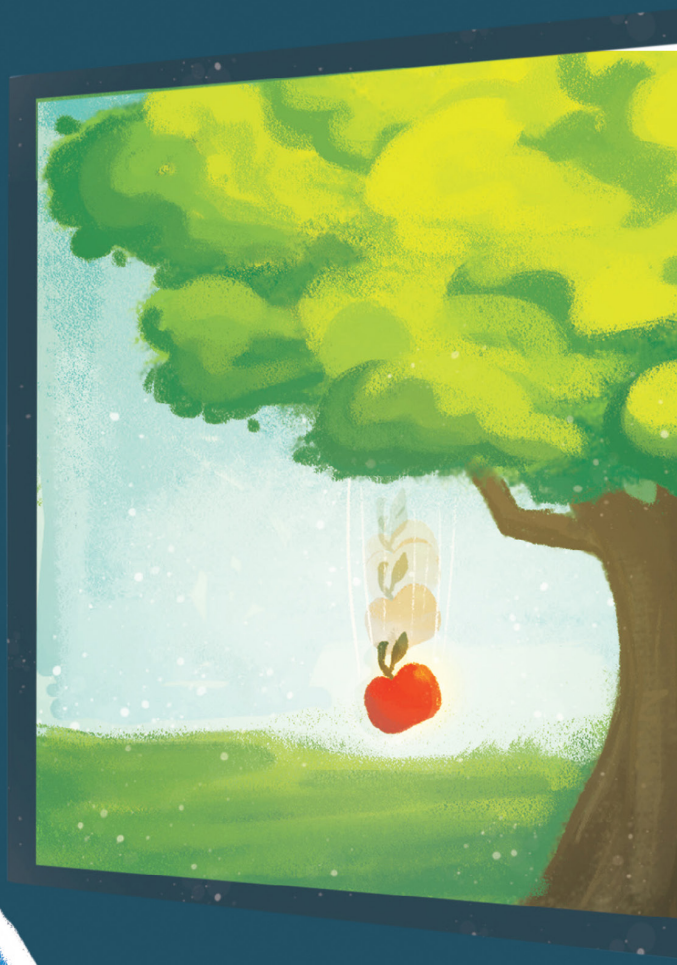
STEM MAGAZINE

"Women in Physics"
Las mujeres en la fisica



Diversity in Chemistry

Rimac C_Two!

Augmented Reality & Autism

(Francia, 1706–1749)

\\250v
April 2021

UNK UNIVERSITY OF NEBRASKA KEARNEY | eCAMPUS

ENHANCE YOUR 7-12 CLASSROOM WITH THE UNIVERSITY OF NEBRASKA AT KEARNEY'S ONLINE M.S.Ed. IN STEM EDUCATION

Traditional **math and science content** combine with **curriculum and instruction** in pedagogical techniques to create a distinctive program structure. Take advantage of UNK's competitive tuition rate and payment plan option to make graduate education feasible.

CHEMISTRY OPTION | INTEGRATED OPTION

Continue to work in your community while you gain the expertise and qualifications you need for your classroom and school. Become equipped with advanced strategies and trends to maximize student engagement and learning in the sciences.

BE AN ONLINE LOPER

For more information or to apply for the upcoming semester, visit ecampus.unk.edu, call 1.800.865.6388, or email ecampus@unk.edu

BE BLUE. BE GOLD. BE BOLD.

University of Nebraska Online

To understand STEM...

...you must DEFINE STEM, but you cannot define an acronym using the words it stands for; you must define the words the acronym stands for.

Universities and organizations around the world continue to debate what a STEM career is. There is no doubt that "every career" uses STEM skills and this observation remains the focus of STEM Magazine.

Science: "The systematic accumulation of knowledge" (all subjects and careers fields)

Technology: "The practical application of science" (all subjects and careers)

Engineering: "The engineering method: a step by step process of solving problems and making decisions" (every subject and career)

Math: "The science of numbers and their operations, interrelations, combinations, generalizations, and abstractions" (every career will use some form[s])

For a moment, set aside any preconceived notions of what you think a STEM career is and use the above dictionary definitions to determine the skills used in any career field you choose.

How does your chosen career compare to these definitions?

We believe that the key to success in seeing higher graduation rates, improved testing results, student inspiration, creativity, excitement and career satisfaction rests in the hands of the teacher.

The example and inspiration of individual educators carries tremendous weight on a daily basis, greatly impacting the quality and effectiveness of the classroom environment.

Our mission: Encourage curiosity, investigation, inspiration, creativity, and innovation; the foundations of every career passion.

Wayne Carley
Educator / Publisher
STEM Magazine
STEM for Woman Magazine
STEAM Magazine

STEM Magazine Corporation
2055 Barrett Lakes Blvd. NW
Suite 928
Kennesaw, GA 30144

http://www.stemmagazine.com

STEM Magazine is a monthly subscription non-profit education publication for educators, students, their parents and industry professionals.

Read monthly in 71 countries, STEM Magazines strive to encourage the educator to better understand the importance of STEM skills, their use in every school subject, the need and ease of integration into curriculum and the urgency for students to embrace STEM.

Caroline Nesaraja
DAWN LEVY / ORNL

Women In Physics
MARLEE BROOKS

Working On Rockets
DR. MICHAELYN THOMAS

Electric Sports Car
KW AUTOMOTIVE

Diversity In Chemistry
GARY J. SALTON, PH.D.
SHANNON NELSON

Augmented Reality & Autism
CIARÁN MATHER

North Carolina A&T State UNIV.
INTERDISCIPLINARY PARTNERSHIP

Do More in Healthcare with a Pharmacy Career

Explore Rewarding Career Pathways in Touro's Doctor of Pharmacy program *in* Manhattan

WITH MORE HANDS ON EXPERIENCE IN MORE REAL-WORLD SETTINGS

Touro prepares you to build a fulfilling career as a pharmacist. Whether you choose clinical or hospital pharmacy, the pharmaceutical industry or a community setting, you'll receive the education you need to succeed. Our small class sizes offer personal attention and support from accomplished faculty. Upon graduation 99% of our students are employed, with an average starting salary of $128k.

Touro College of Pharmacy-NY (TCOP) offers an **Early Assurance Program for high-achieving high school students** who are committed to pursuing a career in pharmacy, providing advanced provisional admission to our Doctor of Pharmacy program. *High School students interested in the Early Assurance Program must meet our prerequisite and admissions criteria.

For more information contact **Heidi Fuchs, Assistant Dean, Admissions & Enrollment**
admissions.pharmacy@touro.edu or 646.981.4750

TOURO COLLEGE OF PHARMACY
Where Knowledge and Values Meet

tcop.touro.edu

OAK RIDGE National Laboratory

Caroline Nesaraja:
Providing nothing but the best nuclear data

By Dawn Levy

Nesaraja evaluates mass chains assigned to nuclear data program centers like ORNL. She selects best values for archiving in a specialized nuclear structure database and publication. Credit: Carlos Jones/ ORNL, U.S. Dept. of Energy.

Nuclear physicist Caroline Nesaraja of the Department of Energy's Oak Ridge National Laboratory evaluates nuclear data vital to applied and basic sciences. Her work ensures that the scientific community has the best nuclear data for fundamental research and applications including medical isotopes, nuclear energy and national and international security.

"At the heart of nuclear data evaluation is recommending values for a range of nuclear properties for the community to adopt and use," said Nesaraja. Her exacting evaluation process starts with gathering extensive nuclear structure and decay data from experimental measurements published in peer-reviewed journals.

Through this evaluation process, Nesaraja discovered in 2018 a long-overlooked mistake from a 1975 reference measurement pertaining to the decay of cerium -137.

She presented her finding the following year at the International Atomic Energy Agency, or IAEA, which motivated three research institutions – ORNL, Forschungszentrum Jülich and DOE's Lawrence Berkeley National Laboratory, or LBNL – to analyze previously available measurements from LBNL, confirming an inaccuracy.

Their publication of the result corrected a reference that had consequences for calculating decay heat in nuclear reactors, element creation in stars and effectiveness of a promising cancer therapy.

