Pramāna
International Refereed

Impact Factor : 4.005

Research Journal (ISSN : 2249-2976)
Year-7, Issue-30 (Oct-Dec. 2018) (Page No. 381-386)

Stem Education System : A Futuristic Approach in Indian Context

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Abstract

"STEM" stands for science, technology, engineering, and mathematics. The STEM education system uses a structure of encapsulated learning by methods of application based educating, which helps in successfully building up the basic leadership and strategizing abilities of kids. Science, Technology, Engineering, and Math, collectively known as STEM, are the four primary academic domains which are currently responsible for development of the entire world's economy and maintaining general well-being of individuals . Thus, in order to develop children into the leaders for future , it is essential for them to be have proficiency in the fields, along with development of critical thinking abilities, knowledge about engineering concepts and design processes, a high creativity , and problem solving skills. This paper highlights the importance of STEM education system in the Indian subcontinent by focusing on those concepts that relate to the domains of science and technology. . It is a systemic discussion of innovation to identify the barriers in innovation, and outline potential directions for effective innovations . There has to be a provision for recommendations for the growth of educational innovations. As examples of innovations in education, it is must to highlight online learning and time efficiency of learning using accelerated and intensive approaches and strategies Also, it is a application in a wide variety of industries and job roles including aerospace engineering, astrophysics, biochemistry, chemical and civil engineering, computer science, nanotechnology, robotics, and many more.

Key-Words : STEM, Science and Technology, Mathematics, Engineering , Education, Logical Aptitude , Indian Subcontinent .

Introduction

STEM in its true sense is called as Science, Technology, Engineering and Mathematics is termed as the academic discipline that corresponds to the modern education system. Education, being a socio cultural foundation serves the needs of society, acts as an indispensable factor for the society to survive and thrive. It should be comprehensive, sustainable, and superb, and continuously evolve to meet the challenges of the fast-changing and ever evolving globalized world. This evolution is systemic, consistent, and scalable; therefore, school teachers, college professors, administrators, researchers, policy makers and other stakeholders are expected to innovate and modify the theory and practice of teaching and learning, as well as all other aspects of this complex process to ensure quality development of all students . It is a systemic discussion of innovation to identify the barriers in innovation,

and outline potential directions for effective innovations . STEM is based on curriculum and the idea of educating students in four specific disciplines — science, technology, engineering and mathematics . It is an interdisciplinary and applied approach. Rather than teach the four disciplines as separate and discrete subjects, STEM integrates them into a cohesive and collaborative learning paradigm based on real-world examples. In case of India, STEM education holds a great significance as it enables the students to learn in a scientific, systematic and logical manner, and also to become future ready. Students need to learn, update, explore and continuously enhance their cognition by various innovative ways and methods. The Indian economy is in need of more and more new skills and new mindset. STEM Education can convert the envisioned dreams into real scenario.It is strongly believed that students with STEM Education will have a better understanding of India's emerging socio-economic challenges.

Importance of STEM Education : The aim of STEM is significantly important to help in creating positive attitudes for present, people and planet. The futuristic prosperity of the country is associated with ways of providing opportunity of learning. STEM education will be helpful in making the students more responsible towards their country's economy. When appropriate opportunities are provided to children early in their lives, STEM can instill in them a keen interest in not only to gather knowledge about predefined subjects, but even in exploring, questioning, discovering and innovating anything that is new and unknown .STEM Education increases the possible maximum involvement of students in the entire learning process. It strengthen their understanding of of concepts and apply them in variety of situations inside and out of school. It is very much helpful in developing their power of reasoning, enrich mental ability and boost confidence and also develop mastery over computational skills and other basic scientific process.

Tsupros, (2009) said *STEM education is an interdisciplinary approach to learning where rigorous academic concepts are coupled with real-world lessons as students apply science, technology, engineering, and mathematics in contexts that make connections between school, community, work, and the global enterprise enabling the development of STEM literacy and with it the ability to compete in the new economy.* According to the above definition by Tsupros , it is evident that STEM is preferred over other conventional methods of educating because of the development of below mentioned advantages:

Development of cognition skills : The STEM education uses a framework of embodied learning by means of practical based teaching, which helps in effectively developing the decision making skills in children. The use of embedded instructions makes it easier for the students to engage themselves in commanding their attention to de-contextualised and not arranged information placed in a meaningful manner . This helps in creating an experience to all the senses in children that accelerates the learning, deepens engagement, improves focus attention, and generates genuine excitement towards the subjects .

Pursuing of Career : STEM supports in incorporating some industry defined skills, talents, and specialized skills in children, so they can pursue and move forward in their careers which are in demand . As a result, it helps the professionals in defining their assigned roles and career outcomes and fulfill the demands in international fields. It is important to understand that young minds need to be motivated towards skill development that will be in demand in future when they step out in vocations and working arena. It requires equal participation from teachers and parents, as the latter must also motivate their wards to engage themselves into STEM activities and develop awareness and interest at home and in extracurricular activities

so that children are able to develop their skills as per STEM curriculum .

