

University of San Diego

Digital USD

San Diego Regional Climate Collaborative

The Nonprofit Institute

9-2023

The Value of STEM as an Educational Tool for Enhancing Cognitive Development

Alessandra Olmedo Robles

Leaders 20/20

Follow this and additional works at: <https://digital.sandiego.edu/npisdcclimate>



Part of the Curriculum and Instruction Commons, Early Childhood Education Commons, Elementary and Middle and Secondary Education Administration Commons, Elementary Education Commons, Environmental Sciences Commons, Nonprofit Administration and Management Commons, and the Science and Mathematics Education Commons

Digital USD Citation

Robles, Alessandra Olmedo and Leaders 20/20, "The Value of STEM as an Educational Tool for Enhancing Cognitive Development" (2023). *San Diego Regional Climate Collaborative*. 35.
<https://digital.sandiego.edu/npisdcclimate/35>

This Report is brought to you for free and open access by the The Nonprofit Institute at Digital USD. It has been accepted for inclusion in San Diego Regional Climate Collaborative by an authorized administrator of Digital USD. For more information, please contact digital@sandiego.edu.

THE VALUE OF STEM AS AN EDUCATIONAL TOOL FOR ENHANCING COGNITIVE DEVELOPMENT



What is STEM Education?

STEM is an acronym for Science, Technology, Engineering, and Math. The focus of STEM education is to provide a holistic approach through hands-on, problem-based learning where students are able to take what they learn in the classroom and apply it to real world problems. Incorporating STEM at earlier ages leads to a better understanding of our surroundings and enhances cognitive development for students while improving their ability to become stewards of the environment. This aids students in succeeding throughout their educational journey and future careers. Another important aspect of early STEM education is that it teaches students to interact with mathematical and numerical data in an intentional way that increases their scientific literacy. This, in turn, helps students identify key concepts and further develops their ability to understand and apply this data analysis to the world around them. This is an essential skill for any career students wish to pursue.

STEM education can help drive our society towards Innovation Culture, or the implementation of creative ideas and conscious sustainability through schooling to provide a foundation for students of any background to have a holistic education. Giving students the chance to relate material to their own lives, as well as learn through hands-on activities, allows students to have a creative and active mindset.