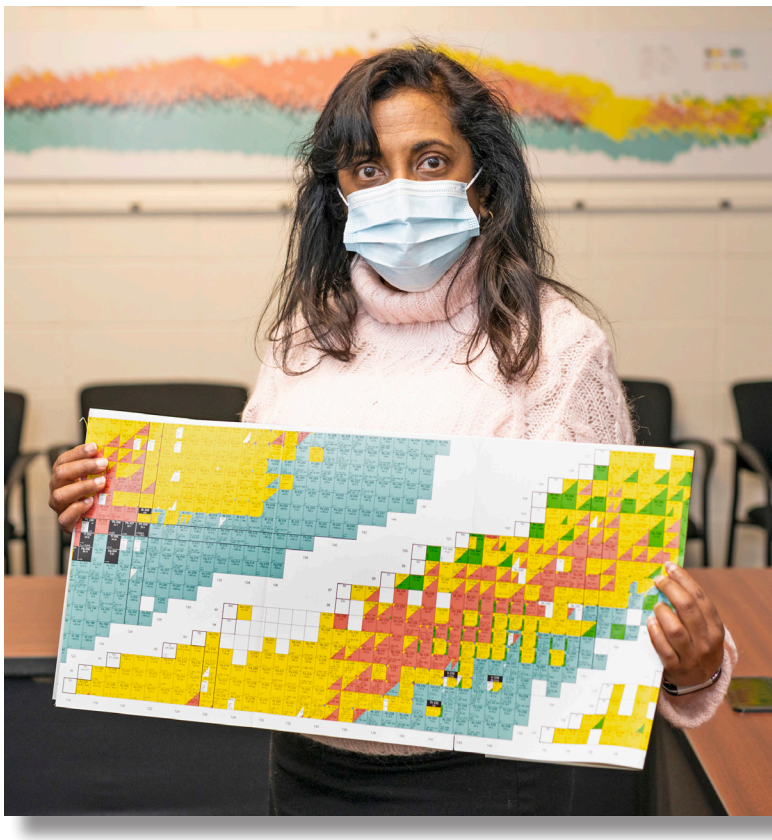
Her work supports the mission of the United States Nuclear Data Program, or USNDP, to provide current, accurate, authoritative data for workers in pure and applied areas of nuclear science and engineering. Through the USNDP, which is sponsored by DOE's Office of Nuclear Physics, Nesaraja and other nuclear physicists at select national labs and universities recommend values for nuclear properties and interactions.

Nesaraja also serves on the International Network of Nuclear Structure and Decay Data Evaluators, which is under the auspices of the IAEA and fills a role similar to USNDP's for the global scientific community.

She evaluates vast amounts of nuclear data from copious studies done over decades. The diverse experimental measurements reveal nuclear structure, such as ground and excited states, and decay properties including decay modes, half-lives, branching ratios, emission probabilities and radiation energies.

Critical review of the data ensures all state-of-the-art measurements are included. When measurements assessing the same property are inconsistent, Nesaraja pores over details of the experimental methods and analyses.

To determine a best value, she relies on her broad physics knowledge, experimental experience, theory and systematic studies. Sometimes, it's even necessary to perform a validation experiment to compare measured against reported values.



Nesaraja, holding a nuclide chart, does stringent evaluations consequential for calculating decay heat in reactors, element creation in stars and effective doses of medical isotopes. Credit: Carlos Jones/ ORNL, U.S. Dept. of Energy

Nesaraja split her effort between nuclear data evaluation and experimentation at ORNL's now-closed Holifield Radioactive Ion Beam Facility. Credit: Carlos Jones/ORNL, U.S. Dept. of Energy

After peer review, Nesaraja's evaluated work enters the Evaluated Nuclear Structure Data File, or ENSDF, the preeminent database of evaluated nuclear structure and decay information for 3,350 nuclides. A nuclide is a distinct species of atom characterized by the number of protons and neutrons in its nucleus.

Nesaraja, who is 100% devoted to evaluation, provides one-seventh of the U.S. output to the nuclides data file that is managed by the National Nuclear Data Center at DOE's Brookhaven National Laboratory.

The need for evaluated nuclear data is growing because of the creation of the Facility for Rare Isotope Beams, a DOE Office of Science user facility, scheduled to open at Michigan State University in 2022.

"It is the biggest challenge for us," Nesaraja said. "When the facility is fully functional, its many experiments will be followed by publications providing important nuclear data that needs to be compiled and evaluated."

ORNL's world-leading position in producing isotopes and developing next-generation nuclear energy technologies also relies on accurate data.

From MacGyver to mass chains

Born in Malaysia, Nesaraja became interested in physics at an early age, inspired by problem-solving adventures in the TV series MacGyver. She has a brother, who is a lecturer, and a sister, who has a doctorate in chemistry; both live in Malaysia but join Nesaraja for travel to Europe and the United States when they can. Nesaraja enjoys trying international cuisines and reading mysteries and thrillers.

She pursued doctoral research at the Forschungszentrum Jülich, Germany's

premier nuclear physics laboratory, and worked with Professor S.M. Qaim, a world-renowned expert in medical isotopes and nuclear reactions. She received her doctorate in nuclear physics in 1998 from the National University of Malaysia and became a lecturer and medical physicist in the university's hospital.

In 2000, Nesaraja joined the Triangle Universities Nuclear Laboratory at Duke University as a postdoctoral fellow in nuclear astrophysics, a field in which nuclear processes explain the formation of progressively heavier nuclei. While there, a colleague introduced her to nuclear data evaluation, giving her an appreciation for the detailed work and catalyzing her career path.

She accepted a joint postdoctoral appointment with ORNL and the University of Tennessee, Knoxville, in 2004 working with Michael Smith, ORNL's principal investigator for the USNDP. Nesaraja was trained in nuclear data evaluation by renowned evaluator Murray Martin, retired chief editor of Nuclear Data Sheets.

Nesaraja spent half her time on nuclear data evaluation and half conducting experiments at ORNL's Holifield Radioactive Ion Beam Facility. She became a staff member in ORNL's Physics Division in 2008 and continued the 50/50 split until Holifield closed in 2012.

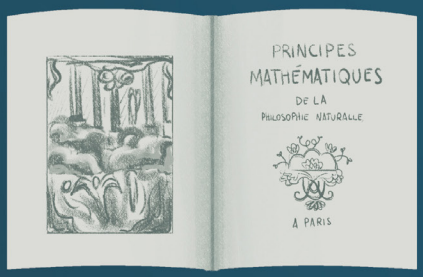
Today, Nesaraja evaluates all nuclides having the same mass number, or sum of protons and neutrons, through a type of assessment called a mass chain evaluation. For example, mass chain 137 has 16 nuclides, such as cesium-137 and xenon -137. Studying nuclides with the same mass number helps scientists follow the beta decay or electron capture and energy states during a nucleus's lifetime.

Recently, joint evaluations were recommended for four nuclides so three important nuclear databases would provide the same values: that of the Decay Data Evaluation Project at France's Laboratoire National Henri Becquerel, IAEA's library of decay data from radionuclides relevant to the Comprehensive Test-Ban-Treaty Organization and the ENSDF database.

Nesaraja and evaluators from France and Australia will evaluate the best value for the decay properties of cesium-137, which is used in part to calibrate radiation detectors.

Her responsibilities will continue with evaluations of mass chains that have not been evaluated for more than 10 years. In addition, she will review evaluations of mass chains assessed by her international colleagues.

The DOE Office of Science supports Nesaraja's research.



Émilie pasó cuatro años traduciendo el libro completo al francés. Su investigación y sus experimentos le ayudaron a crear ecuaciones y a formar ideas nuevas sobre la gravedad. Ella ayudó a que muchas personas alrededor del mundo se entusiasmaron con la física y su trabajo inspiró a futuros científicos como Albert Einstein.

"Women in Physics"

Celebrates Female Scientists, Old and New

Children's Book Series Inspires Curiosity--in English and Spanish

by *Marlee* Brooks

Physics educators have long pondered how to get elementary school learners excited about a field of science that even adults find intimidating. How can we simplify difficult topics and tap into a child's natural curiosity?

In a simple, easy-to-understand format, Women in Physics, and the Spanish edition, Las mujeres en la física, use quirky illustrations and relatable role models to explore fundamental concepts such as gravity, atoms, and energy. The third book in the award-winning Science Wide Open series, this title helps children feel more comfortable with the daunting field of physics and gets them excited about it, too.

Most kids know who Albert Einstein is, but how many female scientists can they name? Female role models in STEM education are important because they can leave an impact on children, and especially girls, for years to come. They can inspire a budding scientist to pursue her dreams to cure disease, discover a new element, or prove her own hypothesis. Representation in STEM is also vital, especially for young girls, because it assures

them that they, too, can make a difference in the world.

