girls. Unable to bear the shame of their actions, they ended their lives and were posthumously deemed a shame in the family name. As I realized that to any and all male “role models” in my life—male teachers were telling me “Your breast is growing, you are becoming a beautiful young woman”—I was nothing but a tool for their satisfaction, my grieving only grew stronger. I knew I was about to be trapped in the same circumstance they were.

Nigeria was renowned for having insufficient healthcare resources. Doctor visits were infrequent, but when they actually occurred, it needed to be an urgent or catastrophic situation. With Nigerian medication, the sensation of assurance was gone. I harbored hope that I could make a difference but was viewed as unserious. Because most doctors were corrupt, I would pursue

my education to develop as a doctor, unlike the clowns in white coats. My teachers always dissuaded me, saying that I was simply too poor to study medicine.

My battle with womanhood influenced my interest in the medical industry. For several African children, becoming a doctor has traditionally been a make-believe ambition. Every time I was asked what I wanted to be, I always declared that I desired to become a doctor in order to provide for my family. But when the deceptive promises of a secure childhood were crushed, I grew increasingly driven to investigate women's health. My ambitions to become a doctor were short-lived, and it wasn't until I discovered that I would be relocating to America that I realized I had an opportunity in the country of opportunities.

The new beginnings were far from fresh; in fact, they appeared all too familiar. Working at 14 in America reenacted the troubling aspects of womanhood from which I assumed I had escaped. Despite the fact that I was a child, my appearance suggested otherwise. Their awareness of my minority was hazy, but their sexual desire was undeniable. "What time do you leave?" "How much for one day?" and other such phrases were uttered by men of sufficient age to be father or grandfather figures. My childhood fear returned, and because I worked late nights and took public transportation, I became more vulnerable. The items on the daily checklist ranged from pencils to tasers and pepper spray. It was disheartening to realize that I along with other women felt bombarded by society, as we became an automatic property of it.

I volunteered as a CNA for four years, shadowed a neurologist at UC Davis, and conducted research regarding the fatality rate of black women during childbirth in America and female genital mutilation. These were areas of interest in my life, especially the mutilation and childbirth aspect. After understanding the current state of our women's health within several societies, I understood the importance of becoming the change many young women wished to see. As a women's health specialist, in America I would aid POC in overcoming the statistics of more deaths during childbirth, and

DO NOT BRING SHAME UPON US!

in African countries, my involvement would ensure the improper practices for abortions would stop. This also ensures that basic women's health necessities would be met.

During my time at UCLA, I hope to create an environment where people get involved and discuss health issues in disadvantaged societies. I believe taking courses like "Reintroduction to Writing: Black Birthing Women" will help me further articulate my understanding of the black maternal mortality rate in America in relation to racial bias and my experience with watching my mother give birth in America. Both experiences provide an opportunity to share a different perspective with my peers regarding my knowledge within various sectors of the world. This cross-collaboration that I hope to have during my undergraduate career will help to foster a community that will aid in the development of modern obstetrics. I aspire to ensure that my trauma with embarking on womanhood would never become another child or woman's reality.

Unraveling Mysteries: from Nancy Drew to Neuroscience

By: Puja Chopade

The local library has always been one of my favorite places. As a child, my mom always encouraged me to check out nonfiction books, which I did grudgingly at an approximately 30:1 ratio, fiction to nonfiction. I loved the Nancy Drew and Geronimo Stilton series for their captivating mysteries, but I didn't give nonfiction much of a chance. One day, I read a book on marsupials which concluded with a discussion on the Tasmanian tiger wolf. Scientists had recovered DNA from a Tasmanian tiger wolf pup with the hope of reviving the extinct species. At that age, I didn't know what DNA was. I wasn't even familiar with this species, but suddenly I cared so much. Biology is mysterious. Biological research is fascinating. Our current knowledge of biology is so vast, yet so small, compared to that which remains to be discovered. This foreshadows many exciting years of future advancements in biology.

From bats and frogs to medicine and neuroscience, my interests quickly evolved over time. However, I maintained the same sense of wonder at everything I learned about biology. I was especially interested in discoveries through medical research that could help people suffering from health conditions. This has always been important to me since several members of my family have been affected by various disorders including diabetes,

COVID-19, hypercholesterolemia, and pregnancy loss. My twin sister and I were IVF babies, and we have medical research to thank for our lives. I hope to someday explore the mysterious fields of biology and medicine and help another family in the same way.

I was first introduced to the biology of the brain when I was in 3rd grade. Students from the local university had set up an incredible larger-than-life display featuring bright flashing lights, colorful models, and interactive stations involving lots of candy. While I didn't truly understand the brain by the end of the experience, it allowed me to appreciate the wonders of the brain at a very young age. After all these years, I have never stopped being amazed by what I have learned.

Every summer, my mom used to give my sister and I a few textbooks. We would select a topic of our choice, make a one-page presentation, and share our findings at the end of the day. This habit stuck with me through middle school. One summer, I decided to read the chapter on neuronal signaling in *Campbell Biology*. I was very excited to learn about the chemical and electrical basis of the cell communication that made all of my body processes possible. Each day, I would learn a new topic and bore my friends and family with long, animated (though one-sided) discussions about voltage-gated ion channels, membrane potentials, and saltatory conduction. What most fascinated me was that although the nervous system is extremely complicated, it depends entirely on a simple all-or-nothing response. This was my first independent study on the nervous system, and I never fell out of love with it.

Today, the focus of my interest is neurological disorders, especially Alzheimer's Disease (AD). When I was first studying Alzheimer's disease for the Brain Bee competition, I learned how Alzheimer's can destroy patients' lives from emotional, psychological, and financial perspectives. Unfortunately, current Alzheimer's therapies can only treat symptoms temporarily. I dream of a world where all neurological disorders are better understood and have therapies that effectively slow, stop, or reverse their

progression. A breakthrough in the development of a disease-modifying Alzheimer's drug would mean a chance for millions of patients and families to truly fight back against Alzheimer's disease. I'm eager to join research efforts to develop novel treatments for Alzheimer's disease and other neurological disorders. However, as a high school student, I realized that my resources and experience were limited, so I looked for other ways to contribute to the field.

I soon recognized that researchers needed a clearer picture of the failures and successes of various therapeutic strategies in order to focus on strategies with the greatest potential for discovering effective novel therapies. During the COVID-19 pandemic, I worked with the Mitragotri Laboratory for Drug Delivery at Harvard University to conduct meta-analytical research on trends in AD clinical trials and therapies. Co-first authoring and publishing our findings in a review article which has been cited in multiple papers was an incredible experience. This experience showed me that, even as a high school student, I have the power to make an impact on medical research. Finding a cure for Alzheimer's disease is one of medicine's greatest and most pressing mysteries, and I'm very excited to see how else I can contribute to this constantly evolving field.

Check out <https://doi.org/10.1002/btm2.10367> to learn more about our research on trends in Alzheimer's and Parkinson's disease clinical trials!

The Worm Story

By: Kevin Pyo

I come from a small American military installation highschool in South Korea. Being secluded in a remote area in the countryside of Korea where I have to smell cow manure every summer, I didn't have access to many of the academic endeavors such as dual enrollment, ISEF regeneron, or any other opportunistic science fairs — except JSHS. JSHS was the one good opportunity to show my efforts in a STEM project especially because it is a military sponsored symposium and was provided by my highschool. I first heard about JSHS in the beginning of my sophomore year (2021) and worked on selectively breeding *Zophobas Morios*, also known as Superworms to degrade PS (Styrofoam) at a feasible and a more practical rate for about a year and half to put it through real world applications which I will talk about later.

South Korea and Japan have an extensive network of recycling systems much more implemented than the US. In 2020, South Korea recycled nearly 59% of their municipal solid waste, while Japan is boasted to have recycled over 85% of their plastic bottles. Their rates are much higher than US's recycling rates. According to the Environmental Protection Agency (EPA), the overall recycling rate for municipal solid waste in the US was around 32.1% in 2018. Being a military brat while also being a mix of Korean and Japanese, I got to live in both countries for a long period of time as well as America. One thing I did notice though is how seriously Koreans and Japanese people take

recycling in their life.

Contrary to most Americans throwing all types of trash in one bag to throw away in the dumpsters, people here are obligated to separate the trash based on the type of material such as cans, plastics, or bottles in separate bags. They then throw away the bags on the dumpster site where they provide dumpsters to people based on the material being thrown away. In one village of Japan, they even take it to the degree of separating the little plastic ring around the bottleneck of the bottle (the hard plastic below after removing the bottle cap) because they are two different plastics PET vs. HDPE.

But one thing I noticed when I went around all types of dumpster sites for recycling was that most of the plastic being recycled was Styrofoam or they at least took up a bulk of the space. During the process of literature review for my research I later found out that styrofoam is composed of around 95% air which is what makes them so difficult to manage when taken to recycle.

At this time of writing and also back when I was researching, no one had any published findings of selectively breeding mealworms, superworms, or wax worms even when scientists have figured out that they have the ability to biodegrade plastic.

Then, I came across a well peer-reviewed and extensive 200 page research paper from Stanford University by Anja Malawi Brandon and her team about a study on Yellow Mealworms being able to digest polyethylene and polystyrene and how a 1:1 ratio of plastic and bran (wheat casing typically used as their feed) improved their ability to degrade styrofoam causing them to eat MORE styrofoam rather than only relying on styrofoam as their diet. I also came across research that when predators such as birds eat these worms that were fed plastic, they had no harmful effects on the body of the predators (although further research is needed.) I also read that around 80% of the time, the worms choose to eat styrofoam instead of bran, maybe due to the hard exterior of styrofoam resembling their natural source of

food: plants.

With all this information, I knew that in order to make plastic eating worms feasible to implement it into the real world, whether it be through letting them roam plastic dumpsters or by providing them a designated space to munch on plastic, the only problem was that they only ate too little plastic. I tackled this problem on a 15 month journey by successfully raising an F3 generation of worms that ate plastic more than their parent generation (around a 40% increase.) I made a part of my room my lab by setting up containers and kept the control variables constant by maintaining a 26 ± 1 °C and $50 \pm 10\%$ relative humidity using a radiator heater and a humidifier. I was able to win top 5 at regionals and go to Virginia for nationals where I got an opportunity to work at a military research facility!

How I Found STEM Interesting at a Young Age

By: Kudakwashe Chikono

Steve Jobs once said, “You can not connect the dots going ahead, but you can connect them going back.” At first it was not promising or interesting enough as I was young. I did not have any idea of what STEM was at that time. I did not have a scientific background like some of my friends have. My parents did not graduate from any high school, furthermore any college. Honestly, they know nothing about STEM and they are far from being fascinated by it. Although being born in such a family, I did not let my background define my interests and what I want my future to look like. My journey in STEM began at a very young age when I developed an insane curiosity about almost everything that I surrounded myself with. It was this curiosity which led me to have an interest in STEM. The biggest driver of this curiosity was a desire to solve problems that I faced because of financial disabilities.

It all started with the love of toys. When I was young, I loved toys so much and I still love them. Though I have such a great affection for toys, my parents did not even buy any for me since childhood. I understand that it was not their fault. It is because they are less privileged and can not afford to buy me one. My parents are not educated so they work low-class and low-paying jobs. The money they get annually is not enough to cater for

all my needs. As their child, I could accept it knowing that there's nowhere they can get the money. Because my parents could not buy toys for me, I thought of a way to get myself out of this conflict. I started learning to make wire cars from those who I saw making them. I taught myself to make wire cars to substitute toys. As much as I can remember, I started making wire cars and cardboard box cars at the age of seven. I do not deny the fact that these cars were ugly but at that time, they served as my toys and brought happiness to my life. This was the start of my STEM journey, trying to solve my problems using materials available to me.

The main reason behind my affection for toys was to have fun. I also loved toys because they gave me a piece of mind. Toys not only entertained me, but also sparked my curiosity about the underlying mechanisms that govern the world around me. As a young child, I was naturally curious and had a vivid imagination. Curiosity can be sparked by different things in life. Some may have their curiosity sparked by the love of money or something fancy but mine was sparked by the desire to solve problems. Those wire cars I made paved the way for many bigger things. Toys allowed me to explore the forces, motion, and energy of my daily life which are governed by the laws of physics. My fascination with STEM grew as I played with my wire cars. No one taught me to make wire cars but I learned from my mistakes so that I can make something better.

As I grew older, my passion for physics only intensified. I began to understand some concepts in physics like the use of an electric motor. I stopped making wire cars that needed my energy input. I started making wire cars that could go on using propellers and power from used batteries. I was inspired to do this when I saw my friend with a toy car that could move on its own. Because of the curiosity that I had, I learned to make a wire car similar to my friend's toy.

As I was growing, the curiosity that I had made me connect with many people. From the description that I was given by the first person to tell me about

STEM, I saw that I was practicing STEM since early childhood. I discovered myself after gaining knowledge about STEM because that's when I started to know what I really want to do in life. I even started trying to solve problems for my family and community using STEM. My first machine that functioned well was a special alarm. I went with it to the SEIT competition (a high school science competition that fosters scientific interests in students by allowing them a chance to exhibit models, collections or investigations on typical society problems) and I won the second prize. This was the first time being involved in STEM at a large scale like a school. I did not only find STEM as a career of choice but something that sparked my joy and that could make me give an impact on my community and the world at large. I did not only experience something through the course of my life but I did learn many things which have shaped me into who I am today.

I became curious about STEM from the time I heard about it because I saw it as the only thing I could use to solve the problems my family and community are facing. I saw it as a way to break the cycle of generational poverty. I got interested in STEM because I could see a bright future in it with many career opportunities and problem-solving abilities. My family and community problems motivated me to apply science in everything I do. I saw Technology being the only tool I could use to solve problems. When I started to understand the four elements of STEM which are Science, Technology, Engineering, and Mathematics, I saw that my life was going somewhere. Not somewhere for me to be a billionaire, but somewhere for me to make an impact in my community and even the world. I began paving my road to greatness. Curiosity and problem-solving are the two major things that made me get interested in STEM and prioritize it in my life.

It's funny to me now when I think of my amazing journey in STEM that sprang from the love of toys. Because of STEM, I have been featured in many different projects that could make an impact in the world. My interest in STEM led to numerous benefits such as improved problem-solving skills, increased creativity, and critical thinking ability. Pursuing a career in

HOW I FOUND STEM INTERESTING AT A YOUNG AGE

STEM can lead to many job opportunities and contribute something to the advancement of the world.

Benefits of STEM education in Madagascar

By: Tsaroana Andrinirariny

Various media often called Madagascar as “the only country that impoverished itself without war.” For a lot of people it is not about knowing whose fault it is, we want to understand why and how to stop it. And trying to understand problems like poverty or the effect of climate change that a whole country faces often feels intimidating. Trying to come up with solutions for those problems feels even more daunting. “How are we going to improve things?”

We do doubt a lot when we are facing something unfamiliar right? (like... maybe trying to change the world)

STEM can bring the tools and opportunities to answer the “How” and STEM education can empower the people to bring these answers, aka the solutions.

But even before bringing the opportunities and tools necessary to make an impact on a whole country and the world, STEM education brings the tools and opportunities that are key to kids thriving and are often missing in developing countries.

Hello, I am Tsaroana! I am Betsileo (it is what we call the people originally

from the south of Madagascar's highland) and I grew up in the capital: Antananarivo. And like many parts of the island, while having a rich and unique heritage, Antananarivo faces different inequalities and insecurities due to poverty that directly affect children's well being and abilities. All around the world, poverty deprives young children of opportunities to develop strong foundations in cognitive and socio-emotional skills, causing decreased learning interest, poor relationship skills, lack of emotion regulation and more. It also decreases access to economic opportunities and opportunities in general. I have rarely seen people from my country participating in international competitions, especially within STEM. Increasing access to quality STEM education can increase the participation of students from developing countries during international competitions who are often in minority during these events. But it also opens more opportunities for them, in terms of study, scholarships, internships and jobs.