What makes STEM education different from the traditional science and math education is its blended and integrated approach towards producing learning environment and telling students how the scientific ways can be applied to everyday life. It teaches students about computations and focuses on the real world applications of problem solving methods . As mentioned before, STEM education begins while students are very young:

- **Primary level school** — STEM education throws light on the introductory level STEM courses, and awareness of the STEM domains and vocations. This entry step provides standards-based , structured inquiry-based and real world problem-based learning, including all four of the STEM subjects. The goal is to inculcate students' interest into them wanting to complete the courses, not because they have to. There is also an emphasis placed on bridging in and out of STEM learning opportunities.
- **Middle school** — At this stage, the courses become more rigorous ,challenging and complex . Student awareness of STEM courses is to be pursued, as well as the academic requirements of such fields are fulfilled. exploration of STEM related careers by students begins at this level.
- **High school** — The program of study focuses on the application of the subjects in a rigorous manner. Courses and pathways must be made available in STEM domains and vocations, as well as preparing students for post-secondary education and employment. More emphasis must be placed on bridging in and out school STEM opportunities.

Some of the ways STEM learning can be made possible for Indian students

- By integrating STEM courses into the curriculum, children can be helped in enhancing their problem solving skills, to discover how things work, to invent new processes , to explore engineering as a career option, to engage themselves in reality based engineering issues, develop critical thinking, improve creativity, inculcate them with collaborative and cooperative feelings ,to communicate about new inventions, and more.
- By developing a enjoyable environment, it helps students to explore the concepts of building, manufacturing and construction through hands-on practical explorations, designing and architecting with practical knowledge of the engineering .
- By conducting Environmental Engineering classes, the students might get help to design, create, manufacture , test, and refine various solutions related to alternative and sustainable energy and environmental issues, and to know the principles behind crafting efficient machines and discover how those machines can be used to help increase the sustainability of resources.
- **Through networking and computational sciences, students can programme to avoid or overcome bugs and other obstacles and reach an end goal.**
- To develop such programme that allows students to design and program robots to help accomplish environmentally friendly tasks and to learn how to contribute to a more sustainable environment.

Scope of STEM : STEM offers a golden opportunity for students to tackle and deal with problems by mastering in these four subjects of STEM and their allied subjects. The solutions through STEM education include developing new methods which aims at finding means to tackle and solve the problems. These subjects are vital for development as they fuel the innovation power of the generations of today and future. STEM-based education opens up various streams of vocations in different industries. If this population develops interest in

STEM, can be trained , India can have an enviable and efficient workforce that could accelerate the growth of Indian economy. This explains the reason for India's requirement to adopt STEM based education system. Today, every developing country must emphasize STEM education to develop their competitiveness in science and technology development. **As a result of its rising popularity across the globe in several countries like Australia, United Kingdom, The United States, New Zealand, India has to adopt STEM education.** Teachers should be trained to conduct and carry out learning modules and workshops based on the STEM protocols , using interactive, easily identifiable approaches. This will definitely build an education system that not only revolves around teaching students a predefined set of subjects, but rather, knowledge they can actually use in the reality and throughout their lives, and hence leading to a better future .

STEM in Indian Context : In reference to India, STEM education holds a significance as it makes the students to learn in a scientific, systematic and logical way, and also to become future ready. A robust STEM based education system creates critical and logical thinkers, problem-solvers, and next generation innovators and scientists. Taking into consideration that India is one of the countries that produces the largest number of scientists and engineers, the growth of STEM has significantly increased over the last decade. Contemporary and ever evolving needs of the globe is in dire requirement of adopting several scientific and technological methods. STEM is an acronym term used to address that education policy and curriculum choices in schools based on the grounds of science and technology . Allied fields such as astrophysics, biochemistry, computer science, robotics, nanotechnology, neurobiology, and many others are based on a solid foundations of STEM curriculum. The aim of STEM based education system is to create and develop an ever lasting interest among students and to encourage them to choose a career in this challenging field. Interaction based learning concepts based on interdisciplinary techniques and project-based methods facilitate creative and logical thinking and collaborative learning. The STEM programs also highlights the problems and challenges faced by students due to lack of unskilled and inexperienced teachers to teach those subjects. Our students need to learn, update, explore and continuously enhance their knowledge base by various innovative ways and means. The Indian economy will need more and more new skills and new mindset. STEM Education can convert the envisioned dreams into reality.