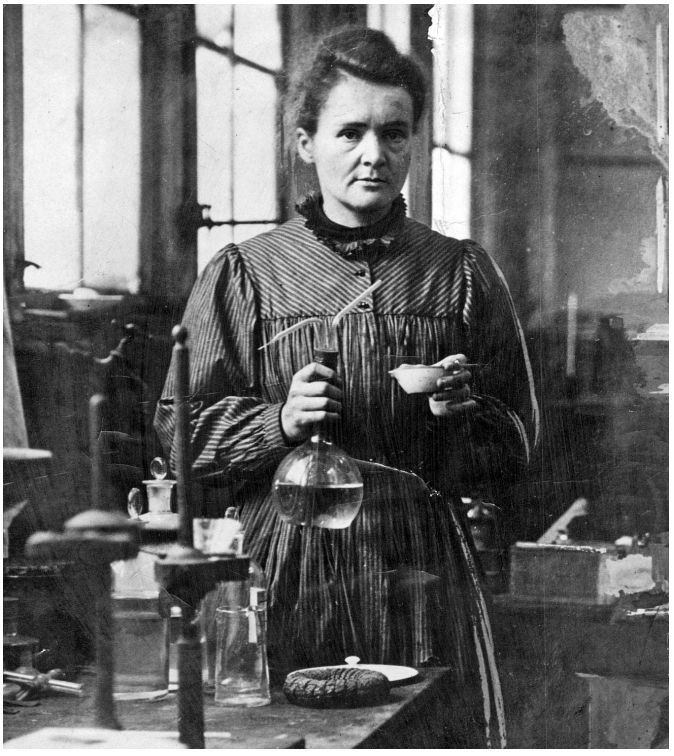
Designed for readers ages 7–10, Women in Physics and Las mujeres en la física are the perfect pathway to help young scientists understand the power of curiosity and resilience. The book introduces readers to the wonders of physics through a conversation between a spunky young protagonist, who asks questions about the world around her, and a scientifically astute narrator, whose answers are crafted to be understandable to young minds.

A variety of countries, eras, and languages are represented through the compelling female scientists profiled in this book. Readers learn about groundbreaking scientific discoveries and the trailblazing women who made them possible.

Donna Strickland, Ph.D., one of the four women to ever receive a Nobel Prize in Physics shares:

"Science is all about wonder. Women in Physics gets us wondering how the world really works. It introduces children to the female icons of physics who opened doors for the rest of us!"

Many students have some familiarity with Marie Curie, the Polish and naturalized-French scientist who conducted pioneering research on radioactivity.

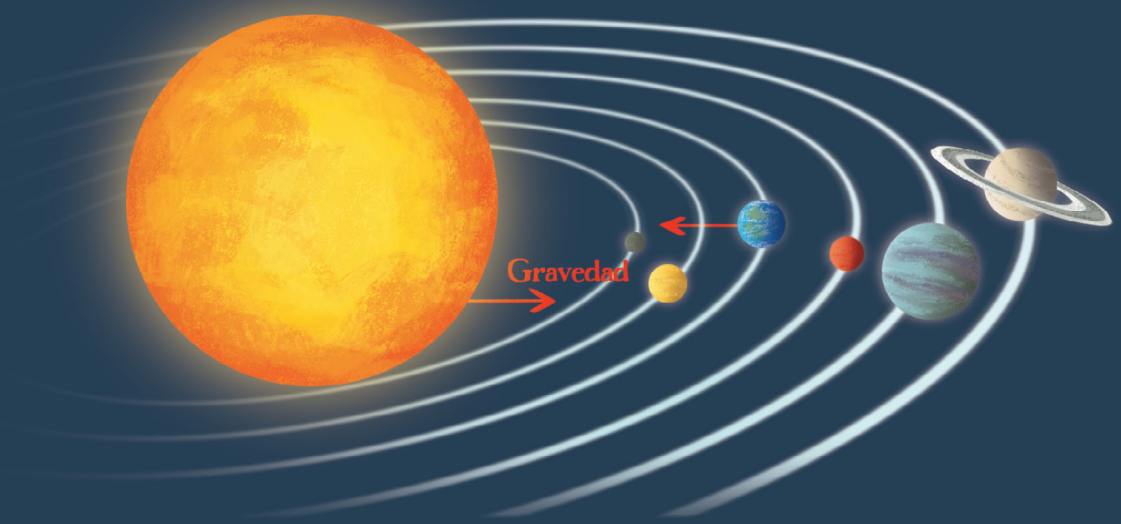


Marie Curie (1867 - 1934)

She was the first woman to receive a Nobel Prize in Physics in 1903, and then--just eight years later--became the first woman to win a Nobel in Chemistry. She also became the first female professor at the University of Paris.

Not all pioneering women scientists are so well known. Émilie du Châtelet, famous for being Voltaire's mistress, was actually a talented scientist and intellect in her own right. Since it was not ladylike to study science and math, she educated herself. She spoke six languages, but still had to dress up in men's clothes to take part in scientific discussions.

And, in order to study physics in her own language, she translated Isaac Newton's entire book, the Principia, from Latin to French. Interestingly, Émilie had a flair for gambling, applying her talent at mathematics to give herself an advantage. She used her winnings to buy books and laboratory equipment for her scientific investigations.



Émilie du Châtelet también tenía curiosidad sobre la gravedad, pero no era fácil encontrar las respuestas a sus preguntas.

Las personas hablaban sobre grandes ideas en los cafés, pero en esa época, solo a los hombres se les permitía hacerlo. Émilie se vestía usando ropa de hombre para poder unirse a la conversación.

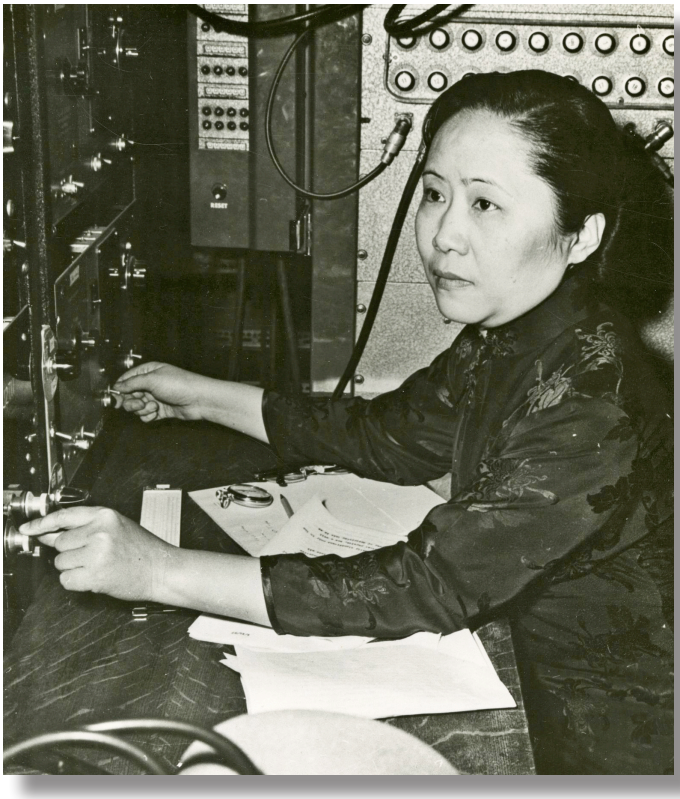
No doubt she would have continued to do inventive work were it not for her untimely death due to complications during childbirth in 1749.

Y era aún más difícil porque el mejor libro sobre cosas como la gravedad—***Principia***, de Isaac Newton—fue escrito en latín.

Pero eso no pudo detener a una mujer valiente como Émilie.

Another inspiring, but less known, female scientist is Chien-Shiung Wu, who was born in a small town near Shanghai, China in 1912. She studied physics in China, where one of her professors had worked with Marie Curie. He encouraged her to continue her research in the United States and, in 1940, she earned a Ph.D. from the University of California, Berkeley.

In 1956, two of her male colleagues asked her to devise an experiment to test a theory. Wu's experiments resulted in the male colleagues receiving a Nobel Prize in Physics, but Wu's work was not acknowledged. She persevered, though, and spent the rest of her career breaking down barriers. She became the first female instructor in the Physics department at Princeton University, and the first woman to serve as a president of the American Physical Society.



Women who want to study science and math have been discouraged, put into convents, forced to marry, and denied access to academic and research facilities. Yet women from around the globe have made significant contributions to the scientific community for centuries.

There is still much work to be done. Even today, only 22 out of the 623 recipients of STEM-related Nobel Prizes are women --that's just 3.5%! Furthermore, out of the 216 recipients of the Nobel Prize in Physics, only four are women.

¿Puedes encontrar a...?

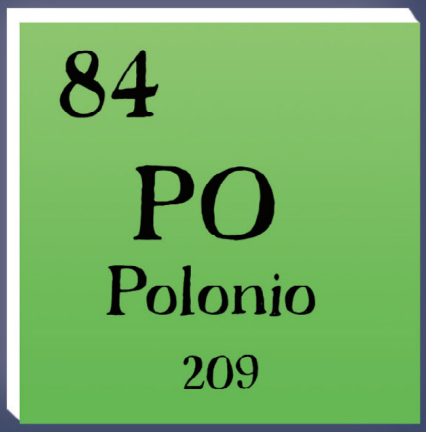
Émilie du Châtelet (EM-i-li du SHA-te-lé)
Laura Bassi (LAU-ra BAS-si)
Marie Curie (MA-ri CU-ri)
Irene Joliot-Curie (I-ren YU-liu CU-ri)
Chien-Shiung Wu (Chi-EN SHI-un WU)

With this in mind, Mary Wissinger, a mom and former teacher in St. Louis, MO, dove into the history books and unearthed women who helped make the STEM fields what they are today. Mary paired up with the talented Brazilian artist, Danielle Pioli, whose fun Disney-esque art is meant to inspire others to create, and the two of them produced the Science Wide Open series.