Though the adventure is just starting out, being part of the Madagascar 2023 First Global Challenge team (something I never expected)already helped me improve my knowledge in STEM, my communication skills and my ability to cope with problems. It definitely broadened my horizons. If, for example, I only considered using economics and psychological principles to base my projects aiming to improve children's well being and access to opportunities, now I am definitely considering more options like using biotechnology or researching gut microbiota and how it is linked to mental health. Because I am definitely eager to bring change through STEM.

STEM education allows students to develop skills like problem-solving, critical thinking, creativity, curiosity and in a group setting it can also help them develop social awareness and consider collective wellbeing which are skills and mindsets they often lack due to poverty.

Paired with sustainability and environmental education it also equips them with the skills necessary to face the world's problems and bring solutions.

But STEM is not the only solution, it is the solution that can be paired with many. It does not limit students to use art or literature, it allows them to stretch the limits they may have faced before, it expands the possibilities to create things and brings change.

Every child should have access to quality STEM education, the freedom to explore their creativity and fully develop their abilities.

Let's strive to provide accessible STEM education and collaborate between each other.

And to every person that may think or not STEM is not for them, I want to say " Just try, don't limit yourself, step outside assumptions. See what's possible, see what you can do (you're probably capable of changing the world)!"

I would like to thank **STEM for Good Madagascar**, the association that allowed me and a lot of others to get into the world of STEM.

STEM education is not important. It is ESSENTIAL...

By: Sahanaa Nishkaran

For STEM competitions, of course! As a scioly-er who competed in the 2023 National Science Olympiad tournament not too long ago, I could go on and on about how amazing STEM competitions are. But I'm sure you've probably already heard about that, either from Rishab Jain (the coolest ISEF person I've never met) or others.

But for the vast majority of students, including myself, science competitions are not appealing when one first steps into high school. Personally, I only participated in one science competition in middle school, and I didn't win anything. I did okay in the (required) math and science courses I took at school, but I wasn't particularly interested in any of them.

Nevertheless, when high school rolled around, I was signed up to take a boatload of STEM courses. I was taking Honors Biology, Honors Pre-Calculus, PLTW Principles of Biomedical Sciences, and AP Physics 1. Looking back, I'm glad I took these courses. Who knew that AP Physics 1 would be the best class I've ever taken?

Aside from these courses being fun and interesting, they also sparked my interest in STEM. Had I not forced myself to take these courses, I would

have never thought of trying out for my school's Science Olympiad team my freshman year, much less pursuing a career in the STEM field.

And I'm sure that many other students feel the same way. My interest in STEM blossomed throughout my freshman year, leading me to secure a spot on one of our school's Regional Science Olympiad teams. Furthermore, I continued to take STEM courses my sophomore year, including AP Chemistry, AP Computer Science Principles, PLTW Human Body Systems, and AP Calculus BC. While the opportunities opened up by STEM education may be different for each student, it is essential for every student.

But don't just take it from me! As a hospital volunteer, I was able to get the opinions of others on the matter:

“STEM education is essential because it gives you a good scientific basis to look at the world.”

-Natasha Singh, MD (physician)

She goes on to elaborate that it's important for everyone to have a foundation in science in order to “understand what's happening in the world, and why things are being done the way they are”(Singh). I wholeheartedly agree with this statement. If everyone had quality STEM education, we'd finally be able to eliminate flat-earthers once and for all! On a more serious note, this also helps pave the way for scientific breakthroughs. When more people understand the scientific progress being made, more minds are being put together to come up with solutions, meaning that more ground-breaking, revolutionary ideas will be generated.

“It [STEM education] teaches people to think in a way that they may not otherwise. It gives people life skills regardless of whether they go into a STEM field.”

-Inez Yu (4th-year medical student)

STEM EDUCATION IS NOT IMPORTANT. IT IS ESSENTIAL...

Of course, there's no harm in just trying out a couple of STEM courses and deciding if that's what one wants to do, but even if it's not, those courses weren't a complete waste of one's time. For example, one may never again use the math learned in high school if one pursues the liberal arts. However, by taking a difficult math course, like AP Calculus BC, one gains invaluable problem-solving skills (I can attest to that!).

There you have it: three different perspectives on why STEM education is essential. Many organizations, such as Khan Academy, Project Lead the Way (PLTW), and Code.org, are already promoting STEM education.

Educating future Educators

By: Rohan Singh

In today's rapidly evolving world, Science, Technology, Engineering, and Mathematics (STEM) are driving transformative changes that can be seen in every aspect of our lives. Therefore, STEM education should be essential for all students at any level of education. These fields serve as the foundation for advancements across diverse sectors, ranging from healthcare and communications to energy and transportation. In this piece, I aim to share my personal experiences in STEM and highlight the crucial role STEM education plays in shaping our future.

During my fifth-grade year, my journey into STEM began when a teacher introduced me to Python for fun, and though I was initially interested in this foreign topic, it had never appeared anywhere in my other classes, and none of my peers were aware of it. I decided to put it aside and continue to pursue "normal" 5th-grade stuff. Later that summer, I watched "The Social Network:", a film that reinvigorated my interest in programming. I used this inspiration to go on my dad's desktop and figure out how to code. After learning the basics through Youtube, I went down a rabbit hole of all the possibilities with not just Python, but programming in general. The more I learned, the more I became aware of how vast the programming world is: web development, AI, data structures, and the list went on.

As I spent my free time experimenting with different skills, I gravitated

towards web development due to its relatively quick results, I started to make websites for friends and family, and later for small companies. I embarked on a self-guided learning journey, learning primarily through online tutorials on Youtube and documentation. Learning this way was challenging, I often wished I had an expert by my side, readily available to answer my questions and guide me along the way, similar to something of a boot camp or course.

After a few years of self-learning, with a solid understanding of Python, I entered high school. It was at this point that I decided to create a club called DevEdu within my school, to give students a chance to be introduced to programming in a beginner-friendly way. I initially only expected a few students to show interest, but to my surprise, a significant number of students joined the club. We hosted bi-weekly meetings where I taught them the intricacies of the Python language. My intention behind establishing the club was to provide a gateway for students to explore careers in programming, a goal that continues to drive me to this day.

The experience of creating DevEdu taught me the importance of introducing STEM to all students, even those who may initially lack interest. It helped me realize that with the right support and guidance, anyone can discover their hidden passion and abilities in STEM. To further my teaching journey, I became a teaching assistant for the Introduction to Python course at The Ohio State University and volunteered at non-profit organizations like NSF, as well as institutions like Stanford's Code In Place. Teaching STEM subjects not only allows me to assist others but also solidifies my understanding and skills.

Reflecting on my journey, I recognize that a more streamlined and tailored path for learning programming would have greatly benefited me. Every year, countless students overlook the potential of pursuing STEM fields due to intimidation or lack of peer involvement. This perception needs to change as soon as possible. Technology is rapidly advancing, as evident in

the news, and failing to alter the stereotypes surrounding programming for the younger generation would result in missing out on innovative ideas and groundbreaking solutions. I, as well as many others, use our knowledge in STEM to introduce young minds to the limitless possibilities that lie within the world of technology – and who could someday become educators for future generations.

STEM education serves as an irreplaceable pillar in shaping our future. Programming, in particular, fosters critical thinking, drives innovation, addresses global challenges, and provides us with economic opportunities. It empowers individuals and societies to thrive in an increasingly interconnected and technology-driven world. Embracing STEM education is needed for gaining the skills, knowledge, and mindset necessary to navigate complex issues, forge new frontiers, and create a brighter and more prosperous future for all.

“STEM is the key to unlocking the doors of innovation and progress in the 21st century.”

It is up to us to create opportunities for STEM education, and unlock its transformative potential to ensure humanity continues to progress and flourish. I believe that you reading this right now is a meaningful indication that you possess the qualities to be one of those exceptional individuals who make a difference.

The Transformative Power of STEM Education

By: Dhruv Ramu

STEM education plays a pivotal role in shaping young minds and preparing them for the challenges and opportunities of the modern world. As a high school junior, I have found the sciences to be captivating and awe-inspiring. Motivated by my deep passion for science, I became determined to share this fascination with others, leading me to embark on an independent initiative to teach computer science to underprivileged students in a government school in Bangalore, India. This experience, along with my co-creation of The Geekly, a science magazine for high school STEM students, has reinforced the essential nature of STEM education and its transformative impact.

In the classroom, I encountered students who primarily spoke Kannada, with limited proficiency in Hindi and English. This language barrier highlighted the importance of multilingualism and intercultural understanding in STEM education. To overcome this challenge, I adapted my teaching methods by incorporating local languages and cultural references. For example, rather than using the standard computer science terminology which other students are familiar with, I used Kannada words or simpler English words, so that not knowing a language doesn't hinder their progress. By bridging the language gap, I not only facilitated effective communication but also fostered a

deeper appreciation for diverse perspectives and the interconnectedness of different cultures. For example, the students found it difficult to understand conditional statements, so they collaborated on creating an obstacle game using Scratch, drawing inspiration from their outdoor play. This reinforces my belief that STEM education is not just important, but should be made “glocal”.

Teaching computer science, or teaching in general, was unfamiliar to me. However, I recognized the requirement of innovative approaches to teaching. I discovered that utilizing anecdotes and real-life examples drawn from the students' daily experiences helped demystify complex concepts. For instance, I explained variables as metaphorical boxes representing different objects, and if/else statements as decision-making processes based on real conditions. Making these connections between abstract ideas and tangible situations fostered active learning and enhanced comprehension. By emphasizing relevance and practicality, I believe that I sparked a genuine interest in computer science among my students.

A fundamental understanding of mathematics is crucial in STEM subjects. Many of my students lacked knowledge of essential mathematical concepts, such as angles, which were prerequisites for certain computer science principles and the practical activities on Scratch I intended on conducting. Recognizing this gap, I dedicated additional time to teaching these fundamental mathematical principles, which required their own anecdotes, examples, and unique approaches. By recognizing the vital role of mathematical proficiency, I gained a profound appreciation for the inherent connection between mathematical and logical understanding, and success in STEM education and beyond.

In my pursuit of effective STEM education, I emphasized practical application over theory. I introduced Scratch, a visual programming platform, to encourage hands-on learning. Through designing their own programs, students not only grasped coding concepts but also developed problem-

solving skills and nurtured their creativity. This approach empowered them to become active participants in their own learning journey and instilled a genuine passion for STEM fields. In fact, some students came up to me and told me they wanted to work in the field in the future now that they know more about it!

Recognizing the value of independent learning, I also co-created The Geekly, a science magazine aimed at high school STEM students. The magazine provided accessible explanations of complex scientific concepts beyond the classroom curriculum. By nurturing curiosity, encouraging research, and fostering critical thinking, The Geekly reinforced the importance of independent learning and was also a platform to spread the same hunger for knowledge that I did.

Apart from these personal examples, there are various fields in which STEM education is absolutely crucial. Consider the field of medicine, where advancements in technology and scientific understanding have revolutionized healthcare. Medical professionals rely on their knowledge of biology and chemistry to diagnose and treat patients effectively. Additionally, the synthesis of fields such as physics and concepts such as nuclear magnetic resonance (NMR), along with computer science, have helped create MRI scans, which enables accurate diagnoses and facilitates targeted treatment plans. A strong foundation in STEM subjects is essential for aspiring doctors and researchers to stay at the forefront of medical innovation and improve the well-being of individuals worldwide.

Perhaps one of the most significant global issues of the present and future is climate change. Scientists equipped with a solid understanding of physics, chemistry, and ecology can contribute to renewable energy research, develop sustainable agricultural practices, and design innovative solutions to mitigate the adverse effects of environmental degradation. For instance, advancements in green technologies, such as carbon capture and storage (CCS), are the result of interdisciplinary efforts driven by individuals

well-versed in STEM disciplines; this involves the collaboration of engineers, chemists, and geologists. Moreover, the rapid advancement of technology underscores the importance of STEM education in preparing students for the digital age. Today, skills such as programming, data analysis, and IT in general have become a prerequisite regardless of field. Learning these skills, along with those of the specific discipline within STEM, is imperative.

In conclusion, STEM education is essential for equipping young minds with the skills and logical and problem-solving mindset necessary in the 21st century. Through my teaching initiative and work on The Geekly magazine, I have witnessed the transformative power of STEM education firsthand. By incorporating localized examples, practical application, and independent learning, students can contribute to a more inclusive world. Investing in STEM education is investing in the future, where curiosity, innovation, and collaboration drive progress.

Fostering Innovation in STEM: A Journey of Curiosity and Innovation

By: Nayib Monteagudo Contreras

Ever since I laid eyes on a circuit board for the first time, I knew my life was headed for a future filled with technological wonders. Growing up in the vibrant city of Cusco, Peru, my journey in STEM has been nothing short of an exhilarating adventure that has shaped the very core of who I am.

Growing up in the picturesque city of Cusco, Peru, was a gift that shaped my perspective on life and ignited my passion for STEM. The rich tapestry of cultures, colors, and traditions that surrounded me from a young age painted a vibrant backdrop for my journey. Being born in Cusco meant being immersed in a melting pot of history and heritage, where ancient Incan ruins stood as a testament to the ingenuity of those who came before us. And it was during those formative years that my fascination for science, technology, engineering, and mathematics took root. From a young age, I had a knack for disassembling watches, motors, and any electronic device that found its way into my hands. Those moments of taking things apart sparked a fire within me, igniting my creative spirit and inspiring me to build something meaningful for society. It was during this time that my grandfather gifted me a set of Lego pieces, which became the catalyst for countless hours spent constructing structures and exploring the endless possibilities of engineering.

But it was when my mom enrolled me in the robotics club in fourth grade

that my journey in STEM truly took flight. Stepping into the world of robotics felt like entering a whole new universe of innovation and discovery. I eagerly embraced the challenges, assuming the role of president and leading my team through exhilarating adventures. Together, we made our mark in the world of robotics, earning our place as finalists in the renowned National Robotics Olympiad. Our victories were not mere trophies to display; they were testaments to the power of collaboration, the spirit of innovation, and the unwavering determination that flows through the veins of every STEM enthusiast.

Of course, pursuing STEM in Peru and in Latam came with its fair share of challenges. Our society lacked a culture of innovation, and there was limited support for young people like me who aspired to create and innovate. However, these challenges have only fueled my determination to forge my own path. No matter the obstacles I faced, whether they were related to my gender, socio-economic status, or other factors, I refused to let them define my dreams. I pushed through, motivated by my own inner fire, seeking opportunities independently, and nurturing an insatiable thirst for knowledge.

Outside the confines of the classroom, thanks to my brother, I threw myself into numerous extracurricular activities and projects that fueled my passion for STEM. As a finalist in the Peruvian Olympiad in Informatics, I had the chance to showcase my programming skills. Inspired by my love for computer science, I founded Comsci—an initiative dedicated to promoting computer science education and raising awareness among middle and high school students worldwide. Through Comsci, I had the privilege of mentoring aspiring young minds and organizing impactful events, collaborating with talented individuals from across the globe.

A turning point in my journey arrived when I had the honor of participating in the prestigious Harvard Science Research Conference. Amidst the hallowed halls of academia, I found myself immersed in a world of cutting-edge research, where I could tangibly witness the impact of STEM on humanity. Engaging in a groundbreaking project focused on Natural Language Processing and Neural Network Analysis of Genomic Data for

Cancer Diagnosis, I was humbled by the realization that my work had the potential to save lives. This experience awakened a profound sense of responsibility within me—a calling to devote my skills and knowledge to making a lasting impact on the world.

