

STEM Education: For Future Success

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ABSTRACT

Learning experience in informal science, Technology, Engineering and Mathematics (STEM) educational settings, such as camps, provide significant benefits for secondary students such as awareness of STEM subjects and career along with increasing enthusiasm Self-efficiency and content knowledge. The aim of this study is to evaluate the studies about STEM education in mathematics and science disciplines between the years of 2010-2015 through the content analysis. STEM – based education teaches children more than science and mathematics concepts. The focus on hands on learning with real world applications helps develop a variety of skill sets, including creativity and 21stcentury skills. The best feature of the STEM education system is that it transforms the students into professionals who can adapt to a changing workplace. In an ever changing, increasingly complex world, it's more important than ever that our nation's youth are prepared to bring knowledge and skills to solve problems, make sense of information, and know how to gather and evaluate evidence to make decisions. These are the kinds of skills that students develop in science, technology, engineering, and math, including computer science—disciplines collectively known as STEM/CS. If we want a nation where our future leaders, neighbours, and workers can understand and solve some of the complex challenges of today and tomorrow, and to meet the demands of the dynamic and evolving workforce, building students' skills, content knowledge, and literacy in STEM fields is essential. We must also make sure that, no matter where children live, they have access to quality learning environments. A child's zip code should not determine their STEM literacy and educational options. In this paper the researcher try to analyse the various aspects of STEM education for future success.

Keywords: STEM Education, STEM Literacy, STEM Subjects

The term —STEM education| refers to teaching and learning in the fields of science, technology, engineering, and mathematics. It typically includes educational activities across all grade levels— from pre-school to post-doctorate—in both formal (e.g., classrooms) and informal (e.g., afterschool programs) settings. Federal policymakers have an active and enduring interest in STEM education and the topic is frequently raised in federal science, education, workforce, national security, and immigration policy debates. For example, more than 200 bills containing the term —science education| were introduced between the 100th and 110th congresses. The United States is widely believed to perform poorly in STEM education. However, the data paint a complicated picture. By some measures, U.S. students appear to be doing quite well. For example, overall graduate enrollments in science and engineering (S&E) grew 35% over the last decade. Further, S&E enrollments for Hispanic/Latino, American Indian/Alaska Native, and African American students (all of whom are generally underrepresented in S&E) grew by 65%, 55%, and 50%, respectively. On the other hand, concerns remain about persistent academic achievement gaps between various demographic groups, STEM teacher quality, the rankings of U.S. students on international STEM assessments, foreign student enrollments and increased education attainment in other countries, and the ability of the U.S. STEM education system to meet domestic demand for STEM labor. Various attempts to assess the federal STEM education effort have produced different estimates of its scope and scale. Analysts have identified between 105 and 252 STEM education programs or activities at 13 to 15 federal agencies. Annual federal appropriations for STEM education are typically in the range of \$2.8 billion to \$3.4 billion. Although the use of STEM concepts (historically) were being implemented in many aspects of the business world; i.e., the Industrial Revolution, Thomas Edison and other inventors, it was not being utilized in traditional educational settings. The use of STEM was primarily used in engineering firms to produce revolutionary technologies such as the light bulb, automobiles, tools and machines, etc. Many of the people responsible for these innovations were only slightly educated and/or were in some type of apprenticeship. For example, Thomas Edison did not attend college (Beals, 2012), nor did Henry Ford; although Ford did work for Thomas Edison for a number of years. These —giants| of innovation used STEM principles to produce some of the most prolific technologies in history: however, STEM in education was virtually non-existent (Butz et al., 2004).Although the use of STEM concepts (historically) were being implemented in many aspects of the business world;

i.e., the Industrial Revolution, Thomas Edison and other inventors, it was not being utilized in traditional educational settings. The use of STEM was primarily used in engineering firms to produce revolutionary technologies.

WHAT IS A STEM EDUCATOR?