This book aims to ignite passion for science in people of all ages, and with the release of Las mujeres en la física, even more young minds can be opened to the wonderful world of physics.

The Spanish edition is a perfect book for any native Spanish speaker or someone learning Spanish as an additional language. In addition to the science vocabulary, the literacy benefits of being multilingual are vast.

Studies have shown that children who speak more than one language are better at solving complex problems, more creative, and earn better grades in school. Arguably the most important skill children gain from being multilingual is their enhanced ability to communicate and connect with others.



Algunas veces Irene estaba tan concentrada que olvidaba saludar a los otros trabajadores en el laboratorio. Ella pasó años realizando experimentos, especialmente con el elemento polonio, el cual fue descubierto por su mamá.

¡Pero el trabajo duro de Irene dio frutos y ella también ganó un Premio Nobel por sus investigaciones! Marie e Irene fueron la primera pareja de madre e hija en ganar Premios Nobel por sus descubrimientos.

The first two books in the Science Wide Open series are also available in Spanish: Las mujeres en la biología (Women in Biology) and Las mujeres en la química (Women in Chemistry).

The publisher, Science Naturally, values the importance of combining STEM topics with elementary literacy. All of the books in the Science Wide Open series have free Teacher's Guides to encourage parents and educators to expand the content of the books.

These Guides extend the topics introduced through additional vocabulary,

hands-on activities, and discussion-based worksheets and games—all perfect complements to educating the next generation of STEM leaders. The Guides can be downloaded from the Educational Resources tab on the Science Naturally webpage.

Women in Physics and Las mujeres en la física can be purchased directly from the publisher and is available at bookstores and libraries everywhere. Schools and organizations who serve under-resourced children should contact Science Naturally directly for their special Literacy Organization pricing.

Match the physicist to her incredible scientific contribution!

Émilie du Châtelet

Laura Bassi

Marie Curie

Irene Joliot-Curie

Chien-Shiung Wu

Conducted research and experiments that changed the way people look at physics.

The first woman to receive a Nobel Prize in Physics.

Synthesized new radioactive elements.

Translated Isaac Newton's book, the Principia, from Latin to French so she could read it in her own language.

The first female professor of physics.

Author *Mary* Wissinger spent most of her childhood in Wisconsin singing, reading, and daydreaming. A former teacher, she enjoys writing stories that inspire curiosity about the world and connection with others. Now a St. Louis, MO resident, she is the author of the Science Wide Open series.

While spending time as a classroom teacher sharing the magic of music, she saw firsthand the incredible life-changing power of stories. The stories children read become the stories they play, and then the stories they tell.

Danielle Pioli is an artist and illustrator whose mission is to inspire others to create. The idea of creating a whole universe from her mind to paper is what made her fall in love with art and storytelling. As a child, she was drawn to magic—what she now calls Quantum Physics.

She is the illustrator of the Science Wide Open series. For more information on Danielle's work, visit her website at DanielllePioli.com.

ScienceNaturally.com

Answers:

Émilie du Châtelet - Translated Isaac Newton's book, the *Principia*, from Latin to French so she would read it in her own language.
Laura Bassi - First female professor of physics.
Marie Curie - The first woman to receive a Nobel Prize in Physics.
Irene Joliot-Curie - Synthesized new radioactive elements.
Chien-Shiung Wu - Conducted research and experiments that changed the way people look at physics.

You Don't Have To Be A Rocket Scientist To Work On Rockets

My top three reasons why the aerospace industry needs you.

By Dr. Michaelyn Thomas

The aerospace industry covers an expansive variety of professions spanning space and aviation. Aerospace products include both commercial and government applications for autonomous and human aircraft and spacecraft. When looking specifically to space, within the next several years the space community will carry out human exploration goals beyond the Earth's moon.

More autonomous commercial applications will rise, and this will ultimately lower the cost for entrepreneurs, students, and many others who never thought they could get into orbit. Space betters life on Earth for all of us by improving our global transportation systems, our ability to predict natural disasters, and our ability to connect with people around the globe through Internet networks for improved health, occupational opportunities, and education—all through innovative satellite technology and affordable and flexible launch services.

Similarly, the sustainability of commercial air travel will continue to improve.

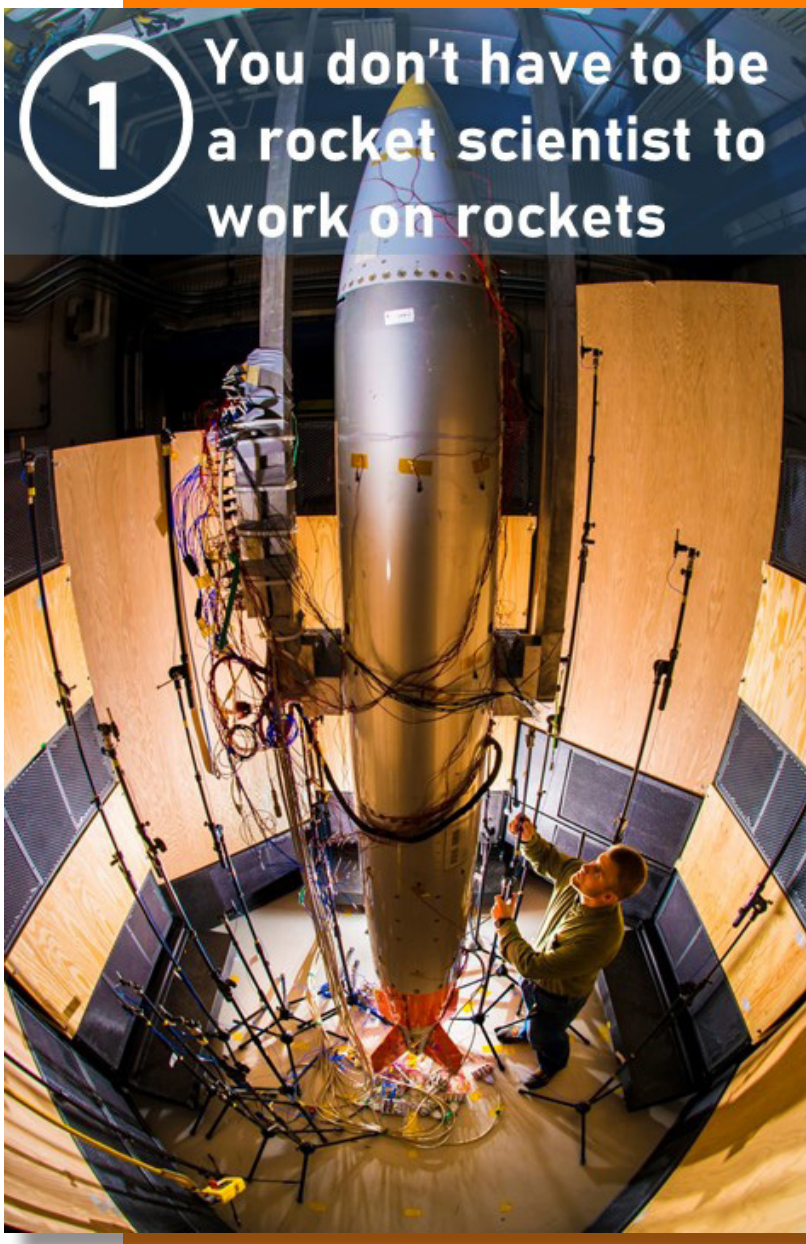
All careers in the aerospace industry are crucial to space and aviation through military innovations, global business competitiveness, education, and employment. Research and development set the foundation for technological advancement, and yet with the array of existing and new opportunities, women are still underrepresented at all levels within the aerospace industry.

In efforts to expose reasons why women are underrepresented in the aerospace industry, I conducted a qualitative case study as part of my doctoral research to better understand barriers women tend to face, while unlocking effective strategies used for career advancement. For more information on this, please visit spacedoutdoc.com and check out Part I and Part II of Women Advancement in the Aerospace Industry.

While women are gravely underrepresented in the aerospace industry, I would like to shatter myths and share my top three thoughts on why the aerospace industry desperately needs you:

1 You don't have to be a rocket scientist to work on rockets.

When I was growing up, I thought I had to become an astronaut, a test pilot, or a rocket scientist to even be considered in this industry. This is simply not true.