But it wasn't just academia that fascinated me; it was the seamless integration of technology with human experiences that truly captivated my imagination. Traveling to Cambridge and participating in the renowned MIT Reality Hack (a hackathon hosted at the Massachusetts Institute of Technology) was an eye-opening revelation—a whirlwind of collaboration and creativity. Alongside a diverse team, I embarked on a mission to create “Flow,” a mixed-reality wellness app utilizing brainwave data sensing and Microsoft Hololens technology. The process was like a symphony of ingenuity, pushing the boundaries of what we thought was possible in just 2 days and solidifying my belief in the transformative power of collaboration and cutting-edge technology.

Fueled by an unquenchable thirst for innovation, I found a new avenue to channel my passion. In the midst of a global pandemic, I founded Naxelattle Studios—a software development startup dedicated to creating meaningful initiatives across various platforms. Simultaneously, I was granted the opportunity to participate in LaunchX, a prestigious summer program backed by MIT that empowers high school entrepreneurs to transform their ideas into thriving companies. As my entrepreneurial journey evolved, I delved into the development of my startup, Mochi—a platform designed to lay the financial groundwork for AI, ensuring its benefits are accessible to all of humanity. The recognition and acclaim I received, including a nomination for the MIT Innovators Under 35 Latam Award, propelled me forward, fueling my unwavering commitment to innovation. This entrepreneurial journey has taught me the art of blending innovation with practicality, all while keeping the human experience at the forefront.

However, after exploring the vast realm of STEM, I discovered that my passion lies in the development of Artificial General Intelligence (AGI). Years ago, when I was starting to explore how to code, I was inspired by the idea of building my own “Jarvis” (like Ironman). I started writing a chatbot — how

hard could it possibly be? I managed to build something that could talk about the weather very convincingly. But no matter where I looked, it seemed that no one had any techniques that could make my bot really work like the one in the movies. Since then, I firmly believe that AGI has the potential to elevate humanity, revolutionizing industries, augmenting human capabilities, and driving unprecedented advancements. With my vision focused on AGI and AI, I aspire to contribute to its responsible development, fostering an equitable and transformative future for all.

As I reflect on my journey in STEM, it's clear that curiosity, perseverance, and an unyielding pursuit of knowledge have been the driving forces behind my passion. From my early days of disassembling gadgets to leading robotics teams, participating in prestigious events, and founding startups, my journey has been a constant voyage of growth, exploration, and determination. Each experience has taught me that the power of STEM extends beyond the knowledge it imparts—it has the ability to transform individuals and society as a whole.

“You have plenty of time to change the world with your big dreams, if you start small and focus on what matters. Nothing worth having comes easy, but you can make it happen”

Overcoming the Barriers of Disabilities with STEM

By: Siddhi Dudgikar

This is the story of Chidambar V Patil, my maternal uncle and my mother's elder brother, who faces a physical disability. He has been affected by a condition known as Cerebral Palsy since birth, which has resulted in limited functionality in one hand, making it unusable. Moreover, he experiences a loss of sensation in his lower body, making it impossible for him to independently perform basic daily tasks. The cause of his disorder was a lack of oxygen during his birth. Chidambar received his education up until the 10th grade at a special school for physically disabled individuals.

Throughout his life, my grandparents made numerous sacrifices for my uncle. My grandfather even gave up a promotion in his Indian Government job, while my grandmother, despite holding a degree at the time, set aside all her ambitions to care for him. It is worth mentioning that my grandfather also served in the Indian Army and has gotten shot on his knee, which resulted in his partial disability. I hold great admiration for my grandmother, who dedicatedly took care of both of them.

My earliest memory is of me sitting on the lap of my uncle and going around the house on his wheelchair or me pushing around his wheelchair. I didn't understand what was happening to him and I'd just enjoy the rides on the

wheelchair. As I grew older, I realized that he didn't attend many family functions or even my birthdays. I was disheartened by this. The reason he didn't come out of his home was not only the physical barrier but also the society who looked at him as a liability. Most places in my city or any city in India isn't very wheelchair friendly, due to all these constraints, his sources of entertainment and human contact was limited. This often led to decline of mental health of everyone. All this just for the fact that he is born different and that we all can't accept someone for how they are born.

I also discovered that it isn't only my uncle who suffers from something like this, but it is a world-wide problem. This challenge of inequality in mobility is even more prevalent when they belong to low income families who can't afford for equipment like wheelchairs and others that are required to perform daily tasks, let alone expensive treatments, in some cases, they don't work.

STEM Education helps us bring equality to the lives of many. With creativity and problem solving, we can help many people live normally. Improving equipment like wheelchair is one part of solution where the bigger problem solving is when we scientifically design public places and public transport to cater the needs of people with different needs. We must respect diversity of the people and their needs. By innovating equipment with the aid of STEM, we also need to make it affordable and accessible that even people living in the rural areas should be able to avail these facilities. This will help bridge the gap between the urban and the rural residents.

In recent years, there has been a rising awareness of the difficulties that people like my uncle, Chidambar, as well as a pressing need to address the problem of accessibility and equality. Assistive technology advancements and the use of STEM concepts have opened up fresh possibilities for improving the lives of people with disabilities.

Innovative solutions that go beyond simply upgrading wheelchair designs

are being developed. Scientists, engineers, and researchers are aiming to create universally accessible smart homes, buildings, and public spaces, guaranteeing that people with varying requirements may traverse their environment freely and pleasantly. The combination of sensor-based technology, automation, and artificial intelligence has the potential to transform the accessibility landscape.

In conclusion, the struggle towards equality and accessibility for people with disabilities is continuous. We can build a society that accepts diversity and encourages all individuals to live their lives to the fullest by implementing STEM education, technology developments, inclusive design, and a shift in cultural views. We can ensure that no one is left behind and that everyone has the opportunity to develop and offer their unique ideas and abilities to society by working together.

I Am a Sum of Parts

By: Stasya Selizhuk

I am a sum of parts. A collection of all the knowledge ever imparted to me. As I grasp onto what I find intriguing, what I want to question, I slowly morph into an individual. I possess passions, skills, routines, and experiences that all affect how I view and react to the world.

STEM has been a crucial aspect of my and others' experiences in this world. Not just through the ability to recite the stages of cell division or the equation for the speed of a particle. STEM shapes the way that people perceive and react to the world. And with this comes the less glaringly obvious value of STEM education. Certainly, comprehending the inner workings of the world holds immense value. However, what makes STEM truly invaluable is the strengths it gives individuals.

STEM teaches failure. When choosing to pursue STEM in any capacity, you are like with anything, signing up for failure. You will, at some point, fail. And so will 99% of people. Failure is inevitable. It is part of the process. The value of STEM education is that you learn what to do when you fail. What to do with that pit in your stomach because you couldn't fathom that this setback would exist or you presumed its existence and ignored it. Still, you have to do something other than just kicking yourself, and STEM hands you the tools to do it. STEM education instills within you the resilience to confront adversity. It provides you with problem-solving skills. It equips

you with the ability to think of a creative solution and to think of another one if this one fails. It allows you to be able to try again and to seek collaboration. You are taught how to react to adversity.

All of these abilities are indirectly being taught through STEM education. When you are tasked with creating a device to allow an egg to survive a drop, you are learning these skills. While the value of learning physics is undeniable, the pinnacle of STEM education lies in the ability to teach students what to do when their egg drop fails. Students are taught that they should keep making iterations. That it is okay to make mistakes. That they should think outside the box and push their creativity. That they should collaborate to come up with solutions. That they should delve deeper into the topic to gain insight. These skills will remain with them for their whole life so when they face another challenge (possibly from STEM) they will be able to overcome it.

However, I cannot write in praise of STEM without discussing one of its problems. STEM has become infamous for lacking diversity. While diversity has many facets, I will be specifically discussing gender diversity as I have the most direct experience with it. Whether I am in the stands of a robotics competition, at a summer program orientation, in a math class, or at an awards ceremony; I instantly notice the lack of diversity. I always realize “Why is only one of the thirteen captains a girl?”, “Why are only 1/3 of this room female?”, or “Why am I the only girl here?”. I have been told that I do not belong in certain places or that I was only chosen for diversity more times than I can count. These experiences are not surprising or unique. STEM remains a male-dominated field which leads to the experience of women and other gender minorities being riddled with microaggressions and sexist comments. This underrepresentation has far-reaching consequences as it perpetuates biases and limits the perspectives and talents that could contribute to the advancement of the field.

I often find myself grappling with cognitive dissonance when it comes to

women in STEM. I have found a passion for the science projects and activities I do and can talk for hours about epinephrine auto-injectors, parachutes, or epidemiology. However, in all STEM spaces, I have had negative experiences just because of my gender. When you are told to “keep your mouth closed because you look prettier that way”, the last thing you want to do is to allow someone else to go through that. Yet, the sexism in STEM is a reflection of the people, not of the field and the people can be changed. I find solace in the other half of me that is fueled by a deep love for science and the want to encourage anyone with an interest to pursue STEM. I remind myself to not get discouraged as it only allows them to win. In the end, these problems will not be gone in a day. They will continue to follow me and all gender minorities in STEM, but they will get better as people fight against them. And they will get better as education provides everyone with the skills to join this field.

At its core, STEM education provides an opportunity for more people to join STEM. It provides an opportunity for people to discover that they have an interest in science. It encourages students to raise their hands, ask questions, and get to the bottom of things. Point blank, this education gives minorities the opportunity to experience STEM and hopefully continue to be involved in STEM. Education slowly helps break down barriers. Continued availability of the ability to learn STEM is an indispensable tool that allows people to learn STEM and the skills that come along with it. Education helps lead to diverse people and perspectives in the field.

When done right, STEM education arms people with the ability to create change. Partially due to direct applications of STEM and the vitality of STEM itself, but also due to the skills and mindset gained that is applicable to all fields. While cliche, STEM continues to allow people to make the world a better place. Education allows this to happen. It allows for even one more person to ask “Why?” when faced with a fact of the world or a way something ‘should’ be done.

I AM A SUM OF PARTS

I started by saying I am a sum of all parts. These parts include the one hundred and two STEM topics I find captivating, the ability to deal with failure, creative ideas, asking for help, the ability to problem solve, and a continuous pondering of the world. This version of me owes its existence to the notions taught through STEM education.

STEM: My education's priceless gem

By: Bernardo Mascarenhas Quintas

It feels like just yesterday when I arrived in the United States and started my educational journey, but it's actually been more than six years. Initially, I didn't pay much attention to the STEM subjects in school (or realize the significance of education as a whole). However, as a Junior in the International School of Beaverton, an IB Program mandatory school, I can confidently say that STEM has transformed my life. STEM, which stands for science, technology, engineering, and math, has not only broadened my horizons but has also shown me the importance of education. In the beginning of middle school, I never really cared about school. Not in the sense that I would actively skip class or not do my work, but I didn't fully grasp how it would shape my future. However, everything changed when I entered 7th grade. It was during my math and science classes that I found my passion for STEM. I vividly remember the day we started a new math unit and I effortlessly understood everything the teacher was explaining. My teacher recognized my growth in knowledge and asked me if I would want to move up a higher math level. This not only boosted my confidence in school, but it also made me realize that school is not just about taking notes and completing assignments; it's a place of learning and growth. This newfound enthusiasm extended to my science class as well. While I had always enjoyed science concepts like mixing chemicals and space exploration, I had never truly appreciated the endless possibilities that stemmed (pun intended) from this subject. Also in 7th grade, I disliked

science because I struggled to understand it, leading to a cycle of not enjoying it and not learning much from it. However, my science teacher's dedication to making science engaging and enjoyable changed my perspective. For instance, when we were on the topic of fish, he brought in a tank and salmon eggs for us to raise. We watched them hatch, witnessed them consuming their egg sacs as they grew each day. These hands-on experiences gave me something to look forward to in science class and fueled my curiosity. It created a positive pattern where I began to appreciate and understand the content because I genuinely enjoyed it. While there are many other instances that shaped my journey, these two experiences were the sparks that ignited my passion for STEM and continue to fan my flame of enthusiasm to this day.

STEM has had a significant impact not only on many people's academic lives but also in various other places. I mean, where would we be without the groundbreaking science, advanced technology, innovative engineering, and essential mathematical equations that shape our world today? STEM encompasses a wide range of fields, including medicine, transportation both on and off our planet, food growth, electronics, and more. While economics, government, and art education are also vital, STEM holds equal if not greater importance. STEM education plays a crucial role in shaping the education and future prospects of middle and high school students like myself. By engaging with STEM subjects, students develop critical thinking, problem-solving, and creativity, preparing them for a diverse range of career opportunities in rapidly evolving fields. STEM education cultivates essential skills and a mindset of curiosity and adaptability, enabling students to navigate a technology-driven world and make meaningful contributions to society. Although I may not have personally experienced it, the knowledge and skills gained from STEM education are invaluable assets that pave the way for future success in an ever-changing world. STEM education extends beyond the classroom and goes through various aspects of our lives. It is intertwined with the fabric of human existence. Imagine a world without the groundbreaking discoveries in science, from the understanding of atoms and molecules to the exploration of the vast cosmos. Without STEM, we

would lack the transformative technologies that shape our daily lives, such as smartphones, renewable energy solutions, and medical advancements.

In the realm of engineering, STEM bridges the gap between imagination and reality. It propels us forward, enabling the construction of awe-inspiring structures, the design of efficient transportation systems, and the creation of innovative solutions to global challenges. Just think of all the marvels of architecture that define our skylines, the intricate network of roads and bridges that connect our cities, or the spacecrafts that venture into the depths of space, expanding our understanding of the universe! Additionally, mathematics, often referred to as the universal language, serves as the foundation for all scientific and technological advancements. It provides the framework for problem-solving and logical reasoning. From the laws of physics to the algorithms that drive computer programming, mathematics equips us with the tools to analyze data, make informed decisions, and unravel the complexities of the world around us.

As we delve deeper into the intersections of science, technology, engineering, and mathematics, we uncover a vast array of possibilities. STEM tears down borders from diverse fields such as medicine, where advancements in healthcare continue to save lives and improve the well-being of individuals. It encompasses transportation, where futuristic innovations in electric and autonomous vehicles redefine the way we move and navigate our world. It creates agriculture, where sustainable practices and biotechnology revolutionize food production to feed a growing global population. It encompasses electronics, where cutting-edge devices and communication systems connect us in ways unimaginable in the past. The importance of STEM education cannot be overstated. It ignites a passion for discovery, cultivates critical thinking, and creates the skills necessary to thrive in a world that changes everyday. STEM education empowers individuals to become active participants in shaping the future.

Reflecting on my own educational journey, I am grateful for the transformative power of STEM. It has opened doors to endless possibilities, instilled in me a thirst for knowledge, and provided me with the tools to navigate the complexities of the modern world. Whether we pursue a STEM-related

career or not, the lessons learned through STEM education are invaluable. They equip us with a mindset, skills, and knowledge needed to contribute meaningfully to society, shape our own future, and forge a path toward success in a rapidly changing and interconnected world. It would be an understatement to state that STEM education has had a profound impact on my life and has broadened my perspective on the world. It has also shown me the boundless opportunities that exist within science, technology, engineering, and mathematics. STEM not only enhances our understanding of the world but also equips us with the skills necessary to tackle global challenges and make a positive difference in society. As we continue to embrace STEM education, we empower individuals to shape a brighter and more innovative future for all, including you.

Breaking Boundaries: From Scientific Olympiads to Advocacy for Inclusive STEM Education

By **Millena Xavier Martins**

I don't see myself as a traditional student. From an early age, I sought alternative solutions instead of following the same process – memorizing formulas didn't satisfy me. Unfortunately, the Brazilian educational system began to hinder me from doing that because the method of assessing subjects requires everyone to simply memorize formulas. That's when I discovered scientific Olympiads, which allowed me to learn in the way I wanted. They were more than just exams; they were my first academic experience outside the classroom. With them, a world of opportunities opened up. The Olympiads took me out of my comfort zone, improved my leadership and initiative, and fostered a stronger sense of community.