STEM can have different meaning to different people. STEM in higher education is somewhat straightforward. A student enrolled in a STEM related program, other than teacher education, is in a stand-alone STEM field. For example, if a student is majoring molecular biology, they will enter the STEM workforce as a scientist. They may or may not be exposed to technology, engineering or mathematics that specifically pertains to their field, but chances are they will be exposed in some way shape or form. Therefore, integration in terms of STEM may or may not occur; however, it must be noted they are within a STEM field. This is not the case with teacher education. Consider a High School Science Teacher that just teaches science, but does not integrate technology, engineering or math into their curriculum or that do not collaborate with other STEM faculty. Although this teacher is in a STEM field the fact that they do not integrate or collaborate makes them just a science teacher, not a STEM educator.

Why is STEM Education Important?

The importance of STEM education is intricately tied to society's technological and scientific advancements. The National Science Foundation maintains that students will need a strong foundation in STEM subjects in order to be successful in the information-driven age. STEM education and the application of technology empowers every student to use their creativity and develop their critical thinking skills. The benefits of STEM education are also far reaching for students of all ages and backgrounds as recent years have seen initiatives intended to add more females and minorities to STEM fields. STEM is an acronym that stands for four content areas and skill sets that are in high demand in the 21st Century: Science, Technology, Engineering, and Math. STEM education programs emphasize the connections among these fields. A biology lesson in which the teacher assigns a textbook chapter and questions about animals' physical adaptations is just a science lesson; a STEM project might require students to research physical adaptations and build a prototype of a prosthetic limb for an animal in captivity. The acronym STEAM includes the Arts in addition to the four STEM fields described above. Incorporating the Arts into core content areas allows students to process and apply information across multiple modalities and senses, which increases understanding and retention. (Some schools have STREAM programs, where the R stands for reading.) If you're already incorporating STEM or STEAM activities into your regular curriculum, take in a step further by using STEM student portfolios as a form of assessment. STEM education is a teaching approach that combines science, technology, engineering and math. Its recent successor, STEAM, also incorporates the arts, which have the "ability to expand the limits of STEM education and application," according to Stem Education Guide (opens in new tab). STEAM is designed to encourage discussions and problem-solving among students, developing both practical skills and appreciation for collaborations.

STEM in Schools

There are a variety of ways in which teachers can introduce STEM into the classroom. This sample STEM lesson plan provides teachers with a step-by-step guide on how to properly introduce the concept to their students. It involves a video lesson then allows students to develop their own STEM lesson. Once teachers introduce STEM education to their students, they can analyze their classroom and determine how STEM projects and activities can be incorporated into it. Classroom set-up for STEM classes is key when it comes to implementing projects and activities. STEM projects and activities for elementary to middle school students can include sensory water bottles, a bridge building challenge, or building a volcano. Teachers at the high school level can implement projects that involve all of the STEM fields. One such project would be a water quality survey where students would utilize underwater robots to collect data from a body of water. Teachers have the option for students to design their own robots or utilize purchased kits. STEM education is an essential, relevant, and continual endeavor for all students. STEM education enables analytical and critical thinkers; increases science, mathematics, and technology literacy; fosters the next generation of innovators and entrepreneurs; provides opportunities for students to engage in 21st-century skills of teamwork, collaboration, problem solving, communication, and creative thinking; and offers learning experiences in which students apply what they are learning in relevant, meaningful ways.

The promotion and advocacy of STEM education

Teachers, school administrators, school boards, and district leaders should identify common goals and pathways to create a shared vision and definition of STEM teaching and learning for their communities. Teachers of STEM should be provided with resources necessary to implement quality STEM education in their classrooms, including opportunities for professional growth and learning through continual and sustained training, mentoring, and support services, as they plan, develop, and execute their STEM lessons and units.