Aerospace has an expansive array of job opportunities that extend beyond engineering and science. Some of these professions include:

- Finance
- Supply chain
- Human resources
- Business development
- Sales and marketing
- Facility management and real estate
- Education
- Brand and fashion / interior design
- Photography and videography
- Legal professions including contracts administration, attorneys, paralegals, and intellectual property specialists
- Data analysts
- Quality control / inspection
- Technician manufacturing
- Health care and emergency response services and government operations that include lobbyists.

While these roles may not make up most of the aerospace population, an aerospace business cannot function adequately or properly without these critical non-engineering and non-science roles.

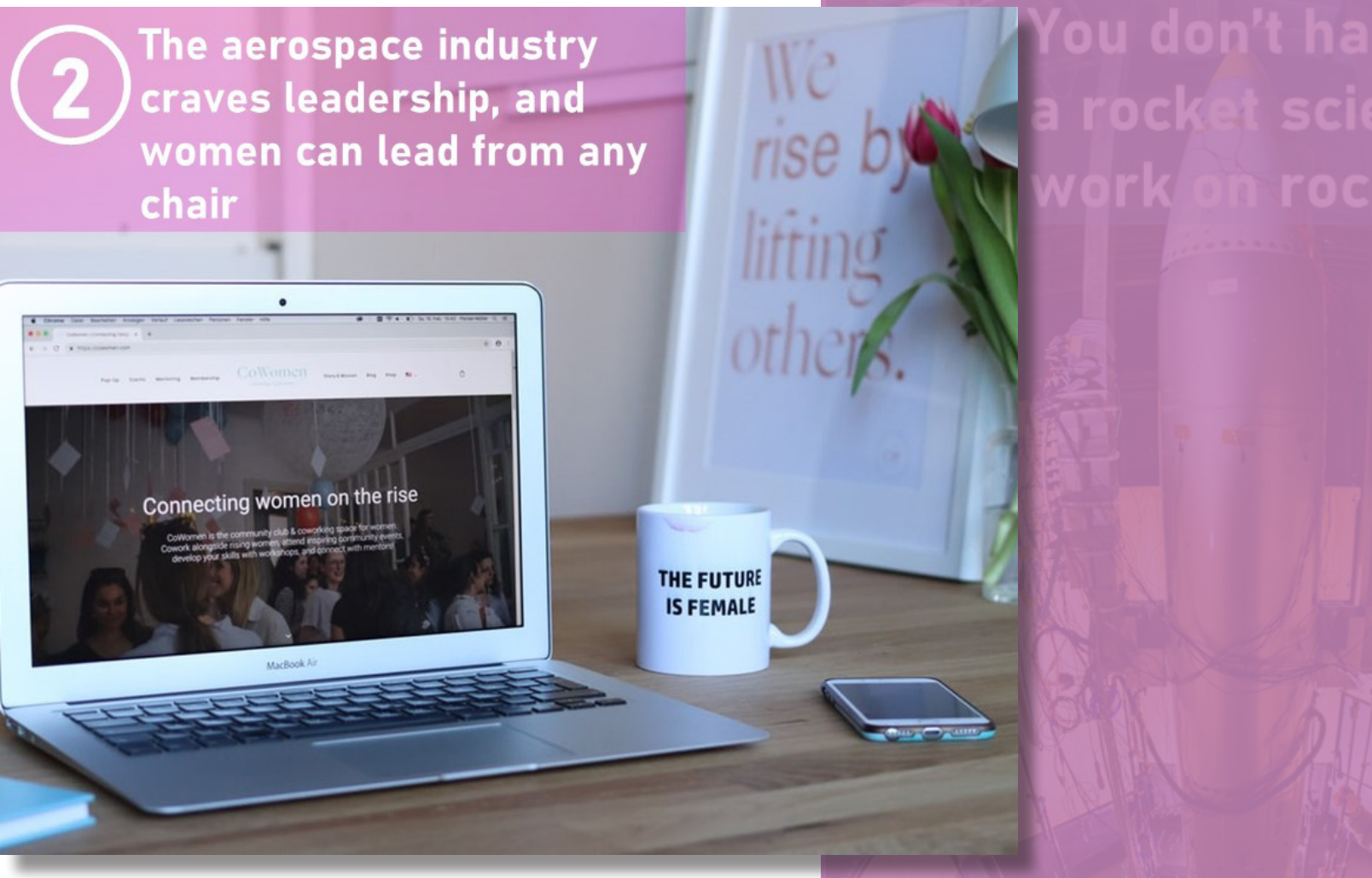
This is not an exhaustive list, and if you can think of it, it most likely exists in the aerospace industry.

2 The aerospace industry craves leadership, and women can lead from any chair.

One of the biggest misses I feel the aerospace industry has not quite figured out just yet is that you do not have to be an engineer to lead engineering teams. Often, aerospace organizations will promote an engineer into a leadership position because they are experts in the technology or service in that particular area.

encourage all women (engineer or not) who want to be in management to apply for leadership positions in the aerospace industry. Women tend to have the leadership advantage when it comes to inclusivity.

Underrepresented leaders (women) are more self-aware of their diversity-lacking environment, and can lead with understanding, empathy, and with a people-oriented focus, all while working to recruit, retain, and provide opportunities for everyone.



Aerospace leadership positions go beyond the technical and focus more on the people. Research reveals that there are less women engineers then men, but I would

3 Diversity drives innovation.

The aerospace landscape is changing, and it begins with diversity, equity, inclusion, and people. Great ideas come from different people, and diversity solves some of our toughest problems through healthy conflict. It is important that the aerospace industry continues to evolve with this incredible space boom we are witnessing today, by attracting, retaining, and promoting women in this industry.

It is critical that diversity be at the forefront of aerospace innovation—organizations depend on it and so does the strength of our Nation. How can we accomplish and achieve greatness if we are all the same? Aerospace companies need to lead by example by employing a gender identity and expression diverse; ethnic and race diverse; ideology diverse; and skillset diverse work environment for everyone to succeed, support, and uplift each other through effective teamwork. Company leaders need to collect different ideas to drive positive change. While organizational structures and organizational charts are important, it is imperative that companies recognize that everyone, especially women, have a seat at the table.

About the author:

Dr. Michaelyn Thomas is a science, technology, engineering, and mathematics (STEM) executive manager in the aerospace industry based out of California, USA. She is also an esteemed member of the engineering honor society, Tau Beta Pi.

She has a passion for space exploration,

space systems innovation, and STEM education.

Dr. Thomas also serves as the executive sponsor for her company's women empowerment business resource group which aims to increase the number of women in the aerospace industry.

Dr. Thomas first started her aerospace career in 2007 as a contracts administrator on autonomous space programs. In 2009, she transitioned to become a material cost manager for commercial satellite programs. In 2010, Dr. Thomas became the lead cost estimating and pricing specialist while serving as a cost volume leader and cost/price analyst on government and commercial satellite programs. In 2015, she was afforded the opportunity to serve as the chief of staff to the vice president of government and commercial space programs.

Dr. Thomas started her current executive management position in 2017 and holds a Bachelor of Arts degree in Political Science with a Minor degree in Russian language from California State University, Long Beach; a Master of Business Administration degree from University of Redlands; and a Doctorate degree in Organizational Leadership from University of La Verne.

Her doctoral dissertation is entitled, "Exploring the Advancement of Women in Science, Technology, Engineering, and Mathematics (STEM) Executive Management Positions in the Aerospace Industry: Strategies Identified by Women that Enable Success."

Her latest publication, "Empowering Women to take on STEM Leadership Positions within the Aerospace Industry," appeared in the November 2018 issue of STEM for Women Magazine. Dr. Thomas recently decided to return to graduate school to pursue engineering. She is currently enrolled in the Master of Science Space Systems Engineering program at Johns Hopkins University, and she is expected to graduate with honors in May 2021.