Thanks to the scientific Olympiads, I participated in camps and got into educational opportunities. I realized how elitist these opportunities were since many Brazilian students didn't even know what scientific Olympiads were. That's why, in 2020, I founded Prep Olimpíadas, which is currently the largest Olympic NGO in Brazil, with over 15,000 followers across all our social media platforms. We have already prepared more than 5,000 students. In these nearly three years of history, more than 80 volunteers have been part of Prep.

My hope is that, in the near future, all Brazilian students will have the opportunity to participate in scientific Olympiads, even in elementary school. That's why I plan to expand Prep Olimpíadas to achieve international recognition and impact students throughout Latin America by 2025. Additionally, in 2021, I founded the Astrolimpíada, the largest 100% online astrophysics competition in Brazil, which attracted over 450 participants from all regions of the country.

With the growth of Prep, I decided to integrate artificial intelligence into the Olympiads and developed Olimpigram, a platform that provides materials and support for students participating in these competitions. With this platform, I won a gold medal in the Brazilian Technology Olympiad (held in partnership with MIT Brazil) and was selected to present my project at SEBRAE University.

I also conducted scientific research. At first, I wanted to start a research project, but I didn't have prior knowledge or the necessary assistance. I started alone, with a theme similar to the one I had previously studied in the UoFT program. After a while, I got opportunities to develop my research and I became a scholar student in the National Research Brazilian Council (CNPq). My investigation aims to develop a machine learning algorithm that helps in the diagnosis of autism spectrum disorder. With that project, I was a finalist in the "Carolina Bori Prize" from the Brazilian Society of Progress and Science (SBPC) and in "Change The World Like a Girl," which is organized by an NGO supported by MIT.

With these experiences, I realized the disparity between girls and boys in STEM. So, I joined "Lidere-se," an organization that aims to develop leadership in low-income girls. With this NGO, I was invited to lecture at the National Conference on Gender Equity (CNEG). I was also the NGO's representative in CONCAUSA, a program held by UNICEF (UN Foundation).

Through the Olympiads and scientific initiation, I had opportunities to study

in summer courses with full scholarships. I was the first Brazilian to receive a 100% scholarship for an Extension Program at the University of Toronto (2021), as well as a program for girls in physics and programming at Stanford (2022) and a 12-week course at UWC (United World Colleges) on Science, Progress, and Society. In all cases, I went through a selection process in which I earned a 100% merit-based scholarship. I am also a member of the New York Academy of Sciences.

Unveiling Science: A Personal Journey of Exploration and Discovery

By: Riya Singhal

My journey in science education began with a late start. It was not until my fourth-grade year that I was formally introduced to science as an academic subject and my scientific journey took a significant turn. Prior to this juncture, my exposure to science had primarily been through immersive encounters with hands-on experiences and an emphasis on experiential learning during the formative years of elementary education. However, following my relocation to a different state, I swiftly recognized a discernible disparity in the pace of the curriculum, with my peers already exhibiting considerable advancement in their scientific knowledge and understanding. Nonetheless, this transition presented a unique opportunity for me to bridge the gap between theoretical concepts and practical experiences, thereby unraveling the underlying principles behind the hands-on experiments I had encountered earlier. This integration of theoretical knowledge and practical application not only deepened my understanding but also ignited a profound passion for STEM subjects and solidified my commitment to pursuing a path in STEM education and exploration. I began to see the beauty of science as a systematic process of inquiry, where theory and practice harmoniously coexist. I began to appreciate the scientific concepts and their real-world applications. This pivotal stage opened my eyes to the world of STEM, giving me a newfound appreciation for its meaning and providing a

framework to understand the interconnectedness of these disciplines.

Through dedicated determination and invaluable guidance from my teachers and parents, I attained commendable grades upon completing fourth grade, thereby affirming the success of my endeavors in bridging the disparity between theoretical knowledge and practical application. Encouraged by this validation, I eagerly entered fifth grade and seized the opportunity to participate in the school science fair. Despite meticulous preparation and thoughtful support from my parents, I regrettably did not receive any awards. It became evident to me that my lack of confidence hindered my ability to engage the judges directly, resulting in a presentation that heavily relied on reading from my poster. Undeterred by my previous setbacks and disappointing performance at the science fair, I proceeded to the sixth grade with a renewed sense of confidence and eagerly participated once again in the school science fair. Astonishingly, my efforts resulted in triumph at both the school and district levels, propelling me to the esteemed regional competition. In a culmination of my dedication and perseverance, I achieved the pinnacle of success by securing a notable third place in my designated category at the prestigious state level competition and a nomination to the Thermo Fisher Junior Innovators Challenge (JIC).

The research project that garnered recognition for me was rooted in a deeply personal experience. To pursue this project, I drew inspiration from my own experience with iron-deficient anemia and combined it with my love for boba. Acknowledging my keen interest in boba, my parents gifted me a spherification kit, which granted me the opportunity to engage in home-based experimentation and explore the art of crafting boba using an array of beverage options. During the course of my experimental journey, an idea dawned upon me that extended beyond the realm of conventional juices. It occurred to me that I could explore the utilization of liquids such as iron syrup, which I had refrained from using to address my anemia concerns due to apprehensions regarding potential side effects. Through the utilization of the encapsulation technique and successful encapsulation

of iron syrup within a hydrogel coating, I recognized the potential of this project to address the common side effects associated with conventional forms of iron supplementation. One prevalent issue, teeth staining, can be effectively minimized by preventing direct contact of the iron syrup with the teeth, thereby reducing the likelihood of discoloration and pigmentation. Motivated by these promising outcomes, I resolved to delve deeper into the process of iron absorption within the body. Engaging in extensive background research, I discovered that the primary site of iron absorption is the duodenum. To investigate the behavior of the gel coating and the release of iron in the body, I conducted experiments wherein the iron pearls were introduced to two distinct pH test solutions. To my astonishment, I observed the pearls rupturing and releasing iron in the duodenal pH solution, further emphasizing the potential effectiveness of this approach within the context of iron absorption.

The research project I embarked upon, centered around the concept of iron spherification, has yielded invaluable insights and bears significant implications for the realm of healthcare and human well-being. Through the successful integration of innovative elements, the iron spherification project offers an enticing alternative to conventional iron supplements, potentially improving compliance with iron supplementation regimens. By providing an alternative delivery system and by minimizing the adverse side effects that often deter adherence, iron spherification can greatly enhance overall health outcomes.

The narrative of my personal journey shared in this article serves as a powerful illustration of the transformative power of formal science education. It highlights how such education can foster a comprehensive grasp of STEM disciplines and ignite a lifelong passion for scientific exploration. Through this experience, I learned a valuable lesson about the importance of resilience and perseverance in the face of setbacks. Despite initial disappointments, I refused to be discouraged and instead viewed those challenges as opportunities for personal growth. By maintaining a positive mindset,

seeking support from teachers and parents, and persistently pursuing my passions, I overcame obstacles and achieved my goals. Moreover, this project serves as a testament to the fact that scientific exploration can thrive in everyday settings, even when resources and equipment are limited. With the right support and access to resources, young individuals like myself have the potential to make valuable contributions to scientific research. Beyond its practical achievements, this project holds personal significance for me. It served as a source of motivation and empowerment, propelling me to make contributions to the field of science and advocate for advancements in healthcare. It reinforced my belief in the transformative power of scientific inquiry and its potential to improve the lives of individuals worldwide.

In today's world, STEM education extends beyond science, technology, engineering, and medicine, serving as a unifying force that interconnects various realms of education and specialization. It empowers individuals to analyze complex problems, think critically, make informed decisions and contribute meaningfully to society, whether through scientific research, technological advancements, engineering breakthroughs, or advancements in medical care. As we continue to embrace the interconnected nature of these disciplines, we pave the way for new discoveries, advancements, and a brighter future for all.

Igniting the Spark: My Personal Testimony to the Power of STEM Education

By: Laxya Kumar

Introduction:

In a world rapidly shaped by technology and innovation, the significance of STEM education cannot be overstated. As a passionate advocate for STEM, I firmly believe that it is the key to unlocking the potential of our future generations. Stemming from my own personal journey, which involved overcoming challenges and discovering my true passions, I have witnessed firsthand the transformative power of STEM education. Through this essay, I aim to present a compelling argument for why STEM education is essential, drawing from my own experiences to exemplify its profound impact.

My Unconventional Journey:

My upbringing in STEM was certainly unusual and dynamic. Initially, I struggled to find interest in the life sciences during middle school. Subjects like biology, environmental science, and chemistry failed to capture my attention. This disinterest persisted throughout my ninth-grade year, partly due to personal setbacks in mental health, which affected both my academic performance and overall well-being. However, as I neared the end of ninth grade, a turning point occurred, and I started reconnecting with reality, gradually improving my mindset and developing a problem-solving skillset.

Discovering My Passion:

It was in the realm of physical sciences, particularly physics and astronomy, that I found my true calling. Applying conceptual understanding to problem-solving scenarios ignited a newfound love and interest in these disciplines. I embraced this passion and enrolled in advanced classes such as AP Physics 1 and AP Physics C, witnessing a significant change within myself as I grew to genuinely appreciate the sciences. This exploration of the “S” in STEM only fueled my curiosity to delve deeper into the other disciplines.

Embracing Technology:

Driven by a desire to evolve and leverage my newfound interest in physics, I set out to explore the “T” in STEM, technology. I immersed myself in computer science, developing a strong skill set in computational thinking. This journey led me to delve into programming, web and iOS development, data science, and machine learning. I even took college-level computer science courses through dual enrollment programs and advanced courses like AP Computer Science A and AP Computer Science Principles. Stepping outside my comfort zone, I participated in hackathons and programming competitions, achieving notable success, such as securing second place in Lockheed Martin’s national Code Quest competition.

Interdisciplinary Research:

As my passion for both physics and computer programming grew, I found myself drawn to the intersection of these fields. I engaged in conducting scientific research that explored the application of computer programming in physics. Through various research projects, I discovered the power of interdisciplinary collaboration and the potential for groundbreaking innovations at their intersection.

Empowering Others:

STEM education not only transformed me academically but also inspired me to make a difference in the lives of others. Recognizing the importance of providing motivation and opportunities to younger individuals who may be

facing similar challenges, I became a director in a non-profit organization called ArtStem. Through this organization, we teach STEM subjects to the younger generation through an artistic lens, conducting workshops both in person and online. To date, we have reached over 2000 students worldwide, empowering them with the skills and enthusiasm for STEM.

Conclusion:

STEM education has been the catalyst for my personal growth, both academically and intuitively. It has not only allowed me to pursue my passions and develop essential life skills like computational thinking and problem-solving but has also provided me with a platform to inspire and empower others. Reflecting on my journey and comparing who I am now to who I was four years ago, I am immensely grateful for taking the initiative to immerse myself in STEM. It is my mission to share this transformative experience with the youth, providing them with the same exposure and opportunities that have shaped my own path. The future is STEM, and through its power, we can create a better world.

A Step Closer

By: Maya Swaminathan

Some people have childhood stories of loving computers from birth, of dismantling any mechanical object they could find and putting it back together again, much to their parents' shock. I'm the exact opposite. My dad works in software, but looking at him working didn't inspire me to do the same at all. If anything, it ironically turned me off of computer science. I had no clue what unintelligible words he typed on his computer day after day, and regarded his work as some sort of mystical sorcery, something that I could never do. That's not to say I didn't try. In middle school, I attended a Python course taught by a few high schoolers and understood nothing aside from the fact that a little turtle could draw circles for me inside the computer. I went to a Scratch summer camp, but was completely out of my element, being one of the youngest kids there. I joined Girls Who Code, but I had to quit because it overlapped with my soccer practice. Computer science and I just didn't seem to click. That is, until high school, when I was able to connect it to one of my other interests: Japanese. Japanese and linguistics were the real catalyst to my interest in computer science, and continue to motivate me to pursue the field to this day.

I've been learning Japanese for around six years now, and often translate Japanese songs into English for my personal enjoyment. I sometimes use machine translators as an aid for my manual translation; it acts as a "spellcheck" of sorts. While it can be quite useful at times, it also has many setbacks. When translating large amounts of text, it can sometimes miss a

chunk or two. It unnecessarily genders objects when there is none. And it often struggles with connotation and nuance, both of which are especially important facets of the Japanese language. Many words have numerous interpretations, such as the often-used “yabai” meaning anything from “amazing” to “horrible” to “crazy”. Furthermore, many Japanese dialects aren’t easily processed by AI translation. It’s like asking a computer to parse the Japanese equivalent of “y’all’d’ve”; a tall task. I began to wonder: why exactly do translators find Japanese so difficult to understand? That was the beginning of my venture into computer science, during the summer before junior year. I took a Java course at a local community college before taking AP Computer Science at my high school. I learned how easily programs can fail. I learned the hours of effort needed to produce a near-perfect result. And I learned, indirectly, just why the machine translators I used tended to misinterpret Japanese. Basic programming was hard. And training AI to interpret something perfectly, I thought, definitely had to be even harder.

I was a bit let down by this newfound realization. The world of computer science, which had briefly shown itself to me, seemed to be once again like the spells inscribed on my dad’s computer. Where should I begin when learning about AI? Was it too late to even start? Thoughts like these plagued me; however, I didn’t let them stop me. I took supplemental courses, like JavaScript and Python, alongside my regular school coursework. The more experience with the field, the better, even if it didn’t directly pertain to AI. And if I get especially wrapped up, thinking about how everyone else always seems to be a step ahead of me, I try to look at things with an open mind and consider all of the things I *have* done rather than haven’t. In the end, what really matters when pursuing any STEM field is a reason to keep going. And while I still don’t know how exactly to train AI to come up with an adequate translation for “y’all’d’ve”, or to contextually understand which “yabai” is which, I get a step closer with every new bit of knowledge I learn.

Cosmic Exploration in Pink Sneakers

By: Zoe Shykind

“Get up. It’s 4 am. Time to see the meteor shower.” My 4th-grade self yawned and got dressed.

With anticipation streaming through my veins, I hastily threw on my pink sneakers and listened to the crisp air whisper promises of discovery. My dad started the car, and we were off, driving slowly into the velvety embrace of darkness until we reached an open field nearby. Together, my father and I pieced together the Celestron telescope, and he patiently explained the functionality and purpose of each component. His explanations transformed the cold metal and glass into a portal capable of unveiling our universe’s mysteries and wonders.

As an only child, I grew up in a log home in the woods and spent much time alone. However, if I weren’t so isolated as a kid, I would not have had the chance to foster a deep love for computers, a constant companion. Learning to code became my gateway from solitude to exploration and a fascination with machines. Through these silent Summers, I forged a bond with exploration, shaping my relationship with creativity and curiosity through the interwebs. Technology unlocked a world of like-minded peers who weren’t just in my backyard.

Microscopes and telescopes were always within reach, serving as a constant

reminder of how significant or insignificant we were. My elementary school sleepovers were under the Blue Whale at the National Museum of Natural History. I spent my childhood eagerly diving into Physics, Biology, Mathematics, and Astronomy textbooks. Whether it was conducting experiments in my Grandpa's chemistry lab, or tinkering with circuit boards, being surrounded by STEM fostered an immense joy in the process of scientific curiosity.

Grandpa Edwin was a legend – a Geologist and science advisor to the White House, with a license plate that read ROCKDR. He had an entire chemistry lab in the basement, filled with liquid mercury, blowtorches, and a room dedicated to screws and bolts. He was just a few materials short of building a space shuttle or one match short of blowing up our neighborhood. Sunday afternoons with him were filled with hands-on activities such as titrations, using iron filings to reveal magnetic fields, building robots, or watching Battle Bots.

As if having one scientist in our family was not inspirational enough, my uncles pursued the sciences as well. One uncle placed second in the Westinghouse Science Talent Search, and the other worked in two Nobel Prize-winning labs. Dinner conversations were always enlightening. STEM became the guiding light of my holidays, its brilliance leading my family and me on many adventures. From watching space shuttle launches outside of Kennedy Space Center, growing protozoa on the fourth of July, garnet mining over Passover, or launching our own rockets for my 11th birthday, I found my purpose and passion illuminated by the wonders of science and discovery. They taught me to question the unknown, see life through a lens of curiosity, and surround myself with the power of knowledge.