Schools and districts should continually provide access to technologies, materials, tools, and resources to facilitate the application of integrated STEM teaching and learning. Schools and districts should recognize that STEM education begins as early as preschool and provide accessible educational experiences that span the preK–16 spectrum. This includes embracing new approaches to STEM teaching, creating new definitions of learning success, and considering new ideas about the physical structure of the educational environment so that it is more inclusive and conducive to exploration, discovery, and design iteration. Schools and districts should implement models of professional learning and ongoing support to sustain changes in pedagogy, including instructional methods that promote learning for adults that mirror the methods to be used with students.

National Attention to STEM

National and state education policymakers renewed efforts begun in 2006 to improve the overall mathematics, science, and technology literacy of U.S. students. These efforts became known as the Science, Technology, Engineering, and Mathematics, or STEM, initiative.

Although many of the nation's public schools had already begun a greater focus on mathematics and science as part of their core curricula, new academies, as well as existing educational institutions, took the focus one step further. Applying for, and receiving, government and private business grants set up for STEM education initiatives, these schools aggressively promoted the concept with the express goal of graduating students competent in a variety of STEM subjects. Schools pursuing these goals explored a variety of approaches such as smaller class sizes of 10 to 12 students with a one-to-one student/computer ratio, inquiry based teaching methodologies, and an active partnership with technology businesses that provide real-world applications for STEM subjects. Whatever innovative approaches were put into place, the STEM educational blueprint was paramount: integrating technology into the daily educational experience, specially trained teachers who knew how to best present these subjects, inquiry-based interactive teaching methodologies and, of course, a robust curriculum with adequate knowledge assessment practices.

STEM EDUCATION FOR EVERYONE

Innovation boosts the economy

With the tech-boom currently, there's a new gadget out every few hours and it's hard to keep up with the trends. However, these trends help boost the economy and create jobs. We need skilled STEM experts to help develop the next successful antibiotic or cure for a disease. US need engineers and developers to create the next new phone or a computer that learns faster than a human. We also need those math-savvy folks to help us understand big data, make sense of our economy, manage finances and explore space seamlessly.

Bridging the gender gap

The gender gap between the workforces in the largest tech companies only gets bigger as you move up the ladder towards leadership roles. Most believe that this gap is related to lack of opportunities available to girls to explore technology when they are younger and gender biases also play a role. However, this gap will slowly start to reduce as more STEM education opportunities are made available to girls around the world.

Talent pool

It is important for companies to have top talent to stay on top of the competition in their industries. And this pushes them to employ talent that will help them stay relevant now and in the future. They need to have the best research and development teams, financial advisors, engineers, web and app developers and designers. Companies are now investing in STEM education programs all over the globe in hopes that they will be able to nurture the next generation of innovators.

STEM education creates other 21st century skills

Developing STEM skills will help children in any future skill they would want to pursue. As STEM learning enhances the expertise to take up research, investigate, look at multiple perspectives and make relevant connections. 5. Solve Real-World Problems It encourages spatial reasoning, thinking, problem solving, and creativity. This helps students to look at problems from different angles and come up with unique solutions.

STEM education in India is the much-needed revolution in the education industry that has the potential to reshape the child's future. There are two basic methods of learning- Rote Learning & STEM learning The first method of learning is the traditional Rote learning which is based on memorizing the information based on repetition. Common Examples of these include memorizing the multiplication tables, periodic table, etc. Although Rote learning is practiced throughout the country for years the drawback of this type of traditional learning is that the students don't get a better understanding of the subject. Also, there is no connection between the new and previous knowledge memorized by the student. There are many

wonderful benefits offered by STEM education in India some of them are given down below: It explains to the students how they can solve real-life problems by using the knowledge which they acquire from STEM learning. It teaches various types of useful innovative skills to students such as computational thinking, problem-solving skills, Creative thinking, logical reasoning, better decision making, and good observation power. By successfully performing the experimentation the students will build self- confidence among them which will help them a lot in their overall development. The students will understand the true value of teamwork when they engage in performing STEM-related activities together. They will also understand the power of team management and collaboration by understanding their individual roles in the team properly. The students will understand with ease the subject which they feel difficult to understand through the theoretical means. With the help of learning by doing the student will develop a solid foundation about the concept and will be able to implement it in solving real-life problems.