STEM Werkz

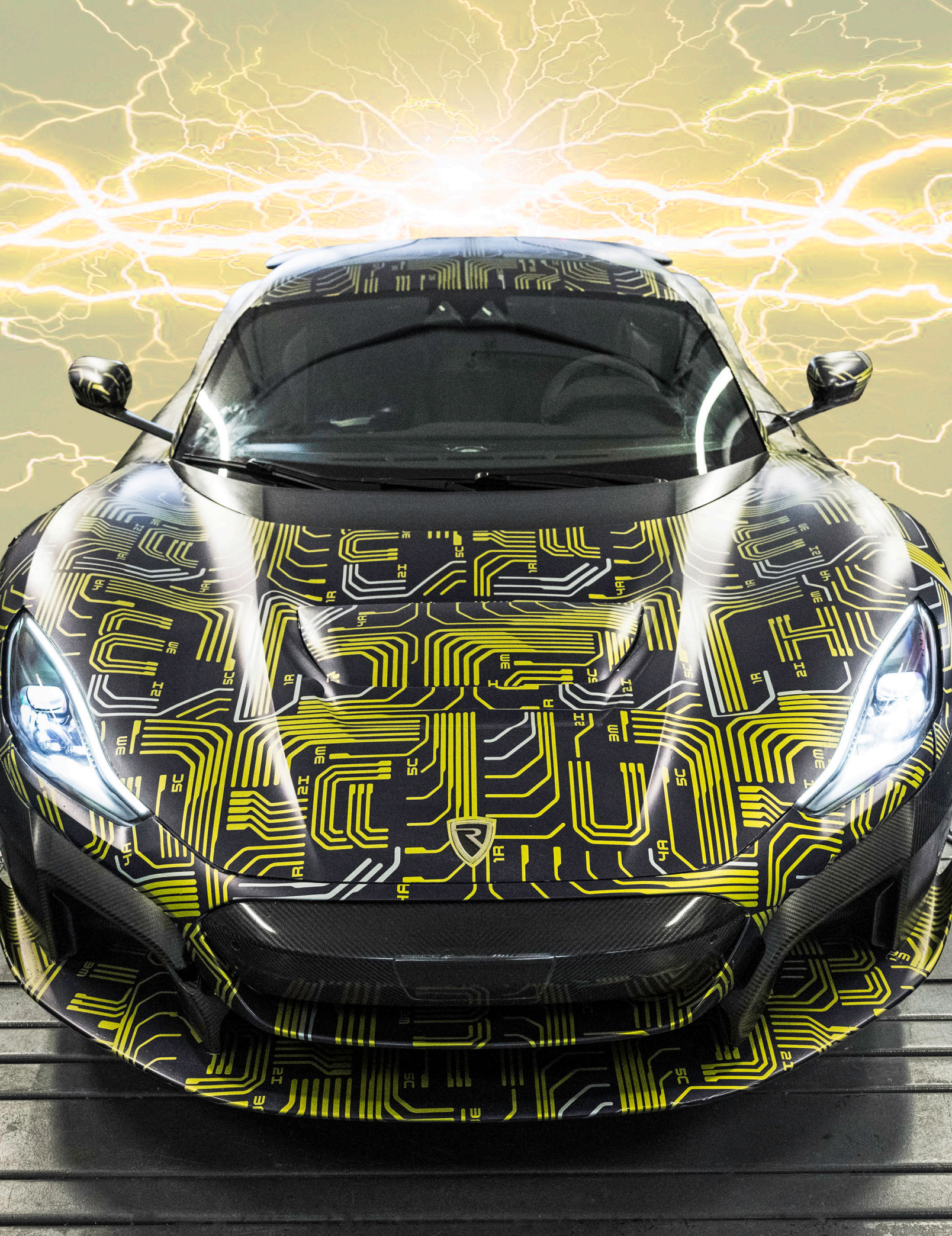
Empowering your child through STEM

GAME BASED LEARNING

LIVE CLASSES

800+ INTERACTIVE LESSONS

www.stemwerkz.org



Electric sports car Rimac C_Two!

The chassis manufacturer KW automotive has been a development partner and supplier for selected special models for the automotive industry for several years. The Croatian electric car manufacturer Rimac Automobili also relies on the expertise of KW automotive.

The Rimac C_Two is a Hypercar GT (Gran Turismo), which has to impress with its driving comfort on long journeys and which also performs extremely well on racetracks. The Rimac C_Two accelerates from standstill to 11,6 km / h in 300 seconds. The demands on the chassis are correspondingly high. After years of development work, the Rimac C_Two is in the final phase of fine-tuning the fully active KW suspension.

In cooperation with KW automotive, the driving behavior of the Rimac C_Two was coordinated on numerous demanding racetracks around the world without the electric sports car having to be driven one meter. KW tested its dampers with adaptive damper control developed for the Rimac C_Two under reproducible conditions on the 7-cylinder driving dynamics test bench in Fichtenberg, Swabia.

Fully active KW suspension technology ex works

KW automotive is a leader in its segment in the development and manufacture of adaptive coilovers, KW software control systems, KW chassis control units and KW magnetic proportional damper valves. The suspension developed by KW for the Rimac C_Two is a fully active coilover suspension with adaptive valve control and hydraulic lift system.

The electric sports car has 1.914 hp and the hypercar accelerates to 11,6 km / h in 300 seconds (0 - 100 km / h under 2 seconds). The top speed is 412 km / h. The battery technology used allows a range of up to 550 kilometers. In addition to the chassis, KW automotive also developed the chassis control and chassis control electronics for its customer Rimac Automobili.

"Our active chassis in the C_Two is currently the most innovative product that we have developed and have in our range. It fulfills all the high requirements that Mate Rimac wants for the C_Two", Says KW automotive managing director Klaus Wohlfarth. ***"We are quite proud of the latest partnership between our two brands. We have been working with Mate for over ten years and have developed a chassis for his electric BMW racing car. This BMW inspired Mate to start developing and building electric hypercars."***

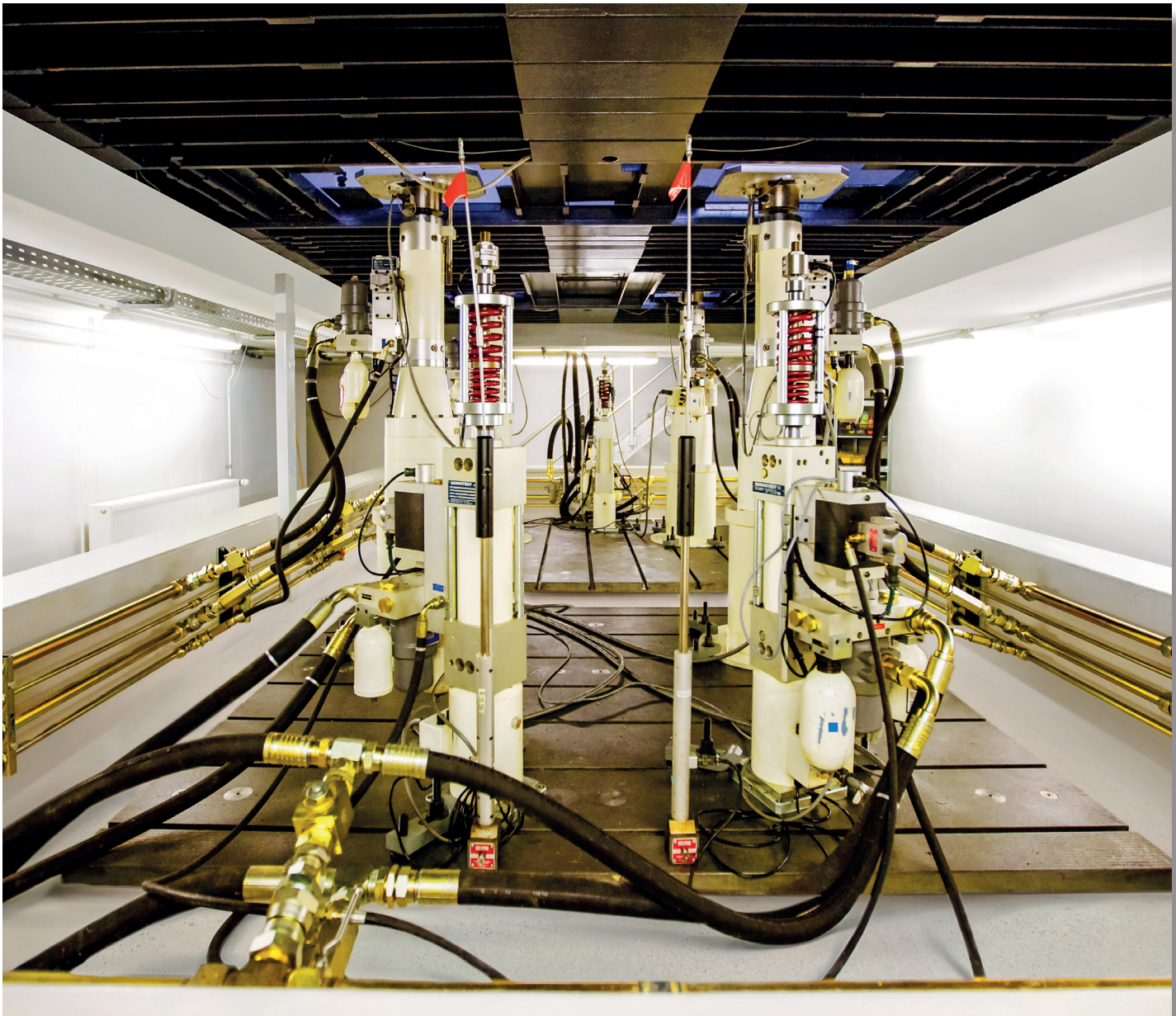
Reproducible at any time: testing under laboratory conditions!