This year was my first at Mercersburg Academy, a boarding school in rural Pennsylvania. Separated from the comforting feeling of home, the longing for familiarity weighed on my heart. However, as I was wandering around campus, I stumbled upon the second floor of the mathematics building.

The moment I took a sharp left and headed into the physics lab, I was immediately excited. Every corner held a collection to discover, from gyroscopes to testing out rocket engine impulses; every day was new and exciting. The physics lab became my place of solace on campus, a sanctuary shrouded in my youth's most joyous memories.

As I reflect upon these treasured moments, I am reminded of the words of the astronomer Carl Sagan: "Somewhere, something incredible is waiting to be known." With every early morning adventure under a blanket of stars, guidance from scientific mentors, or rocket launches on birthdays, I am propelled forward in my quest to unravel the mysteries of our universe. As I move into the next chapter of my life, I plan to study Astrophysics or Aerospace Engineering, but I will continue to pursue science academically and personally. Experiences and mentors such as these shape the young, fueling a passion for STEM, which drives innovation and advancement. The future is STEM, and it's ours to shape.

Less is More: Perspective of an FGLI Student

By: Frances Lu

Less is more. This contradictory sentence followed me throughout my 17 years of living as my parents repeatedly mentioned it. Although foreign at first, I came face-to-face with the concept that resources aren't accessible to all communities, which sparked my initial curiosity for STEM.

Growing up in a low-income immigrant household consisted of long lectures on strategic ways to save money along with a work ethic that allowed me to appreciate the people around me more. Words couldn't compensate for the endless hours I spent on my first job at the age of 12. Unlike many, it wasn't a job that earned money, but rather a survival job of being the family translator. With me being one of the few English-speaking people in my household, my mind was constantly centered around figuring out how to submit W-2 tax information or what exactly "Form 1040" meant. The heavy stacks of paper that loomed over my homework were a constant reminder of the rigorous academic curriculum that was merged with my busy lifestyle at home. It didn't take long to realize how applicable mathematics was in understanding the economic gap.

Mathematics created a platform for me to merge my creativity and curiosity as I was able to tell the stories of numbers, something that could not be

expressed in words, but rather my love of creation in databases. Last summer, I had the honor of working as a real estate intern and I remember hearing my boss tell me that “seeing a young mind like you pitch such an amazing idea is what gives me faith in the future” which was something that deepened my interest. I was able to utilize mathematics to advocate for more women and minority representation in the real estate industry. As an Asian American woman, I hardly ever got to see faces like myself being represented in the industry and that was when I realized that pursuing STEM meant I could make a quantifiable impact on the people around me. Not only that but STEM is connected to a plethora of topics allowing me to develop analytical but also creative skills.

These skills would always spark “what if” questions where it allows me to ponder an imaginary world where I’m able to ignite my curiosity. STEM has always served as that platform for me where it has become a field that is growing at such a rapid rate that I can’t help but look back at how far we’ve grown as a society. When I was younger I was always questioning what if someone was to invent a more advanced set of technology that unlocks a new world, what if technology expands to the point where humans can no longer control it, but as this list increased, I realized the true beauty of STEM. There is never a singular set way to solve something or a right answer because new information is inevitably becoming unlocked.

STEM opens up the skills of perspective-taking where I’m able to understand more about the thought process of one’s thinking. During my computer science class, it was truly a moment that sparked my upbringing in STEM. It is connected to a multitude of issues and one of the notable ones we studied was its relation to systemic racism. When I heard about how some AI technology has been equipped with systems that target certain demographics, I realized how a lot of overarching issues that we see today can be solved through STEM.

Thankfully, STEM also made me realize my love for design and new

innovations. When I was younger, my inability to afford a board game became a catalyst to design my own in hopes of overcoming my boredom. I collected scrap paper from my sister's finished homework, cardboard boxes from the post office, and other supplies from the local dollar store. While my parents were glad that I had something to be entertained with, I was eagerly sketching out my dream board game: three people trapped in the dragon's dungeon where they would have to bargain and buy supplies from other characters as a way to survive and escape. I spent weeks drafting and revising, perfecting every aspect to ensure that when I did execute the plan, everything could be made with my limited budget (literally just \$2). Soon enough, the cardboard was no longer viewed as something that would simply send mail out; instead, it gave me the chance to transform my ideas from an inanimate object into a 3-dimensional playing piece. While this was a small-scale project, it made me realize how STEM can be at the frontier of change for many with its innovation and ability to make profound breakthroughs.

STEM is something that we see often in our daily lives and interactions as it serves as a topic that deserves more recognition. I chose STEM because I knew the concepts would allow me to better understand how to bridge the economic gap. As I am wrapping up my last moments of senior year, I hope people realize that STEM can be for everyone and anyone – the most important thing is taking that first initiative to try.

Hall of Scientists

By: Siddhant Borkar

The Hall of Scientists is a landmark of my high school's previous tenant, the Sigma Xi Scientific Research Honor Society. Every day, on my way to AP Calculus, I pass by twelve towering black pillars that together form this hall. Etched into the square, black-granite plates of these pillars, are the names of significant researchers in Science, Technology, Engineering, and Mathematics—the best scientists of the honor society. I remember touring my high school as a rising underclassman and being emotionally moved by this landmark. As I read into the many names, I looked through the shiny reflective black-granite, like a mirror, to see my own face; my dream to become a scientist was formed that day.

To support my ambition, I decided to take advanced courses early on, giving me a solid baseline of STEM experience. This meant taking college-level classes in life science, computer science, and statistics, all of which contributed to my widespread interest in STEM. For instance, without taking AP Environmental Science, I would never have found myself digging topsoil samples from our school garden beds. After conducting pH, nutrient analysis, and cation exchange tests, I found the soil contained an excessive concentration of clay and recommended a solution accordingly. This allowed my school to justify the funding of the floral displays in front of our school.

In addition to the college courses, I found that I was able to learn even more deeply through research projects. In my junior year, I took a zero-period class called Advanced Research, in which I wrote a literature review

about recycling psychology and developed a mobile application to correct recycling habits in my high school. Through these efforts, I eliminated the recycling contamination costs at my school. These projects and classes allowed me to build the foundation of my interests and knowledge in STEM.

As an aspiring computer scientist, I have taken advantage of the opportunities around my residence. Through programming robots on my FIRST Robotics Competition team, I learned the value of gracious professionalism and applied it to internships at companies like SCORE Mentorship, where I allocated mentors to the development of vital business startups. Over the summer of 2022, I attended the North Carolina School of Science and Math's intensive summer research program—Summer Ventures. For 4 weeks I resided on the coastal campus at the University of North Carolina at Wilmington alongside other high schoolers with a deep interest in STEM. I worked with an associate data mining professor to study Atrial Fibrillation (AFib), a heartbeat arrhythmia that causes life-threatening strokes. AFib episodes can be unpredictable, increasing the likelihood of misdiagnosis in medical clinics. Our goal was to develop predictive models for preliminary AFib diagnosis based on electrocardiograms. We did this using machine learning and features typically utilized in stock market evaluation.

After the program, my group presented our findings at multiple research conferences and we were awarded for having the best project in the program. Our research has compelled my team with so much interest, that we have continued the project outside the program for the past year. Besides amassing graduate-level machine learning and statistics knowledge, the highlights of my experience came from conversations I had with my professors. My primary research professor told me that there is always an underlying purpose behind creation. She explained that as a professor, her purpose for creation and source of happiness is in impacting the lives of others—a stance I learned through the program I greatly shared.

The STEM opportunities and experiences I have been afforded through my high school and through my community have shaped who I am and who I want to be in the future. This is why I believe in the importance of government funding for young students to have these experiences.

Researchers are brought to the edge of a cliff and told to go further. As an aspiring computational health scientist, I hope to soar off that cliff, with the help of the hands-on approaches provided by the STEM programs I pursue in the future. I am passionate about research because all my research endeavors are rooted in my desire to contribute to the STEM community I saw in my high school's Hall of Scientists. After consulting my principal, I learned that the pillars in the hall were specifically made of shiny black-granite to resemble the Vietnam War memorial in Washington DC. This material was meant firstly to last the test of time, but more importantly to serve as a mirror, reflecting the faces of admirers, so that when they read the names of fallen soldiers, those admirers could see themselves: the fallen soldier and the admirers are one and the same. It is my hope that someday I can look into the reflecting black-granite panels of the pillars and read my own name.

The Butterfly Effect

By: Lance Xu

I clicked the big green “join” button.

It was my first year of high school, and I desperately needed help in AP European History. Having gotten my first C ever, I realized that things needed to change drastically, and I hoped that joining a discord community dedicated to AP subjects could be the answer. Little did I know, this C would be the start of my life-long love for STEM and research.

I quickly met many dedicated helpers who were more than willing to volunteer their time to help me in AP Euro, and my grades improved dramatically as a result. Inspired by their dedication, I wanted to do the same in a subject that I was comfortable in. Coincidentally, I was also taking AP Statistics during that time and felt confident enough in it to help out those who were struggling. As I devoted myself to helping others in statistics, I had the privilege of meeting a close-knit group of dedicated volunteers, forming strong and lasting friendships with many of them.

However, there was this one friend who I talked with the most, and it was only by chance that she was also a huge nerd in biology. You see, after taking honors biology, I became super interested in the topic, but I didn’t have room in my schedule for the AP level course. She inspired me to do something that I would have never thought possible of myself - for me to self-study AP Bio.

I was never a person to read textbooks for pleasure, let alone in my bed. However, the very night that I decided to start self-studying biology, I

opened the PDF of *Campbell Biology* that I got from a totally legitimate source and was instantly sucked into the fascinating world of biology, shocked at how many interesting discoveries I had been missing out on. For instance, did you know that immune cells account for every unique antigen-binding site of every possible invading microbe by synthesizing trillions of random combinations of antibodies?

How would the antibody bind to the receptor without the specific chemical properties or complex physical interactions between them? That's right: it can't. Without a solid *understanding* of the underlying sciences that Campbell emphasizes, biology's just a stack of flashcards. In fact, as someone who emphasizes *understanding*, I never used flashcards to learn—instead, I constantly dug deeper, spending hours going down the Wikipedia rabbit hole in search of the “why” behind each biological process. As the last paragraph of the 1493-page textbook says: “Biology is the scientific expression of our desire to know nature. We are most likely to appreciate what we *understand*.”

It's this curiosity that drives not just my passion for biology, but also my emphasis on understanding topics in other fields such as psychology. It's a positive feedback loop: as I dive into the complex nuances of each discipline, I feel an exhilarating sense of discovery that fuels my interest in the subject and urges me to explore deeper.

This passion for biology and the “yearning for learning” mindset that came out of it would bloom into something much bigger: my love for scientific research.

At the start of my junior year, my school friends convinced me to join my school's STEM Research Club. Initially I was reluctant to join, not having previous research experience, not knowing what topics to do research on, and overwhelmed by the endless tasks that I would be required to complete. Weeks passed, and the deadline inched closer and closer. Not wanting to miss out, I joined the club at the last minute. Coincidentally, at the same time, we were learning about the framing effect in my AP Psychology class. Wanting to investigate more into the medical implications and demographic variability of this effect, I searched online for research articles, but I found none pertaining to this specific topic. Then, a lightbulb clicked – I could be

the first to investigate this!

I pulled my first ever all-nighter that day, frantically researching everything on that topic. It was like diving headfirst into the deep end of the pool as a 5-year-old: never before was I exposed to such high-level literature, and I had to digest it all without help from a mentor. I worked to review the latest developments in my specific topic, and with inspiration from tens of research articles, I meticulously designed a survey and collected 850 responses from all over the USA. I spent months processing and interpreting the data using my AP Stats knowledge from the year prior and creating figures used to draft research papers and posters.

I was named a Regeneron STS Scholar with this project, but in the end, the research experience and the skills that I learned overshadow any awards that I won from this project. Surprisingly, I hadn't heard of competitions such as ISEF or Regeneron STS until the last stages of my project. Instead, I was doing it for the sake of learning and discovering, just like my original passion for biology. Through this project, I developed a deeper understanding of statistics from constantly applying my statistical reasoning skills in real world applications that wouldn't have been possible in the classroom setting. The ability to efficiently interpret and write research papers stuck with me as well, being an invaluable help in my future research endeavors.

It just so happened that my STEM Research Club advisor ran a competitive program that invited a small number of high schoolers to intern and conduct a year-long research project at a local biotechnology facility. My previous project and my background in biology allowed me to secure a spot, and I couldn't have been more grateful for my past experiences in STEM. This opportunity allowed me to design and conduct my own project with the help from a lab and mentor, and my background in STEM and research enabled me to dig much deeper than I could have thought before.

My project sought out to find the first novel non-invasive therapeutic for hepatocellular carcinoma, the most common type of liver cancer, and I found some very promising results that could point researchers in the correct direction. I did well in local competitions, but unfortunately, I just barely missed the cut for ISEF. Guess what? I couldn't care less. I learned

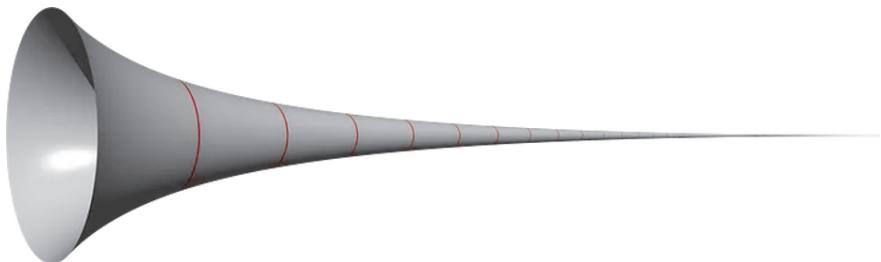
so much from my lab experience - the lab techniques, the biology research article format, and the research mindset - that I just did not care about my competition results.

None of this would have been possible without me taking AP European History and AP Statistics in my sophomore year - which resulted in me clicking the green “join” button - and the friends I made along the way that inspired me to do more in STEM and research (thanks Lidia :)). I’ve since been finding ways to give back, such as conducting and organizing volunteer tutoring for STEM related topics and becoming a leader for the very same STEM Research Club that allowed me to conduct my first research project, even guiding one researcher to qualify for ISEF! I hope to continue inspiring and guiding the next generation of researchers, fostering the same passion I had for learning and discovery.

Mathemagical Paradox

By: Vimal Jai Kirithika Vimalanathan Sankarapandian

My definition of an eye-opening experience is when I took AP Calculus BC during my junior year of high school. Calculus totally changed my perspective of math and made me realize that math isn't just a bunch of numbers floating around: I realized that math is a mechanism to provide an explanation for things that can't be quantified using simply human common sense. A concept that was my primary trigger to this realization was Gabriel's Horn.



Discovered by Evangelista Torricelli, the geometric shape of Gabriel's Horn is produced as the result of revolving the curve $y=1/x$ about the x-axis in the Cartesian plane. This geometric shape led to the “painter’s paradox,” because it looks as if there wouldn’t be enough paint to coat the surface if it was being painted, but if you filled the horn with paint on the inside of

the object, there will be enough paint to completely fill it. Many wondered, “How is that even possible?!” This observation baffled many people after the time of the discovery of the shape and is still a hot topic of inquisitiveness even centuries after the discovery. There was just one thing that could help quantify an explanation for this: Math.

The idea that this geometric object seems to have a finite volume but an infinite surface area is impossible to wrap your head around when you think about it. Many might think that, since the object becomes extremely narrow at the end, the paint could cover only up to a certain point where the paint molecules could fit in, with the rest of the end being too narrow to fit in any paint molecules. This could potentially be a logical explanation as to why the object has a finite volume, however, it isn’t a solid explanation, and trying to come up with a solid explanation for the infinite surface area is even hazier.