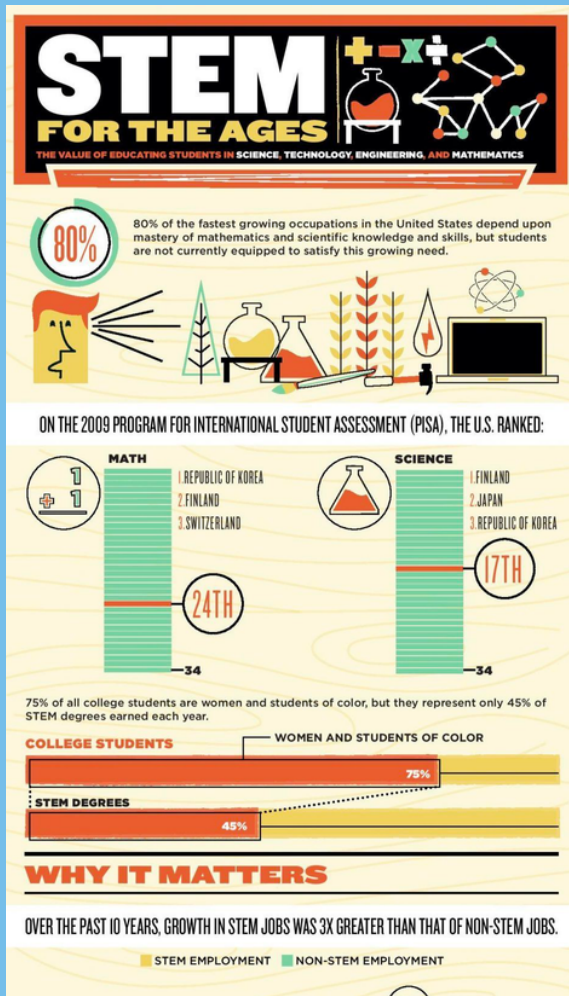
The Importance of Early STEM Education

Scientists and researchers have long discussed the importance of incorporating STEM into the educational curriculum at earlier stages. This is due to the benefits of early exposure to STEM, which enhances cognitive development and promotes critical thinking skills that can be utilized by students in their future careers and daily lives. Currently, early STEM education is introduced between the ages of 5 and 12 and has been proven to be a critical promoter of child development as well as an indicator of how students will view the world and interact with it as they age. Although there are schools throughout the country that have already implemented early STEM education into their curriculum, this integration must occur nationally.

Introducing STEM at a younger age sets the foundation for students to see themselves as capable of enacting positive change. By instilling creativity and innovation through exposure to STEM, young learners are able to view problem-solving as second nature and stay engaged with their surrounding environment. Creating an environment that encourages STEM in early education can have lifelong impacts on students as well as our environment. One of these impacts is that it allows students to be introduced to the effects of climate change at an earlier age. Students become involved in addressing climate impacts and have the opportunity to be a part of the solution earlier in life which helps drive climate action forward.

In addition, exposing younger students to STEM in age-appropriate ways has positive impacts across the learning spectrum including literacy and executive functioning. Through STEM education, students are able to reach their full potential and create innovative work. Research shows that the trajectory of technology and its growth can be further supported by early STEM education. In addition, this implementation creates a guide for a better lifestyle. Providing students with an in-depth STEM background affords greater opportunities for them to thrive in a global STEM workforce and have a prosperous economic future. Through a holistic introduction to science, technology, engineering, and math, students are able to develop critical thinking skills for real-world problems that allow them to advance in higher education and use those skills for future technological occupations, advancements, and opportunities.

STEM Education for a Successful Future



The implementation of STEM in public education would increase the support students receive to prepare them for higher education and onwards. "More adults will require re-tooling and upskilling to continue in the future workforce."¹ This demonstrates the need to train students to adapt to new environments. Educators must guide students as they age and new information and technological advancements become available. As a result, we must make sure that technological innovations are present in the classroom and that teachers are appropriately trained to incorporate them into their curriculum. In addition, technology must be accessible to all students, regardless of background. Providing opportunities for students to interact with STEM will improve their adaptability to technological change.

Providing support for holistic learning must be done equitably. When discussing equitable access, funding is one of the most important considerations, especially in STEM focused classrooms. The National Science Foundation Board points out in their Vision 2030 Plan the need to grow STEM education to keep up with the globalization of science and technology. This plan aims to invest in creating and developing talent within the classrooms as early education must incorporate STEM.

Ocean Discovery Institute

Ocean Discovery Institute's goal is to continue "providing continuous science opportunities, paired with mentoring and the tools to overcome challenges to unlock [students'] potential."² The free program also has pop-up events for San Diego students enrolled at various schools in the surrounding areas. Resources to support growth and leadership development programs are combined with rigorous science programming and college and career services. They prepare students for the present and future through their values of learning, leadership, community, and justice, and by encouraging the imagination of endless possibilities



San Diego Coastkeeper: BIPOC Youth Science Program



The San Diego Coastkeeper BIPOC Youth Science Program is designed to create and develop campaign work around the community to enact equitable policy. SDC partnered with Groundwork San Diego-Chollas Creek and Outdoor Outreach to provide more resources for students in the community. Through their advocacy work, SDC has focused on making "a pathway for BIPOC students in Chollas Creek to network, connect, and work with environmental organizations around San Diego"³ while learning about the impacts daily actions have on the environment. In addition, this no-cost program empowers students to care for their communities through field-based learning and outdoor excursions.

Climate Kids: San Diego

Climate Kids: San Diego dedicates its program and funding to educating the youth on climate change through science, art, and storytelling.⁴ Established and administered by the Climate Science Alliance, Climate Kids is able to introduce topics of climate change and natural resource conservation through storytelling, art, and science. Through their robust partnership with the San Diego Natural History Museum, they provide students with accessible knowledge on how the environment has been protected for millennia and how it should continue to be protected.