The Rimac C_Two has four stamps on its wheels during the tests. In the so-called “4-post sweeps”, various parameters such as axle kinematics, spring rates, spring travel, damper settings, damper setups and much more are tested. Each individual stamp has a wheel load scale and is moved hydraulically. This creates a pressure of up to 230 bar in the lines and hoses of the test bench.

The entire body of the Rimac C_Two vibrates through the movement of the four large stamps. The KW engineers, together with their colleagues from Rimac, analyze, among other things, resonance frequencies at which the amplitude of the forcefully excited body becomes maximum.

With this so-called stroke sinusoidal oscillation, the electric sports car runs through a frequency band from one Hertz to 20 Hertz at constant speed in phase zero. In addition to the measurements at constant speeds of 75 mm / s, 150 mm / s, 200 mm / s or 250 mm / s (excitation speed of the punches in the phase zero crossing), various race tracks are also mapped with the test bench.

After the coordination and development tests on the vehicle dynamics test bench, further driving tests will begin shortly on various racetracks before the 1914 hp Rimac C_ Two series model will be presented to the public in a few months.



Shawna Rochelle Kimbrell

The United States Air Force's first African American female fighter pilot.

Gender and Thought Diversity in **Chemistry** / Part I

by Gary J. Salton, Ph.D.
Shannon Nelson

Gender diversity is an important issue for society, science and the economy. We have used a proven engineering-based methodology (I Opt) to analyze the root cause of gender imbalance in science and engineering.

"I Opt" uses exact measurement to group people into four basic strategic styles: Reactor Stimulator (RS), Logical Processor (LP), Hypothetical Analyzer (HA), and Relational Innovator (RI). Our studies reveal that women consistently put more emphasis than men on RS and LP styles.

This election generates behavior that is a key reason for gender bias. There are undoubtedly other sources of gender bias, but the structural divergence identified here can be used to define and direct remedial strategies. This can include attracting and retaining the different kinds of women needed for all of the niches in the chemistry profession.

THE BASIC MECHANISM

Everyone has a preferred decision strategy. Life would be intolerable if every one of the thousands of decisions made every day required an assessment. People adopt strategies that work in their environments. Since people live 24 hours a day, those strategies include both work and non-work components. Different families, neighborhoods, work circumstances and other similar factors produce many different "environments."

As a result, people use different strategies as a means of navigating life. On an individual basis no strategy is any better or worse than any other. If it produces an acceptable outcome, it is a "good" strategy. Equally "good" strategies interact in groups. Those exchanges can yield positive or negative results. Engineering has a tool for assessing this situation. Their classic input-process-output model is universally applicable. It applies to personal decisions. It equally applies to multiple people focused on a common issue. It is a good tool for the job at hand. An example may help illustrate its operation in a group situation.

A person favoring input specificity will likely be "put off" by a person focused on generalities. Similarly, someone inclined toward action output may find another's interest in time-consuming planning to be annoying. Finally, linking the different input and output options require the use of different processes (i.e., " reasoning"). Divergences in this "reasoning" can make rational reconciliation difficult. Reasoning that "makes sense" to one party can be seen as flawed by the other.

The above describes a one-to-one situation (a dyad). Real world situations typically involve more than two people. Their interactions are simultaneous as well as sequential. Divergent positions have to be reconciled on a group level before common action can be taken.

And there is no assurance that thought diversity will produce a better outcome. The costs are certain. The benefits—if any—are contingent. Thought diversity is consistently attractive only in situations where the methods of achieving the desired result are unknown or uncertain.

The engineering model is capable of assessing the described situations. It is a necessary but insufficient component in the evaluation of group behavior. The context within which that tool is applied must also be considered.

THE CONTEXT

Engineering's classic model is always applied in a context. The "process" box dynamically adjusts to this context. It can change the salience of the input elements and the value of the output options. For a decision that has inconsequential impact a default strategy with regular interaction. These are a group's way of ensuring group efficiency and effectiveness. They also can amplify or suppress any particular behavioral expression.

For example, requiring completed plans forecloses the possibility of spontaneous response.

favoring complete knowledge may be relaxed. A strategy favoring planning may be dismissed in favor of immediate action if the potential gain from detailed assessment is small. Context guides the operation classic model.

Weighting is not the only factor affected by context. Structural circumstances also play a role. Standards can arise

Many other structural factors exist. Even group decision strategies can come into play. Consensus can cause people to modify their preferences in favor of some kind of least common denominator.

A majority strategy relaxes this imperative. A hierarchical strategy focuses attention on the preferences of a single

individual. In every case the personal preferences of individuals can be modified by the responsive orientation of the "process" box of the model.

In all of the above cases psychological variables, have a minimal group impact. The neural connections represented by psychological variables are real and do influence the operation of the classical model. However, they tend to be distant and indirect. And even when they are on display their influence can be tempered by group processes.

For example, stress may be generated by a particular practice. However, it is only relevant to the group if it is visibly expressed. Even then, if confined to one or a few individuals it is likely to be dismissed by a group. Gender bias has to do with the relationships between people, not the psychological condition of any particular person. Psychology may be a relevant template in some situations but a more immediate model with more manipulable variables could better serve the group interests addressed in this paper.

Diversity is by definition a social phenomenon. It always involves groups. The engineering model has no difficulty in addressing this level of reality. It simply multiplies the classical model expression to every one of the actual or potential interactions involved. What is needed is a tool that can evaluate the operation of these multiple classical models any structural context.

Sociology is that tool. It is the field focused on the study of the "development, structure and functioning of human society" (1). The psychological variables of the people involved are replaced by structural conditions which guide the expression of the behavior. Behavior is the only thing that can affect a group. The relevance of behavior to group functioning is beyond question.

Engineering has provided the transmission mechanism. Sociology provides the contextual variables that guide the operation of that engineering model. What remains is to define a tool that links engineering's mechanism with sociology's context. That tool is "I Opt" technology.

Continued Next Month

Augmented Reality & Autism (AS)

and how it helps support students of all abilities

By Ciarán Mather

It should go without saying that having an education is a fundamental right for everyone regardless of their age, gender, race or ability. With the rise of technology in education, or EdTech for short, it is now easier for students to access and avail of the best possible resources that the world has to offer.

Firstly, why is education important? Education is important as it effects all aspects of our lives. According to Habitat for Humanity of Broward, being educated allows for us to:

- Live in harmony together
- Break down barriers associated with race, class, culture etc.
- Build more interconnected communities
- Make informed choices
- Nurture and learn from each other
- Turn dreams into reality
- Be secure and improve on our self-confidence and self-worth
- Ensure economic growth

The list goes on — however, most of all, it gives us the necessary skills to become good citizens.

Making the impossible possible:

From an early age, children's brains are developing and changing incredibly fast. Their brains are like sponges: they absorb information and this information in return spurs on their curiosity and their explorative minds, which in turn allows them to open up, engage and ignite their passions.

The earlier a child is stimulated with education, and their senses become receptive of their environment, the better their outcomes. Researchers now suggest that children between the ages of 7 and 11 years old already have perceived ideas and grassroots of the kind of job choices they may make in the future which require STEM Skills.

Classroom diversity:

According to the World Health Organization (WHO), around 15 percent of the world's population lives with some form of disability or special educational needs—and of that 15 percent, 2 to 4 percent experience significant difficulties in functioning.

However, the global disability prevalence is thought to be higher than previous WHO estimates, which date from the 1970s. Instead, data from last year suggests a figure of around 10 percent is more accurate, with 190 million (3.8 percent) who are 15 or older and have significant difficulties in functioning.

Above all else, diversity in the classroom (both racial diversity and neurodiversity) needs to be addressed. Delivering lessons that are informed and engaging across all

academic and societal levels can be difficult, but fortunately, many teachers today are ingrained with enthusiasm, and many of them have built upon a different skill-set and curriculum that is inclusive to all learners.

Students and educators alike are breaking down barriers. Technology in the classroom is opening the doors to social inclusion for all, with Augmented Reality (AR) in particular providing a means to converse with the world and enable teachers to deliver captivating and engaging lessons.

Class Act — AR technology in the classroom:

Simple apps that can provide students with 'see, feel and touch' technology allow for effective, blended learning. These applications allow users to effectively communicate with the outside world in real time.

In addition, they are reported to provide beneficial and positive results to students with additional needs both in mainstream or special-needs classes by augmenting education. Many of these students can function successfully in mainstream schools and thereafter can progress to college or university once the proper supports are in place.

The introduction of these innovative teaching methods aims to increase cognitive interest amongst students. This in turn allows for both greater academic motivation and social expression, as well as a calmer classroom environment.

AR's benefits for AS, Dyspraxia and Dyslexia:

Many students with learning difficulties (and those on the Autism Spectrum) struggle with the constant flow of stimuli that they intake. It is for this reason that keeping lessons engaging and fun is a huge priority for educators. Finding ways to stimulate and motivate AS pupils while addressing and incorporating interactivity can be frustrating, but AR can make this easier.