Instead of baffling your minds in trying to come up with a solid logical explanation on this issue, this unique phenomenon could be neatly explained using some “Math Magic”. Incorporating the integral function with some formulas, the volume of a revolved object could be found: doing that produces a finite volume of π for Gabriel’s Horn. However, using the same procedure to find the surface area of the object will yield an answer of infinity. This phenomenon that exceedingly blew the minds of people over a long period of time was cleanly provided an explanation for, using some Math.

Many people shy away from Math because they find themselves asking the question, “At what point in my life would this ever be useful?” I utilized the same approach toward Math for the majority of my academic career until taking advanced Math classes like Calculus 1 and 2, where I truly started to realize that, what I thought were simply numbers aren’t just numbers but are key building blocks that are part of many interconnected concepts which explain many engrossing concepts in the world. The Gabriel’s Horn painter’s paradox is simply just one of many fascinating concepts out there

and it's important to not shy away from Mathematics in order to appreciate the beauty of it.

Not only did the spike in my interest in Math help me decipher complex concepts, but it also widened my interest in the STEM field in general since the field incorporates Math and applies it to intriguing real-world uses. With the future relying heavily on major developments in STEM, I reaffirm that developing an understanding of Math is crucial to succeed.

Lights, Camera, Action: Let the STEM Journey Begin!

By: Tanish Gadireddy

Inspiration can come from the most unexpected sources, and for me, the animated TV series Phineas and Ferb became a catalyst for my pursuit of a STEM (Science, Technology, Engineering, and Mathematics) field. This popular show, known for its creative and out-of-the-box ideas, instilled in me a sense of wonder, curiosity, and a passion for problem-solving. In this essay, I would like to discuss how Phineas and Ferb inspired me to embark on a journey in STEM, despite limited exposure in my home state of Missouri. I will also explore how STEM is an integral part of our everyday lives, fueling my curiosity and desire to explore these fields.

Building a Foundation of Curiosity:

Growing up in Missouri, I did not have the same level of exposure to STEM fields as those in more tech-oriented regions. However, Phineas and Ferb opened my eyes to the endless possibilities and excitement that lay within these disciplines. The show served as a gateway to a world I had yet to discover, captivating my imagination and driving my curiosity to explore the realms of science, technology, engineering, and mathematics.

While I may not have had access to advanced laboratories or cutting-edge technology, Phineas and Ferb showed me that curiosity and resourcefulness were the true catalysts for innovation. They reminded me that STEM is not confined to specific locations, but rather a mindset that can be cultivated

anywhere. Through simple experiments and everyday objects, I began to understand that STEM was not just a distant concept but something that could be constantly seen and explored in our daily lives.

The Power of Creativity and Problem-Solving:

Phineas and Ferb's ability to think creatively and solve complex problems was both mesmerizing and inspiring. The show pushed me to think beyond conventional boundaries, igniting a passion for innovation and problem-solving that extended far beyond my television screen. Living in a state with limited exposure to STEM opportunities only fueled my determination to seek out knowledge and explore the subjects that fascinated me.

As I watched the dynamic duo navigate challenges, it became evident that STEM was not just a series of disconnected subjects, but rather an interconnected web that shaped the world around us. The inventions and contraptions created by Phineas and Ferb showcased how science, technology, engineering, and mathematics seamlessly intertwined. This realization compelled me to seek a deeper understanding of these fields and appreciate their impact in our lives.

Guidance and Support:

Phineas and Ferb's adventures were not undertaken in isolation; they were supported by a network of friends, family, and mentors. Despite living in a state with limited STEM resources, I found solace in my own support system. My family, though not experts in the field, encouraged my curiosity and provided the foundation for my STEM journey. Their belief in my potential and their support served as a constant reminder that pursuing my passion was not only valid but also essential to my growth.

Moreover, Phineas and Ferb's escapades inspired me to seek out communities beyond my immediate surroundings. I began connecting with like-minded individuals online, joining STEM-focused forums, and participating in virtual events. These interactions exposed me to a broader range of ideas, projects, and opportunities, allowing me to foster a sense of belonging within the STEM community.

Ultimately, Phineas and Ferb have had a profound impact on my life, inspiring me to pursue a STEM field despite limited exposure in Missouri.

THE FUTURE IS STEM

The show's emphasis on curiosity, creativity, problem-solving, and the importance of support systems resonated deeply with me. I am truly so thankful that this astounding show was able to ignite a passion for STEM inside of me that has led to an abundance of fulfillment in all the STEM related endeavors I have done so far, and hopefully the STEM path I have chosen will continue to lead me on a very prosperous and fulfilling journey.

Illuminating the Path: A Personal Journey into Cancer Biology Research

By: Belinda Lin

Ever since I first learned of the existence of something called cancer – when my art teacher was afflicted by it – I have been fascinated yet horrified by the disease. Why is it that so many other diseases have been cured, but cancer is still with us? Early on, I became particularly obsessed with the mechanisms which fuel the growth of tumors, driven by unhealthy cells reproducing at an uncontrollable rate. In my imagination, cancer cells struck me as a raging storm, wreaking havoc and destruction throughout the human body. To me, the field of cancer biology presents complex scientific questions and puzzles that require critical thinking, problem-solving skills, and a deep understanding of biological processes, allowing the scientific community to unravel scientific mysteries. The personal experience of witnessing a mentor close to me being diagnosed with cancer sparked a strong determination within me to delve deeper into understanding this disease.

My scientific understanding of cancers continued to develop in middle school biology class, for which I prepared a presentation on oncogenes and tumor suppressors. Throughout high school, I have actively pursued cancer research in the context of my independent research class. Finding my own lab placement came with its own challenges. Finding a lab placement each year required me to send cold emails to more than 70 mentors and labs. Unfortunately, only a few responded, leaving me with the task of carefully

selecting the labs and mentors whose research aligned most closely with my own interests and goals.

First, during my sophomore year, I explored the effects of green tea consumption on the risk of breast cancer and found an inverse correlation between the two. I started my understanding of data analytics under the tutelage of a Harvard Undergraduate Student. The following summer, in collaboration with Dr. Paolo Boffetta at Stony Brook University of Long Island, New York and Dr. Giulia Collatazzo at the University of Bologna, Italy, I statistically analyzed the effects of red, processed, organ, and white meat consumption on the risk of gastrointestinal cancers, specifically esophageal and gastric cancer based on data from the Golestan Cohort Case from the northeastern part of Iran. The Golestan Cohort Case, initiated in 2004 across more than 1,300 rural and urban provinces, encompassed a vast dataset comprising records from over 70,000 individuals.

During the previous summer, under the guidance of Dr. Bhupesh Parashar at Northwell Health, I went beyond studying factors within individuals' control through dietary choices. I took on my own research project that focuses on examining the correlations between the Human Papillomavirus, particularly the p16 antigen of the oncovirus and oropharyngeal squamous cell carcinoma survival and recurrence patterns. This project is currently ongoing.

Through conducting research at Northwell, I also had the privilege to shadow radiation oncologists in the radiation oncology department of Northwell Health, allowing me to gain valuable insights into their work and procedures.

Intrigued by the vast store of knowledge available to me in the study of the life sciences, I have decided to major in Biological Sciences at the Massachusetts Institute of Technology. MIT, located within one of the top cancer research universities in the world, would allow me to immerse myself in study of the inner workings of the human body while allowing me deeper insights into dietary and lifestyle factors associated with cancer. A concentration in Genetics, Genomics, and Development will allow me to delve into my preferred area of focus; I'm particularly excited to study

Cancer Genetics, specifically diving into the genomics of DNA replication timing and mutagenesis. As a woman in STEM, I aspire to discover ways to sharpen my acumen in carcinogenicity and cancer research. I am determined to join the collective efforts in battling cancer and contributing to the quest for effective treatments and potential cures.

My STEM Journey With Water

By: Vidhatri Iyer

My journey with STEM started in 6th grade. My curiosity began when I wondered what happened to the amount of waste, especially sewage water, we created each day. The United States alone produces 34 billion gallons of wastewater each day. I was interested in knowing where all this water was going. This water could be volatile and cause unsanitary conditions if left in the environment. After reading more about the topic, I learned that most sewage water goes through wastewater treatment plants. The water is cleaned and goes back into our environment. Fascinated by this information, I reached out to various wastewater treatment plants in my area to learn more about this process. TRICO, a regional wastewater treatment facility, responded and allowed me to visit their treatment plant. I asked the head lab coordinator, Mr. Roudebush if I could learn more about the wastewater treatment plant and their treatment process. Mr. Roudebush was grateful for my interest and was excited to show me around his plant.

Over the summer, I worked alongside Mr. Roudebush to track water quality during wastewater treatment. At the treatment plant, I was grateful to have the opportunity to work in a lab setting. Mr. Roudebush allowed me to look at the amount of ammonia, phosphorus, and suspended solids in his treatment plant. This work in a lab got me interested in a career in science. It allowed me to discover my passion for science, especially in the water department. I took the research I had done with Mr. Roudebush and presented at the ISEF regional science fair. At this fair, I won the Women

in Science award. Winning this award inspired me to continue my STEM research with water.

I continued to read about water and followed the local news about sewage, plastic contamination, and nanoplastics. Reading all these articles made me curious to see if water companies like TRICO were monitoring the plastic levels in our waters. As I continued my research, I learned that plastics are not a government-regulated factor. So many plastics go unchecked in our environment. I also learned that detecting plastics is extremely hard in the water, especially nanoplastics. These two facts concerned me, and I wanted to do something to help with this problem. This motivated me to start my journey to find a fast, cost-effective, one-step method for nanoplastic detection in water.

I worked for around two years to perfect my technique to make sure that my technique could help better the water community. Throughout these two years, I continued working in a lab setting and my interest in STEM grew. In the summer of 9th grade, I perfected my technique and started sharing it with the water community. I started talking about my technique at water conferences, and I reached out to many water experts for a chance to get feedback from water scientists. I was recognized by the local press and media for my creativity and innovation and won awards at several competitions.

What was supposed to be a high school science project transformed into a chance for a lifelong career in STEM. I have had amazing opportunities to compete in science fairs and ISEF competitions. I am now involved in monthly monitoring of plastic levels in water streams to keep them safe and I continue to talk at various water conferences about my research. Through my journey with STEM, I have learned that the world doesn't need complex solutions to complex problems but it needs simple solutions to solve the world's complex problems.

Immigrating to STEM

By: Rayan Mubarak

Growing up in a household where science was cherished, I found myself naturally drawn to this fascinating subject. My father, who had a deep passion for science himself, played a pivotal role in shaping my interests and aspirations. His journey from a small rural village in Bangladesh to becoming a neurologist in America made me realize the power of STEM. This realization inspired me to embark on my own scientific path at a young age.

My father's passion and interest in STEM were evident from an early age. He dreamed of becoming a physician to help people and cared deeply about his community. Every day, he witnessed the people he loved dying without anyone to help and treat them. He recognized the potential that science had to create opportunities and improve lives. He started working even harder in school, studying while the other kids played. This helped him become the top student in his class every year. Moreover, he had to work outside of school, helping his single mother with daily chores, working in the fields, and tutoring his siblings. After completing high school, he didn't have enough time to study and prepare adequately for the medical program entrance exam. Instead, he had to work extra hours at his family's farm. When the exam results came, he realized that his name was not on the list of those who passed. Soon after, he fell ill and was bedridden, unable to work. He saw this as an opportunity to study and spent many months reading

science books while recovering. When he regained his health, he retook the exam and performed exceptionally well, securing a place at a top medical program in a university.

In my dad's final year of university, he applied for a Japanese government scholarship for higher education and was selected for the program. He faced the tough decision of leaving his community, his family, and everything he loved behind. While in Japan, he continued to work hard every day to pursue his dream. Soon, he received his master's degree in pharmacology and not long after, started his Ph.D. in neurotoxicology. After completing his Ph.D., he was offered a postdoctoral fellowship in America. His journey was a testament to the doors that STEM can open.

Today, he is a professor with his own laboratory researching neurodegenerative diseases, funded by the NIH. Curiosity about my father's work led me to learn about his fascinating research on the pathophysiology of Parkinson's and Alzheimer's diseases. These two diseases are common causes of death among the elderly, affecting approximately 65 million people worldwide. Surprisingly, only about 10% of these cases are due to genetics, with the rest being attributed to aging and various environmental factors. My father's research focused on studying these environmental factors. By identifying the root causes provided by the environment, he aimed to reduce cases and potentially reverse the effects of neurological diseases. Through his comprehensive studies, he discovered that pesticides play a significant role in these conditions. When I learned about this connection, I was not only shocked but also gained a newfound appreciation for STEM and scientific research.

As I grew older, I witnessed the incredible impact of my father's research on the scientific community and the lives of others. For the first time, I saw and recognized that science wasn't just about personal accomplishments; it was a powerful force for shaping a better future for society. Inspired by my father's passion for science and his dedication to making a difference, I

knew that I wanted to follow a path in STEM—a journey filled with exciting possibilities to change the world.

Over the years, I eagerly participated in many science fairs, took all the science classes offered at my schools, and visited various science museums. All of these experiences further solidified my love for STEM and my desire to pursue a career within it. They also helped me develop valuable skills such as critical thinking, problem solving, and analytical skills. I decided to take my interest in STEM a step further. I conducted my own research funded by the NIH, studying the Dok7 gene, which is associated with many neuromuscular disorders. I aim to find the mechanisms related with the Dok7 gene. With this, I can try to improve the lives of those suffering from disorders caused by it.

My upbringing in STEM has been an incredible journey shaped by my father's unwavering passion and the transformative power of scientific research. Through his example, I have come to realize the immense potential of STEM fields to shape our world and positively impact the lives of others. As I continue to pursue my own scientific endeavors, I hope to follow in my father's footsteps, using my knowledge and skills to revolutionize healthcare and create a brighter future for all.

Success = Passion × Hard Work

By: Kush Sharma

Success = Passion × Hard Work². This equation fundamentally ties into my STEM journey since it deeply influenced my thought process and mentality during the last couple of years, while I was doing STEM competitions, participating in science fairs, and, more recently, doing STEM research. While I only consciously started thinking of success as a combination of passion and hard work a couple of months ago, I realize now that this principle has governed my decision-making for much longer.

Before I explain the equation, it is important to explain what each of the variables signifies in order to give you a comprehensive understanding of my thought process. First, success, to me, signifies the ability to achieve STEM-related goals, whether it is winning a medal at the Science Olympiad or doing research and publishing a paper in a prominent journal. Passion, on the other hand, is the level of prior interest that one has in STEM. Hard work, meanwhile, consists of the activities that one does to improve his/her understanding of STEM concepts and improve his/her STEM education. For example, if my goal was to win a medal at the Science Olympiad (success), I might show passion by being curious about the world around me and work hard by reading textbooks and doing past papers.

Now that you understand what each of the variables represents, you can get a better understanding of the equation as a whole. It was specifically

designed with a few key properties in mind. For example, the multiplication sign ensures that having either o passion or hard work will result in o success. This is also true in the real world since working hard without a purpose or having a passion but not acting on it are not effective paths to success. However, if one has a passion for STEM, working hard will become a pleasurable task, which will eventually lead to success. Additionally, hard work is squared because it holds more weight than passion. Working hard is, in the long run, more important than the passion for achieving success.

Before I share my story, I wanted to include a quick disclaimer so that my piece isn't unintentionally misinterpreted: The following narrative is meant to show how a certain mindset influenced my STEM journey with the purpose of inspiring the next generation of STEM students to pursue their dreams; it is not meant to exaggerate my achievements or brag in any way, shape or form. That being said, I now proudly present to you: my story.