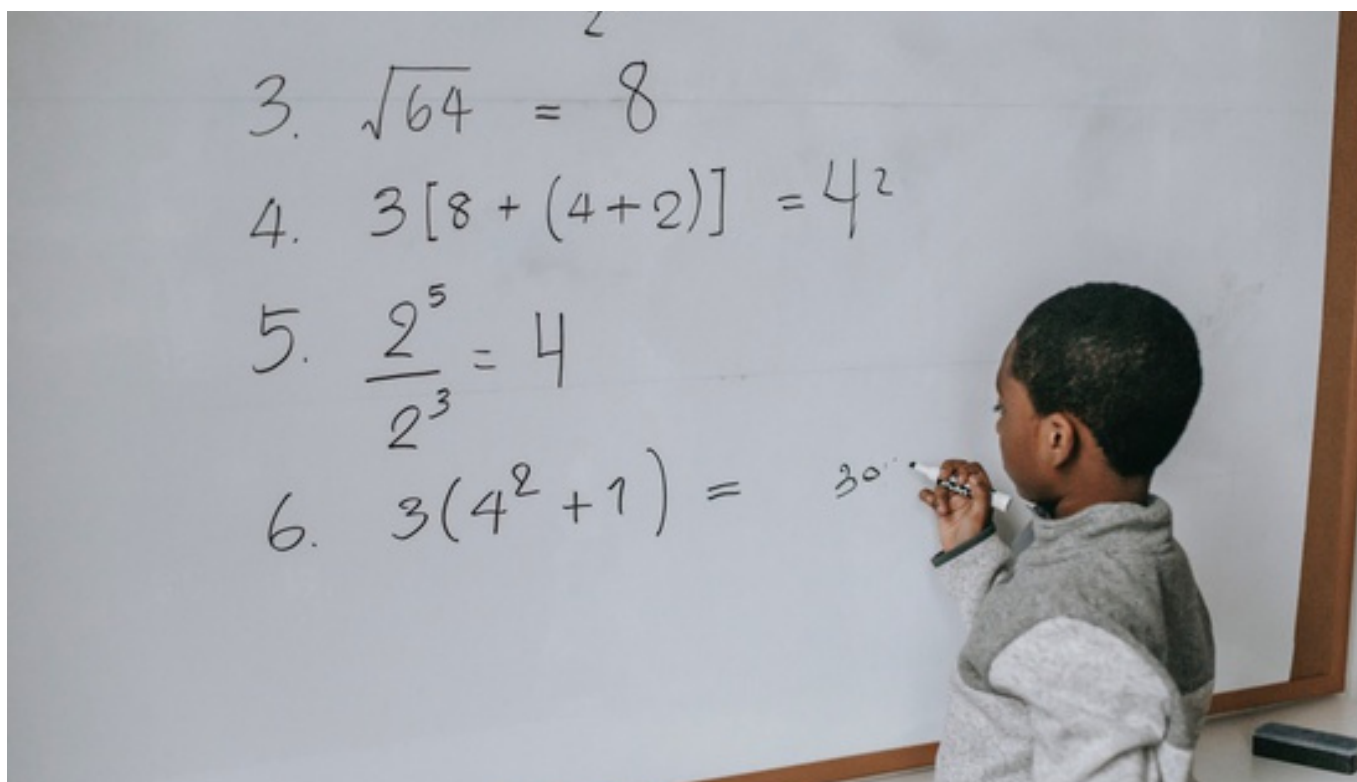
UCSD EarthLab Station



The University of California San Diego's holistic program, EarthLab Community Station, focuses on preserving and creating more outdoor climate action parks in three locations within the San Diego-Tijuana region.⁵ They focus on teaching and assuring that research is conducted collaboratively between UCSD researchers and communities, through the integration of the Indigenous practices of the Kumeyaay people. EarthLab aims to provide lessons and activities designed to improve the scientific, ecological, and cultural literacy of students while demonstrating accountability of individuals towards the world around them. Conversations include energy conservation, water, and food distribution, as well as conservation infrastructure throughout the greater San Diego area.