Increasing Demand of Stem Education in India : India is at a stage where the number of STEM based occupations are growing at an accelerated pace and currently giving the world the number of STEM graduates. According to the National Science Foundation, a prediction is made that 80% of the vocations will require some form of math and science skills. Despite having the quality talented young minds , the exam-focused education model in India has limited the students when it comes to innovation, problem-solving and creativity. This is where the STEM curriculum come in to bridge this gap.Researches shows that children develop interest in STEM subjects at an early age. This is due to the reason that technology and gadgets always fascinate them. But, the jump from being a user of such technologies and gadgets to an innovator is hard to do and, if at all it is possible , it is a very slow transition. The evidences of associating bridge between engineering-technology-entrepreneurship is missing in Indian system of education. It is essential that educational institutions must be provided with the tools and techniques and funding to include STEM into their curriculum and bring it to the classroom, inspiring young minds.Trained and skilled people are needed to fill the void in technical domain. Children who enroll themselves in the STEM courses are at a greater

advantage for availing jobs. According to research, there will be a significant increase in jobs STEM-related fields within the next decade through out the world. .Indian educational stakeholders should be able to acknowledge the responsibility to perform against the fundamental right to education by instilling the STEM into the currently improvised curriculum. Giving equal opportunity of STEM education to every child can provide a meaning and long term investment in *Skill India* mission The beauty of STEM is to give freedom to all the learners *by doing and learning by themselves style.*

Challenges for Implementation of STEM in India : One of the biggest hurdle in the process of implementation of STEM education in India is to design and manufacture the required infrastructure, curriculum and to acquaint children with the best guidance and counseling . Another challenge can occur in terms of funding. Institutions do require money for construction of infrastructures of the STEM education. Many of the educational stakeholders do think that by including STEM in currently running curriculum , students will get distracted from their studies and they would not be able to complete their curriculum in the stipulated amount of time. The only way to solve this is by making all the stakeholders of education sector aware about the positive results of introducing conventional classrooms to STEM learning approach. Nations across the globe are moving forward this methodology by introducing national curricula which apply the STEM methodology. Upon realising the potential of a STEM, Indian should to make the transition in traditional system of education. Being the second densely populated country with unmatched talent and culture, India needs a collaborative support from government and other education stakeholders to avail the benefits of STEM education. Now, with the Government of India also focusing on campaigns like 'Make in India' Mission, there is focus on creating innovation among the youth . This is considered as the right time for India to develop a culture of application-based learning and innovation. India must have "STEM education for all" mission. Mini Science Centre mush be established in the schools. The first focus should be on building of teachers' capability of teaching science and technology in the modern education regime. Teachers well-equipped to impart STEM play an important role in guiding children. As the most populous with supreme diversity in talent and culture, we need a collective efforts from government and others working on education to avail the opportunity and benefits of STEM education.

Actions to Promote STEM in India : Nowadays all the educational institutions are taking steps to incorporate activities that would encourage critical thinking scientific temperament in students. The conventional school system in India is inclined towards putting emphasis on the STEM curriculum. From kindergarten to senior secondary, teaching process is being woven into the STEM system to make the child more adjusted to real life situation. However, these efforts need to be done on a large scale for impactful results.

To mention, some workgroups have to be created to help young minds learn the art of cooperation in these fields rather than working singly . These specialized educational institutions must have an innovative curriculum that simulates daily faced situations to make the students more attuned to future needs.

Measures should be taken to integrate STEM learning into the National Education Policy by government of India. The aim of this venture is to create a platform where young minds are encouraged towards science and technology. The policy is aimed to encourage, develop and implement exciting, mentor-based programs that inculcate interest towards science and technology in the minds of young people, inspiring them to meet the challenges of the global, technology-driven society through innovation, collaboration, and creative problem-

solving.Early learning of science and technology will create appropriate encouragement in choosing right career paths of future and become technology leaders. Some of the programs of the Government of India include **Atal Tinkering Lab Solutions** helps to create a scientific temperament in students. It is an initiative under the Atal Innovation Mission (AIM) at NITI Aayog with the objective to develop curiosity, creativity, and imagination in young minds. To sustain innovation in globalization, supporting STEM curriculum is important. It is crucial for future innovation as it can help lead to solutions to global challenges such as cancer, global warming, hunger, and many more. Universities must support this global initiative by lining all their programme and courses with the vision of bolstering India in the science and technology realm.

Conclusion

Most of the courses in STEM curriculum is aimed towards attracting and dealing with developing and underrepresented populations. Especially in India , female students, for example, are significantly less likely to pursue a college degree that follows STEM curriculum . The best way to ensure success it is to make sure that students must get opportunities to learn STEM education at school level. Though there is nothing new, the gender gap in choosing STEM subjects has significantly increased at an alarming rate in the recent past. Male students are also more intended to pursue engineering and technology oriented courses, while female students are likely to prefer science subjects , like biology, chemistry, and allied subjects of humanities. Overall, it is keenly observed over the past decades that male students are three times more likely to be interested in pursuing a STEM career. Global market economy will gain a lot from embracing the benefits of STEM. But the current curriculum in colleges are not totally focused towards STEM subjects. Current curriculum hardly inculcates scientific temperament in students. Students should be motivated to learn STEM courses in an interactive manner. Globally also, there is a need for developing future, cutting-edge, technological advancements. Building a strong STEM foundation through a compulsory curriculum is the best way to ensure that students are exposed to math, science, and technology throughout their academic career.

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