My interest in STEM started with math. My first-grade teacher used to hold weekly math tests wherein students were expected to solve basic one-digit addition/subtraction problems in a fixed amount of time. Perhaps I had an aptitude for numbers, or maybe I just took school more seriously than my peers, but I always turned my test in first. That was, until one day, my friend, let's call him Donald, turned his test in before mine, and, in my 6-year-old brain, took my position as the reigning class math champion. This event started a friendly competition with me and Donald, wherein we would compete against each other to see who was better at math, motivating me to study more and more math concepts.

While this friendly competition served as my initial motivation to study math, it did not remain the only reason for long. Math was tremendously mentally stimulating to me, more so than any other activity could have been during my childhood. With my initial passion for STEM established, I now began to act on it and enjoyed various STEM activities (the hard work portion). My passion for math motivated me to create an FLL (FIRST Lego

League Robotics) team with my friends as well as apply for my county's STEM middle school magnet program in 5th grade. This program was limited to 50 kids and acceptance into it changed my life profoundly.

It was at this program that I took my first computer science classes, which increased my passion even further and motivated me to work even harder. I learned web development in 6th grade, worked with robotics in 7th grade, and started programming with Python in 8th grade. Discovering the combination of math and logic that was computer science greatly motivated me to do even more hard work. I entered science projects into my state science fair, started participating in Science Bowl, and did math competitions such as the American Mathematics Competition (AMC). In an effort to further expand my knowledge of computer science, I applied to and was accepted into my county's most selective high school STEM magnet program.

I narrowed my focus to computer science in high school and started my study of algorithmic programming when one of my friends introduced me to US-ACO (USA Computing Olympiad). I started participating in this competition and even got selected as one of four members on my school's competitive programming team. I finally achieved success after so many years by representing my school at my state's most prestigious pre-collegiate programming competition and even landing a research position at my state university.

As you hopefully realize after reading my story, success is not an easy thing to achieve. I attribute my success in high school to the passion and hard work that I have put in since elementary school, although none of my elementary school endeavors resulted in success immediately. Both passion and hard work were necessary. For example, if I didn't act on the passion I showed during elementary school, I would never have achieved success. Similarly, if I chose to concentrate on a different field that I didn't have passion for, such as the humanities, I wouldn't have achieved success. It was only by

working hard on a topic I was passionate about that I could find success.

I sincerely hope that my story will inspire the next generation of STEM (you) to pursue your dreams and never hesitate to reach for the stars. Hopefully, my story and equation help you see your path to success just a little bit clearer. Science and Technology have only been increasingly advancing in the last couple of decades and it is my dream that everyone plays their role in advancing STEM even further. After all, the Future is STEM and you are the Future of STEM.

A YouTube STEM Story

By: Matthew Jeong

STEM is all around our world and it's a predominant reason why our world is advancing more as our time progresses! My name is Matthew Jeong and this is my story and experience of how I approached and discovered the field of STEM. Ever since I was an elementary schooler, my favorite subject was math. I grew to learn a lot about the topic and was fascinated by how all the numbers, variables, and other components in math all coincided with one another. At the time, my parents also had put me in local STEM workshops hosted by high schoolers and those just flourished my passion for STEM even more. Alongside these workshops, I also watched a lot of YouTube videos. Youtubers specifically included TheOdd1sOut, Kurzgesagt, and other cartoon and peculiar theory/concept interpretation shows. With various influences of STEM, digital art, and sometimes both combined, I had found the world of science (specifically biology and how humans function) and of course, mathematics fascinating.

Attending workshops as my elementary school self and watching YouTube videos really influenced my passions as a person and one day I thought to myself, "Why not try to make my own?". At the time I was in 5th grade and as soon as I thought of this question to myself, I immediately told my mother that I wanted a drawing tablet for my birthday in June. June rolled around and my parents had purchased a drawing tablet for \$25. I was ecstatic. As soon as I went home I began to draw doodles and comics on an extremely

old Acer laptop that took a solid 5 minutes to turn on. Regardless of the perpetually lasting startup time, I still would draw on it everyday. This was essentially how I founded two of my first major passions of exploring STEM through workshops and youtube videos alongside digital art in my life.

As time progressed, I began to rethink my question of “Why not try to make my own?” and revitalized that question into “Why not try to take part?”. At this point, I was in my 9th grade year and barely had started my freshman year of high school. In this time period, I realized that I was old enough to take part and become those who had guided me the path to the world of STEM and my passion of digital art (that had soon evolved to animating). It was around the time in our school when clubs were introduced. As a freshman in high school, my curiosity burst when the introduction of all clubs started. Club after club, I couldn’t find specific clubs that sparked my interest until one of my friends had informed me about a club called “Operation STEM”. A club that spreads awareness within STEM with one aspect of the club including STEM workshops hosted by members of the club. This facet caught my attention and immediately, I became a member of the Operation STEM club.

During November of 2022, I was alerted of an upcoming STEM workshop being held at a local library in Portland Oregon for kids in the third grade up to the fifth grade. As a student that has a passion for science and mathematics, I was extremely excited when I received an opportunity to lead the mathematics part of this workshop. At this time, I was self teaching myself number theory and one that caught my attention was the “Harmonic Sequence”. A concept in number theory where the reciprocals have a constant rate of change. The reason as to why I chose this concept was because of the diverse applications it had in our world and in the workshop, I contributed by interpreting the harmonic sequence and its applications in a feasible and accessible way by giving the kids a hands on activity where they created their own origami cranes that were then used to demonstrate how the harmonic sequence can be used in real life.

My experience working and leading a part of the Operation STEM's November workshop was a huge opportunity that I will forever be grateful for. This one workshop filled me with happiness as I had acted upon my goal of taking part in activities that were the pathway towards STEM prosperity when I was a kid. I got to meet new people in the club and most importantly, also met 5 incredibly amazing elementary schoolers who were excited and engaged in learning some aspects of STEM. While teaching, the kids were very versatile towards the material and were motivated to learn more which also motivated me to keep teaching more. My experience was, to say the least, a memorable experience that I will never forget and I look forward to contributing more with more workshops to come!

This workshop experience strengthened my motives towards Science and Math more and encouraged me to go further beyond. With my passion for digital art animating, I created a youtube channel to show and expand my vision of Science and Math. With concepts such as De-extinction, calculus, formation of tooth decay, and more, I strive to keep creating more digital animations to demonstrate interesting concepts and theories in these fields. Learning concepts and theories in Science and Math are one thing but it's another thing to share your knowledge with the world as well.

A Journey Towards Discovery in STEM

By: Annie Ting Zhang

“Ready?”

I grinned from ear to ear. I knew mathematics all too well—how hard could it be?

My dad revealed the daily puzzle: “ $x+y+z=6$, $2x+3y+z=11$ ” inked onto a piece of notebook paper. *I knew how to solve systems of equations with two variables, but how could I account for a third?* Pages of half-legible mental odysseys later, my initial excitement morphed into frustration. I brought the problem back to him, awaiting his “explanation.”

“It’s impossible,” he responded. “An equation is needed for each unknown.”

He wrote a third equation, the missing piece! It kicked-off an addiction to math, real math where I could manipulate variables to discover relationships between expressions.

By middle school, I used all my free time to zealously scribble math problems—labeling steps with brief descriptions, numbering derived sub-equations. The finishing touch of course, was the satisfying three-dotted “therefore” symbol, commemorating another problem solved. I discovered that everything had a place and finding those solutions satisfied a yearn for truth and belonging.

As I entered high school, the place where people explore subjects, I put a dot on the previous chapter—seizing the opportunity to help others appreciate math. I delved deeper into the field, branching out to computer

science. As part of this dive, I founded CS clubs, attracting peers curious about the subject while nourishing my passion.

Similar to how math shaped my life, I wanted CS to shape theirs. I assigned challenging app projects to exercise their skills in logic gates, explaining concepts and expressing my enthusiasm. The joy of solving a problem, the thrill of brainstorming solutions, and the satisfaction of learning something new, are all feelings I wanted the students to experience through a cohesive teaching plan. It felt fulfilling as I watched their skills grow.

To further explore new subjects in science, in the summer after my sophomore year, I partook in neuroscience research under Dr. Gal Bitan of UCLA through the Pioneer Academics Program. I've always wanted to become a scientist and contribute innovative findings, much like the famed figures in STEM—working on a scientific project was the first step.

I began diving into the correlated factors of aging and dementia in search of my own explanation, eventually going down a rabbit hole of papers on retinal imaging as a novel alternative to conventional AD diagnosis methods.

With my interest in machine learning, I merged my passions into one study: an initiative to search for AD progression retinal biomarkers utilizing four types of deep learning algorithms. To carry out this project, I frequently engaged with my professors, coming to meetings with a handful of questions. My mentors directed me to relevant datasets and provided clarity on experiments, highlighting crucial strategies I would later implement. Eventually, through hard work and assistance from advisors, I completed my paper, adding my mark to the scientific community. It showed that science was a field I could love, and what once seemed almost unreachable—creating something impactful—was now not just a possibility but a reality.

For now, I have yet to put a “therefore” symbol on my learning journey in STEM and CS as this is just the beginning!

I can see why people dedicate their lives to research. They're hooked on the truly joyful moments of discovery, and so am I. I hope to continue making findings in STEM alongside other motivated and curious individuals. Now, I'm currently skipping my senior year of high school to start attending college at UC Berkeley to fast-track my career path. Going forward, I hope

THE FUTURE IS STEM

to expand my skills and fulfill those values as a student, friend, and in the near future, an engineer: crafting innovative solutions in a world that sorely needs them.

“I’m ready.”

Unraveling the Puzzle

By: Araf Reshad

When I was in the 4th grade, I was obsessed with a small, unassuming puzzle box that my grandmother had given me. The box was a maddening contraption - a blend of twists, turns, and secret compartments that promised an undisclosed reward at the end. I'd spend hours, then days, then weeks trying to decipher the mystery of this little, wooden paradox. Frustration would set in, and yet, a stubborn determination propelled me forward. The puzzle wasn't just about reaching the end; it was the process, the engagement, the chase, that kept me going. And then, one day, the final piece clicked into place. The rush of euphoria was momentous - like finding the last digit in Pi or discovering a new elemental particle (only with less fame and more of a 'take-that' satisfaction).

In retrospect, that tiny puzzle box wasn't just an exercise in patience; it was my initiation into a lifelong romance with STEM. Just as the box held a labyrinth of secrets waiting to be unveiled, so does our world, with layers of scientific wonder, technological marvels, engineering conundrums, and mathematical enigmas. My journey in STEM, much like solving that puzzle box, has been an exploration of understanding complexities, unraveling mysteries, and finding delight in each 'Aha!' moment."

My grandma's puzzle was the spark that set my path towards a pursuit of STEM. Guided through twist after twist towards understanding, my journey

towards self-discovery began in the fourth grade. Like any 10-year-old bright eyed millennial, I turned to the only form of learning I knew: YouTube. STEM videos, in particular, were my forte - Numeration, Algebra, Energy, Geology, Astronomy - every topic promised me the thrill of discovering something new. From the intricacies of the DNA double helix, to the patterns in the night sky, everything was a puzzle just waiting to be solved.

Self-studying STEM topics quickly became my outlet, for it propelled me to discover more about myself and my interests than any other subject. I dived into articles, textbooks, and online resources, finding joy in each piece of knowledge that clicked into place, whether it be numbers, formulas, or laws. From then on, I sighed and sulked through classes on History and Art in eager anticipation of the formulas and applications I would be learning later in the day. Heck, I even skipped middle-school recesses to stay inside and do math problems. Yeah, I was *THAT* kid.

Regardless to say, my passion for STEM only grew as I entered my freshman year of high school, where I began participating in various local STEM competitions, as well as collaborating with other teachers and students in my area. And slowly but surely, my hard work bore results. I achieved a 4.0 GPA my first year of high school, twice won 2nd place at nationals in a health sciences competition (representing Canada at the international stage), and earnt 1st place across 15,000 competitors at an international math competition with a perfect score. Each victory, however small, was a testament to my perseverance, commitment, and ability to make the best out of every situation.

In fact, when the COVID-19 pandemic hit in 2019, I was determined to turn adversity into opportunity. Undeterred by the challenges, I used the internet as a vehicle to meet other like-minded STEM oriented individuals from around the globe. Every time I came across somebody interesting or curious, I took the initiative to reach out over email, introduce myself, and ask them to hold a meeting. And surprisingly, the majority.. said yes!

From once a meeting a month, to a few meetings a week, I was soon doing several meetings a day through Zoom, talking to some of the most successful, adventurous, and fascinating people I'd ever come across.

Driven by this newfound community and camaraderie, my appreciation for STEM flourished. Each conversation, whether it was discussing the latest news in machine learning or debating the ethics of gene editing, added a new layer of depth to my understanding of the field. This wasn't simply learning; it was an exciting exchange of ideas, a dynamic forum where innovation, curiosity, and passion intertwined. The more I dove into these discussions, the more I realized how STEM, in all its complexity and beauty, was a universal language, capable of bridging cultural gaps and fostering connections. It was a shared curiosity, a collective pursuit of knowledge that united us all, regardless of where we came from or what our backgrounds were.

And now here I am, on the cusp of my junior year of high school, my excitement for STEM growing exponentially with each passing day. This summer, I am eager to channel this zeal into impactful projects at the World Health Organization, where I'll help develop an educational program to mitigate community disasters, and at Harvard University, where I'll delve into the study of American Mass Incarceration from Comparative and Historical Perspectives.

As I stand on the precipice of a new phase in my life, I'm excited about the challenges and rewards that lie ahead in my journey in STEM. Just as my grandma's puzzle box promised an undisclosed reward at the end, my journey in STEM continues to promise and deliver rewards – not just in the form of career prospects, but in the unending journey of learning, discovery, and the satisfaction that comes from solving complex problems.

Just like that small puzzle box, I know there will be twists and turns, but the thrill of the chase, the spark of revelation, and the delight in each 'Aha!'

moment will make the journey worthwhile.

The Molecular Connections of Computer Science: Programming Towards a United Future

By: Vinay Gupta

Molecules and chemical reactions: the essential biological relationship which can be applied to each aspect of life. The two scientific components are inseparable, and in unison, they pave the path for society's future.

Lines of Java, pins on a Raspberry Pi, and data structures are the *molecules* that have built my interest in technology. Born and raised in a typical single-parent household in the heart of Silicon Valley, I've been surrounded by these components for all of my life. My father is a Software Engineer at Oracle and has always experimented with new technologies since I can remember. His keen interest in computer science naturally passed down to me, and I began to partake in these technological experiments throughout my childhood. As I entered high school, I started learning to code, building projects one after another based on my interests. Some of these projects included a realistic guitar with reverb, a graphical maze solver, and various two-player games, reinforcing my interest and impact in the field of computer science. However, these aimless projects weren't quite enough to pave my purpose as a future developer; I struggled to apply my knowledge beyond the classroom until I visited Indonesia in July 2021: the *chemical reaction* that prompted me to learn more.

I sat in the back of a dented Suzuki truck, traversing the rocky Indonesian

land to return to my hotel in Central Bali. We suddenly jerked to a halt, and thick black smoke rapidly rose in the distance. In response, many locals immediately exited their cars and took charge by directing traffic; Our guide explained that emergency responders are often far too late to the scene in the particular region. After safely returning to our hotel, we learned that the thick smoke resulted from a deadly bus crash, and the lack of funding for communication and infrastructure to reroute vehicles caused a preventable traffic jam. Through this incident, I was shocked that it was the common people who stepped up in the midst of the chaos. Witnessing this tragic scene ultimately inspired me to direct my technological aptitude to think about potential solutions to the issues that the world faces today.