STEM Should Be in Every Classroom

Due to historical disparities students face in the education system, it is essential to maintain an equitable approach. Students who have various real-world obstacles in their personal lives have a harder time focusing on theoretical problems within the classroom. Implementing equity through access to resources and education allows students to thrive despite social barriers. Appropriate funding for a successful delivery of STEM education should support opportunities outside of the traditional classroom space such as labs, additional tutoring, and after school programs. This contributes to forging the gap for equal educational access and opportunities. Our future lies in the classrooms; current students will one day have the power to enact change that can affect millions of people throughout the world. It's important to view education not just as an investment, but as the future we are building. Innovation culture cannot function without equity and inclusion for all students in all spaces. Planting a seed towards education by funding schools, programs, and training opportunities for teachers to continue to develop their educational approaches creates a sense of belonging and care that enhances students' cognitive development.



Sources

1. STEM Education for the Future: A Visioning Report. *National Science Foundation*. (May 2020) <https://www.nsf.gov/edu/Materials/STEM%20Education%20for%20the%20Future%20-%202020%20Visioning%20Report.pdf>
2. Ocean Discovery Institute. <https://oceandiscoveryinstitute.org>
3. San Diego Coastkeeper: BIPOC Youth Science Program. <https://www.sdcoastkeeper.org/science/bipoc-youth-science-program>
4. *Climate Kids: San Diego*. <https://www.climatekids.org/programs>
5. UCSD: EarthLab. <https://gjustice.ucsd.edu/earthlab>
6. Holmlund, T., Lesseig, K., & Slavitt, D. Making sense of "STEM education" in k-12 contexts. *International Journal of STEM Education*. 2018 August 24. <https://stemeducationjournal.springeropen.com/articles/10.1186/s40594-018-0127-2>
7. Funk, C. & Parker, K. Diversity in the STEM workforce varies widely across jobs. Pew Research Center. 2018 January 18. <https://www.pewresearch.org/social-trends/2018/01/09/diversity-in-the-stem-workforce-varies-widely-across-jobs/>
8. Fuad, D., Musa, K., Hashim, Z. Innovation culture in Education: A systematic review of the literature. *Sage Journals*. 2020 October 5. <https://doi.org/10.1177/0892020620959760>
9. Parker, C. Stem education is the key to raising a generation of climate change leaders. *Changing America*. 2020 May 13. <https://thehill.com/changing-america/opinion/497609-stem-education-is-the-key-to-raising-a-generation-of-climate-change/>
10. The Roots of STEM Success: Changing Early Learning Experiences to Build Lifelong Thinking Skills-Why Now is the Time for Institution-level Thinking in STEM Higher Education. https://fpg.unc.edu/sites/fpg.unc.edu/files/resources/presentations-and-webinars/CCC_The_Roots_of_STEM_Early_Learning_0.pdf
11. Storksdieck, M. *Transforming Institutions: Undergraduate STEM Education for the 21st Century: Transforming Undergraduate STEM Education: Responding to Opportunities, Needs and Pressures*. Purdue University Press. 2016
12. Weaver, G. *Transforming Institutions: Undergraduate STEM Education for the 21st Century: Introduction*. Purdue University Press. 2016 <https://www.jstor.org/stable/j.ctv2x00vcx>
13. Waters, C and Orange, A. *Transformative STEM Approach*. *Journal of Pedagogical Research*. Volume 6, Issue 2, 2022. University of Houston-Clear Lake. 2022. <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://files.eric.ed.gov/fulltext/EJ1339684.pdf>
14. Waters, C. & Orange, A. *Science, Technology, Engineering, and Math, including Computer Science Report*. *Journal of Pedagogical Research*. <https://www.ed.gov/stem>

The Leaders 20/20 Network is a young and emerging professionals network that provides education and civic engagement opportunities around our region's quality-of-life issues while offering professional development and networking opportunities to create confident leaders in this space. It is currently housed at The Nonprofit Institute at the University of San Diego.