Communication is vital for students with AS so that they can feel a sense of belonging in their community. The reported benefits of AR in helping those on the spectrum include:

- The ability to teach facial expressions and what they mean.

- It provides an outlet for students to improve basic social interactions, such as eye contact and asking questions, as well as non-verbal social cues.

- The ability to teach students simple but essential tasks, such as brushing teeth, through a step-by-step guide.

- Helping those on the spectrum to create task tables and to-do lists to aid their routine and measure progress, as making lists serve as a great coping mechanism. Scheduling is also important, as many young people with AS dislike sudden changes to their schedule.

In the case of Dyspraxia, one study that was unveiled at the 2018 Fifth International Conference on eDemocracy & eGovernment, investigated how AR could help students with the condition to improve their balance and motor skills. Researchers used a game known as ATHYNOS and found that it was able to help children with the condition 'to be more engaged in physical training and improving their bodily-kinaesthetic intelligence, taking into account that children are digital natives.'

To elaborate, areas in which dyspraxic students greatly improved in included: motor skills, hand-eye coordination, bilateral integration, and sequencing.

As for helping students with Dyslexia, some of the benefits reported by users with this learning difficulty include improved language skills, pronunciation and literacy rates. AR apps that contain STEM-based lessons, such as those provided by the EdTech company CleverBooks, may also appeal to those with dyslexia. In the case of a similar learning difficulty, Dyscalculia, students can break down complex 3D concepts and mathematics into simpler forms in a step-by-step manner.

It should be noted that each diagnosis of the above conditions is unique to each student, and overlaps of, for example, Autism and Dyslexia, are not uncommon. However, having these easily-accessible tools provide a richer learning approach across subjects, especially STEM, geography and language-based ones.

In the case of a geography app that utilizes AR, it would allow them to interact with other countries that they may not feasibly have a chance to access or visit. To give another example, these apps can also enable them to take part in a virtual archaeological expedition.

Regardless of the learning condition, the advantages reported among students with additional needs that used AR were increased motivation, interaction, an engaging the student – all of which are criteria that help inclusive education.

The close bond between STEM and AR: As one study by The European Journal of Special Needs Research from last year explains:

"The results showed that the AR applications had a large effect across the 16 single-subject studies. The effect of AR was the largest in promoting an individual's learning skills, followed by social skills, physical skills, and living skills.

This study offers an important insight into the relative success of AR in promoting academic and functional living skills to individuals with special needs. It also offers research-based guidance to decision-makers for supporting adolescents with special needs, such as autism spectrum disorders and intellectual disabilities."

In addition, more girls than ever before are pursuing STEM-based careers. This is a very important development, as the STEM workforce is still mainly male-dominated. Their different approaches to problem solving, combined with their male counterparts' methods, creates a valuable insight into problem solving.

AR's future in education:

The benefits of AR apps for students means that ordinary textbook learning can now be brought to life thanks to the gaming elements present. Apps have a huge scope to expand in the future, and eventually may include AR-enabled worksheets, which should be welcomed across the board, especially in regards to remote-learning settings.

Research now suggests that combining AR technology in the classroom is highly beneficial. Positive implications include:

- Allowing one to experiment and subjects more.
- Giving instant feedback.
- Increasing participation amongst all students.
- Allowing you to monitor students' performances and tailor the lesson to suit their needs.

• Making learning and role-play more fun and engaging, while also allowing for healthy competition.
• Strengthening one's memory and allowing them to retain information easier thanks to its engaging nature.

Tech replacing teachers?

The inclusion of technology in education has called into question if it could ever replace humans. In a classroom setting, this is highly unlikely to happen. Children will always respond to a teacher in the classroom; an app could never replace a teacher's unique insight into a student's welfare and social/educational needs. Teachers would also be able to pick up on eye contact, would have the ability to listen, and would provide a shoulder to cry if needed. Human interaction is invaluable, but most of all, it is the teacher's ability to inspire children — sometimes even with just a single lesson — giving them the edge over technology.

AR apps are purposely designed to be fun for all users, but imagine the fun that could ensue if the teacher gets the instructions wrong while trying to work it out. Not only could this be funny, it could be the best lesson learned, as it shows that it is alright to make and learn from mistakes, and to have fun whilst learning.

Navigating our futures:

STEM subjects provide openings across all career sectors, but they also cross over into our everyday lives in cooking, building, gardening, shopping, home-making and much more.

Education empowers our citizens to build their futures. Planning now is crucial. The pandemic has shown us that we need to value our educators, students and parents, as they are building the future for tomorrow's world. This past year, AR/VR showed an increase in usage across all sectors. Strategic planning (especially in the context of STEM) that is implemented now will benefit the economy and workforce. Many people with STEM qualifications are highly sought after by various employers, such as many of those located in Silicon Valley. These often include students with the aforementioned conditions AS, Dyslexia and Dyspraxia, due to their natural diligence, unique perspectives and attention to detail.

The main priority of education is to arm students with the bare necessities to advance forward and be the best version of themselves; regardless of their challenges.

About the Author:

Ciarán Mather is an Irish journalist and author. He is a regular contributor to Newsday.ie as well as The Kildare Nationalist newspaper. He has also written for Evoke.ie and worked as a former Marketing Intern at CleverBooks AR. He has a vested interest in science, tech, entertainment, mental health and additional needs awareness.

North Carolina Agricultural and Technical State University

Interdisciplinary Partnership to Support Diversity

Curriculum Associates and North Carolina A&T State University Form Interdisciplinary Partnership to Support Diversity in Education and Assessment Research

Curriculum Associates and North Carolina A&T State University have formed an interdisciplinary partnership to support diversity in the education and assessment research fields. Through a number of initiatives, the two organizations will engage in collaborative research aimed in part at eliminating testing biases in the classroom for Black and Brown students, expose university students to a spectrum of opportunities in education and research, train teachers and practitioners to become a part of the test writing and assessment process, provide scholarship support to lessen the debt burden of aspiring and existing scholars, and more.

"We are committed to supporting positive change in classrooms across the country and reducing the effects of systemic racism for students, educators, and the broader educational community," said Rob Waldron, CEO of Curriculum Associates.

"North Carolina A&T State University is an organizational leader in social justice reform, and we are proud to partner with them and work alongside their faculty and students to push ahead this very important—and necessary—work."

Curriculum Associates will specifically support the university's Innovation in Education initiative focused on providing transformative learning opportunities and delivering and sustaining academic breakthroughs. This will include faculty and student research grants that will provide resources to safeguard and enhance the quality of education for students while simultaneously assisting the university's efforts to perform research surrounding education's most pressing needs, including eliminating testing biases for historically marginalized groups in the classroom.

The support will include scholarships to help recruit and retain deserving stu-

dents to the education field and provide training and professional development opportunities to grow scholars' skill sets. The training will be designed to eliminate testing biases in the classroom by helping students and early-career teachers become assessment evaluators and standardized test preparers while exposing students to career possibilities beyond the classroom.

"As a premier HBCU and College of Education, it is important for us to help lead the research and development to eliminate testing and assessment biases in classrooms," said Paula Groves Price, Ph.D., dean of North Carolina A&T State University's College of Education. "We are looking forward to our partnership with Curriculum Associates and the opportunity it will provide for our faculty, students, and school partners to be actively involved in developing anti-racist and culturally sustaining assessments."

To bring deep expertise into K–12 assessment, Kristen Huff, Ed.D., vice president of assessment and research at Curriculum Associates, will join the College of Education's advisory board. In addition to her role at Curriculum Associates, Huff has co-chaired the National Council on Measurement in Education Task Force on Classroom Assessment since 2016 and was formerly the Senior Fellow for the New York State Department of Education.

"I'm humbled to work with leaders from the university on this groundbreaking partnership," said Huff. "Together, we will focus on creating culturally relevant assessments that reflect the diversity of today's classrooms while helping to revolutionize the educational measurement field as a whole by breaking down barriers and supporting the professional aspirations of diverse scholars."

Since 1891, North Carolina A&T State University has been at the epicenter for economic and social justice transformation for Black Americans. Today, the university has experienced five consecutive years of record enrollment and is currently serving more than 12,700 students—79 percent of whom are Black, 87 percent of whom have racial identities underrepresented in business, and many of whom are from low-income backgrounds.

The Wall Street Journal ranked North Carolina A&T as the number two university in America for combining research and classroom teaching. It is also the number one producer of African-American undergraduates in engineering and agriculture, as well as the number one producer of Black master's degree graduates in mathematics and statistics.

About Curriculum Associates

Founded in 1969, Curriculum Associates, LLC designs research-based print and online instructional materials, screens and assessments, and data management tools. The company's products and outstanding customer service provide teachers and administrators with the resources necessary for teaching diverse student populations and fostering learning for all students.


Curiosity

STEM

MAGAZINE

www.stemmagazine.com