Learning from experiences like these across the twenty-five countries I visited became the *chemical reaction* that shaped the way I approached STEM. Although my journeys began as simple vacations during breaks, each experience abroad slowly became an adventure offering fresh perspectives on the human condition and empowering me to relate my learning with reality. I began using my skill set to solve problems like miscommunication in Bali, considering mandatory “amber-alert” type notifications in vehicles by using sensors and basic networking throughout underdeveloped terrain. Successfully converting a negative experience into a potential solution for the world was extremely rewarding; beyond this, I realized that experiential learning is one of the most valuable ways to grow as a student. Beyond my time in Indonesia, visiting technological hotspots such as Central Singapore, Akihabara, Japan, and Songdo-Dong, South Korea, inspired me to explore technology’s future trajectory and its impact on diverse societies. In contrast, I experienced traditional living in the rural outskirts of Norway and Thailand. Being able to compare these visits and how technology has shaped societies across the world has been a pivotal point for my journey as a computer scientist.

With a fresh mindset on programming, I decided that my next step would be to solve an issue within my own community. At my high school, I was involved in numerous clubs: the band, Business Professionals of America, the Frisco South Asian Student Association, and many more. In each of

these organizations, I was welcomed by an officer board of upperclassmen; Their guidance went beyond the minimum and gave me valuable life advice that helped shape me into who I am today, another *chemical reaction* that reshaped the way I viewed computer science. However, my initial academic experience couldn't have been more different. A strong culture of independent work was common, and students were often left on their own to navigate their path as a student. While some students learn to thrive in this environment, many students, especially first-generation students like myself, struggle initially. As I worked through my freshman, sophomore, and junior years, learning from my mistakes, I decided to take action to fix what I saw, an effort that was ultimately inspired by my experiences overseas.

Going into my senior year, I was accepted into my school's Independent Study and Mentorship program, where I had the honor to develop a project under the guidance of Mr. Shaniel Mathur, a Software Developer at Google. After thoroughly researching machine learning and the traditional dynamics of school education, I began to create my product, "Connected." Connected is an algorithm that would analyze student data from my school's student body and pair up students who could benefit from each other's advice. Through this, my goal was to transfer the same community I felt from my clubs into the classrooms of my school, boosting both student morale and academic performance. After two full semesters of researching, programming, and testing, I created a functional prototype for Connected.

From starting off in the heart of Silicon Valley, exploring the realm of basic code, and questioning the applications of computer science through my eye-opening experiences overseas, I realize that my journey has only just begun. As I apply the lessons learned from my travels to my own community, I move forward with unwavering determination, fully aware that my purpose lies in using technology as a means to connect others. With my community at school and trips overseas working as *chemical reactions*, my molecular basis in computer science will finally allow me to step forward and solve prevalent issues, like the ones in Bali that got me started.

From Shame to STEM: A Teenager's Story of Finding Herself in Research

By: Anushka Peer

Most stories of STEM education begin with the stereotypical “my-mom-put-me-in-kumon” and “I-learned-calculus-at-four-years-old”. My first look into STEM was a little different.

At a young age, I developed Atopic Dermatitis, or Eczema, the fiery skin disease that was characterized by red rashes all over my body, leading to a compromised immune system and many viral infections. My parents had never seen a skin condition as severe as mine, so my weekend tradition would be visiting different doctors all across my city. Dreary gray walls in hospitals and taking oddly shaped prescription pills were a staple in my childhood life. Mirrors were my worst enemy. I remembered wearing socks as mittens in order to prevent myself from waking up with blood cuts all over my reddish skin. As an anxious child, another core memory was taking a clinical test where different substances were pricked into my skin in order to elucidate a reaction and properly understand what allergies I had. And naturally, the list was exhaustive: eggs, chicken, seafood, strawberries, soy, whey, and milk.

In fact, Eczema was also a huge part of my reduced self-esteem in school and characterized my introvertedness. I was always worried about being asked

the dreaded question: “what’s wrong with your skin?” In some form, I felt like my skin condition had almost stolen a part of my mental wellbeing, one that I would never recover from. My fears were confirmed in fourth grade when I was under a new treatment with a new doctor, where I unlocked another level of Eczema in which my skin would ooze, which I would cover up with turtlenecks and scarves.

As you can tell, I wasn’t the most popular kid in the playground. However, later that year, when I contracted a viral infection and was bedridden for three weeks, I had a lot of time to reflect on how my condition had affected me. Like every story arc, I would consider those three weeks of my life as the turning point; I used to be so addicted to my physical image that I rarely took the time to recognize the beauty of my Eczema. However, that week, wrapped in a blanket while drinking my mom’s magical soup, I realized that I could leverage my unique experiences into something more powerful. So, I had my heart set on becoming a doctor. Not only because I wanted to help people, but because I believed that I could accurately relate to the patient’s struggles and my qualities of empathy and devotion would play well in the field of medicine.

I simply couldn’t imagine myself doing anything else. So, from middle school, I started to connect well with the STEM classes in my school and naturally . In high school, I applied to a local research program that kickstarted my research career. Soon, I was published and had presented at national and international conferences, feeling more confident in my own abilities in STEM. In sophomore year, I conducted research at UCSF in identifying biomarkers in atopic dermatitis, my own disease. The feeling of being able to make scientific advances in a field that had plagued me for ages was a feeling like no other. It was the moment that I knew that I had made the right choice in my career and that I’d come a long way from the shy, reserved kid that I once was.

Fast forward to now, I conducted research that was recognized as an excep-

tional project to be launched into space at the Genes in Space competition and am currently working on publishing my independent research on bone marrow biopsies in blood cancers. Finally, I'll be conducting research at UCSF in chemical proteomics this summer.

I wouldn't say I was always this positive and optimistic about my Eczema. Back then, I spent years irritated with the fact that out of all the people in my school or in my world, I was the one "chosen" to be different, but in a bad way. I had never considered that every tribulation is just a period of growth as it led me directly into renewing my passion in STEM. Even if I had the option to live a different childhood, or even, an "easier" childhood, I wouldn't change a thing.

Pioneering Change: A Personal Journey of Curiosity and Change

By: Bahiya Areez Ahmed

Growing up in Dhaka, Bangladesh, one of the most populated and polluted cities in the world, I have always been acutely aware of the devastating effects of pollution and environmental degradation. The air was thick with smog, the waters were contaminated, and the city was plagued by frequent power outages. As I grew older, I became increasingly concerned about the impact of these issues on public health and the environment. I found my calling in Environmental Science, a field that allowed me to address the unique challenges facing my community and the world.

My interest in STEM began at a young age, when I would often tinker with broken electronic devices and try to fix them. I found it fascinating how a machine could be dismantled and repaired to make it work again. This curiosity led me to explore the world of science and technology, and I realized the immense potential STEM had in shaping the future of society. My school played a pivotal role in shaping my interest in STEM. The curriculum emphasized hands-on learning, incorporating practical experiments, field trips, and collaborative projects that instilled a deep appreciation for the scientific method and critical thinking.

The significance of Environmental Science in Dhaka cannot be overstated.

The city's exponential population growth, rapid urbanization, and lack of effective environmental policies have resulted in severe pollution levels, compromised air quality, and adverse health impacts. These issues disproportionately affect vulnerable communities and exacerbate the consequences of climate change. A city plagued by severe pollution and vulnerable to the impacts of global warming, I felt a personal responsibility to address these environmental issues. It was clear to me that pursuing Environmental Science was the path I needed to follow to make a meaningful impact. Witnessing rising pollution levels, deforestation, and the effects of climate change on vulnerable communities ignited a spark within me. I wanted to understand the underlying scientific principles and contribute to finding solutions for a better future to mitigate its effects.

One of the biggest challenges I faced as a Bangladeshi girl pursuing STEM was the stereotypes and expectations that came with my gender and cultural background. my choice to study Environmental Science went beyond the desire for personal fulfillment. It was a deliberate act of defiance against it. Persistent gender biases that attempted to limit my choices. Many people assumed that I would not be interested in or capable of pursuing a career in STEM. Girls were often discouraged from taking up science and math, which were considered to be male-dominated subjects. I refused to let their opinions deter me from pursuing my passion. I worked hard to excel in my studies and proved that girls could be just as good as boys in STEM subjects.

It was not only me who faced peer pressure from my classmates who were pursuing more traditional STEM subjects like Biology or computer science, but my parents, who had been getting comments from everyone about what subject I should take.

They were worried if the path I had chosen was good enough for me or a complete waste of time. On a positive note though, it made me want to work even harder.

In addition to that, I found that there was a lack of representation and

support for women in STEM in Bangladesh. A multitude of challenges contribute to the underrepresentation of women in STEM in Bangladesh. Limited access to quality education, lack of role models and mentors, and cultural norms that prioritize traditional gender roles all hinder women's progress in these fields. Societal expectations may pressure women to prioritize family responsibilities over their career aspirations, making it difficult for them to fully engage in STEM education and pursue demanding STEM careers. This made it difficult to find female role models and mentors to guide me on my journey. However, I was fortunate to have a supportive family (after consolation, of course) and few female professors who served as role models and mentors. My parents, recognizing my fascination with the environment and my eagerness to explore scientific concepts, supported my interests wholeheartedly. They encouraged me to engage in hands-on experiments, visit science exhibitions, and read extensively on environmental issues.

Choosing Environmental Science was a natural progression for me, as it aligned with my passion for environmental conservation and the urgent need to find sustainable solutions for Dhaka's environmental issues. By studying this field, I hope to contribute to the ongoing efforts to create a healthier, more sustainable city.

Beyond the Crescent: Navigating STEM with Sickle Cell Disease

By: Sai Shreyas Nayak

What is the structure of your RBC? What is its lifespan? For the majority of us, our answer would be bi-concave shaped and 115–120 days respectively. However, unfortunately, this is not the case for all of us.

I was born with Sickle Cell Disease (SCD). Yeah! The name says it all. In SCD, the RBCs are crescent-shaped (similar to the shape of a sickle), and they die within 15–20 days!

A question might arise, which is, “What problems or complications, if any, does it cause?” Well, there are a lot of complications associated with this disease, such as Avascular Necrosis (AVN), Acute Chest Syndrome (ACS), renal failure, retinopathy, stroke, splenic infarction, etc. Out of all these complications, vaso-occlusive crisis is the most common.

The worst part is that these complications may arise out of nowhere. You may have planned to go to the movies with your friends but only to cancel at the last moment because of a crisis episode. Or, you may be rushed to the ER from your exam hall. This is just the tip of the iceberg.

However, despite the challenges I faced, there were certain unexpected

benefits. I was always surrounded by the healthcare industry, which allowed me to gain a thorough understanding of the ins and outs of the medical field. From hospital administration to MedTech, I had mastered it all. This exposure sparked a keen interest in the field of medicine and healthcare.

Unfortunately, my dream of pursuing medicine remained just a dream. My parents and doctors advised against it, citing the labor-intensive nature of the field and the risk of further exhausting my fragile body.

But I did not lose hope. In 2014, a new buzzword caught my attention – AI. I was fascinated! I knew that I had a passion for the healthcare industry, and AI gave me the perfect opportunity to blend my love for mathematics and healthcare.

Let's fast forward a few years to 2019, which turned out to be the worst year of my life. I was admitted to the hospital for almost 9 months, during which I developed ACS, experienced several AVN attacks, and faced a shifting vaso-occlusive crisis. I underwent a total of five surgeries, and unfortunately, my right femoral head collapsed. It may require a total hip replacement in the future, but for the time being, my right femoral head fused with the cavity.

That year I spent a significant portion of that time at Al Zahra Hospital, Sharjah (now known as NMC Royal Hospital), and the remaining two-thirds at Fortis, Gurgaon.

Just a few days before my final exams, I returned to the UAE. Unfortunately, the extended hospital stay took a toll on my academic performance, and I didn't score well.

I found myself devoid of motivation. Desperately searching the web for some inspiration, I inadvertently stumbled upon research that painted a grim picture:

“Students with sickle cell disease demonstrate notable academic difficulties and

are at high risk for grade retention. Development of academic interventions and increased access to school support services are needed for this vulnerable population.”

These concluding lines from the study conducted by Heitzer et al. left me disheartened. Instead of finding stories of individuals with SCD who achieved greatness despite adversity, I discovered that many warriors struggled to graduate high school, let alone engage in STEM fields.

The following year, something changed. I had a class teacher (homeroom teacher) who believed in me. She provided unwavering support, constantly motivating me to be ambitious and never lose hope. She also encouraged my interest in STEM. With her guidance, I regained my drive, and that year, I secured over 96% in my finals, one of the top scores in my school.

It became evident that anyone can achieve anything as long as they have someone who believes in them. I would also emphasize the importance of considering your physical well-being. Pulling all-nighters may seem innocuous, but trust me, it's not!

The following year proved to be critical. I finally decided to undergo a Blood and Marrow Transplant, also known as Bone Marrow Transplant or Hematopoietic Stem Cell Transplant (HSCT). Finding a complete HLA match (Human Leukocyte Antigen) for a donor proved challenging, and I ultimately proceeded with a half-match donor - my father. Consequently, the procedure could be termed as Haplo-identical Hematopoietic Stem Cell Transplant.

HSCT is an arduous procedure that takes more than a year for complete recovery. During HSCT, one's body is in an immunocompromised state for months, if not years. It was a daunting journey, but one that I believed was worth it.

Although I wasn't able to do much during my transplant, I seized the opportunity to learn new skills. I delved into learning Japanese (still a work in progress) and worked on many portfolio projects. Additionally, my interest in research grew exponentially. I immersed myself in reading research papers and, proudly, I am currently working on a research paper focused on improving ACS diagnosis.

For those who find themselves torn between various disciplines and need help making a decision, I suggest blending those disciplines. For instance, I combined my love for mathematics, medicine, and computer science in the scientific study I am currently undertaking.

Life will always have individuals who possess more resources than you do, as well as those who have fewer. This unfairness should not discourage you; instead, let it serve as motivation, knowing that the fruits of your efforts will be all the sweeter.

That being said, it's essential not to overexert yourself. Working a hundred times harder is not the solution. Instead, work smarter. Always seek simpler and more direct approaches, even if they may seem unorthodox. As Jason Fried wisely said, "It's simple until you make it complicated."

Conclusion

I am sure—without a doubt—that you have been inspired by these stories.

I'll leave you with a call-to-action: empower local communities with the resources they need to deliver a better, more equitable science education.

This is precisely what this book was created to do. By inspiring students, educators, parents, policymakers—WE can make a big difference for STEM education.

If you wish to support our mission and help us inspire thousands of more students, please consider donating a copy of this book to a school, student, or library.

We can do that for you, donate here (tax deductible) here:

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Interested in doing STEM research like many of the students in this book? Check out Rishab Jain's 100% free, YouTube playlist on doing STEM research: <https://tinyurl.com/rishabstem>

Looking for STEM opportunities/competitions/more?

Check out <https://whop.com/stem> for some STEM guides.

About the Author



Rishab Kumar Jain (Portland, Oregon) is an American teen researcher, activist, and speaker. He is a rising freshman at Harvard College.

At the age of 13, he was named **America's Top Young Scientist** for his research on improving radiotherapy for pancreatic cancer patients. In 2018, he was named one of **TIME Magazine's 25 Most Influential Teens**. In 2022, Jain won the Regeneron Young Scientist Distinction for his work to improve recombinant DNA technology.

Rishab's work has been featured in TIME Magazine, Insider, Forbes, NPR, TeenVogue, Cancer.gov, and more. Rishab speaks about the ongoing artificial intelligence revolution, the importance of STEM education for youth, and the promise of AI in medicine. He carries this advocacy as an

expert for science and research on various global committees.

In his free-time, Rishab likes to run, read, and make YouTube videos.

About the Editor:



Aditya Jain is an MD student at Harvard Medical School. In his spare time, he works as a student researcher at the Broad Institute and Massachusetts General Hospital. He has authored several publications on the topics of bioinformatics, cancer, and artificial intelligence in medicine. As a past STEM high-schooler himself, Aditya participated in several international science fairs including ISEF and Broadcom MASTERS. He is an avid science fiction writer and editor for *In Vivo Magazine*. Most importantly, he is Rishab Jain's older brother.



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