What type of challenges are faced by STEM education in India?

There is a misconception about STEM education among the educators that it will divert the students from their regular studies and they will not give proper attention to their textbook curriculum in that stipulated amount of time. But this is not true. STEM learning can go hand-in hand with the academic curriculum and cultivates the young innovators of the future. There is no qualification requirement for STEM teachers, thus it is possible that the teacher might not be well-versed in the subject domain which he/she is teaching the students. Thus, hiring highly experienced teachers in their respective domains is the need of the hour. The STEM education program mostly starts from middle school which most of the Education Expert believes is too late for getting the student's attention. According to these experts, the STEM education in India must be introduced from elementary school so that the students will develop a solid foundation of STEM-related subjects.

The STEM education in India programs is for every student but it is commonly observed that only the naturally motivated and well-prepared students will benefit more from this STEM learning program than the under-performing students. It is the responsibility of teachers to make sure that all the students are on the same level of STEM education. If a student understands a concept at a slow pace then the teacher needs to provide proper guidance to that individual student.

What are the benefits of STEM Education?

Preparing students to be successful in their careers is emphasized in STEM education. The knowledge and skills gained go beyond what they will need to be advantageous in their careers.

It helps you stay current

Technology is always changing. Since we live in a technology-based society, we are in contact with it every day. Keeping up with technology through STEM education helps us stay up to date with vital knowledge.

It allows you to be innovative

Other skills acquired through STEM education include creativity, leadership, decision-making, acceptance of failure, critical thinking, problem-solving, and more. No matter what career path students plan to follow, these skills will help them be innovative. The basis of innovation is critical thinking and challenging standards. Innovation is an essential component of economic growth. The potential to change the world lies in critical thinkers. Just take a look at inventors who have made our world what it is today.

It helps you make a difference

The ability to create an impact on a large number of people is a side-effect of STEM education. As technology advances, turning ideas into inventions become easier. Finding cures, building shelter, and inventing ways to speed up communication are examples of things that have already made a difference. So, when future technology and STEM education are paired, the possibilities we have to make a difference for tomorrow become endless.

It prepares for Higher Education

Problem-solving and critical thinking are not just real-world skills gained from STEM education. They are also valuable skills needed for test-taking. Students with STEM education score higher on SATs and take fewer remedial classes when they start college.

It boosts confidence

Meeting challenges and solving complex problems are ways to boost confidence tremendously. STEM education takes it a step further. STEM classes require students to communicate their findings, defend their positions, and have meaningful discussions. When you can do this, you exude confidence.

It teaches 21st-century skills

STEM education teaches more than math and science concepts. A variety of skills, including creativity and 21st-century skills, are developed through hands-on learning with real-world applications.

Examples of 21st-century skills:

- Communication
- Productivity
- Initiative
- Flexibility
- Social skills
- Technology literacy.
- It gives you a higher income.

CONCLUSION

STEM education—encompassing science, technology, engineering, and mathematics—is more than just a curriculum; it is a critical foundation for future success in an increasingly technology-driven world. As global challenges become more complex and interconnected, the demand for skilled professionals who can innovate, problem-solve, and adapt has never been higher. By fostering curiosity, analytical thinking, and creativity, STEM learning equips students with essential tools not only for career readiness but also for informed citizenship in a digital society.

Investing in STEM from an early age helps build a pipeline of talent prepared to lead advancements in health, sustainability, communication, and infrastructure. Moreover, it promotes equity and inclusion by opening doors to high-demand, high-paying jobs for underrepresented communities. With strong STEM education, we empower future generations to become not only consumers of technology but also its creators and leaders.

In conclusion, the future belongs to those who can think critically, solve real-world problems, and harness the power of science and innovation. STEM education is the key to unlocking this potential. To ensure global competitiveness, economic growth, and societal well-being, we must continue to prioritize and expand STEM opportunities for all learners. The future starts in today's classrooms

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