Revitalizing STEM Education

Why in News?

Recent studies show that a vast majority of students graduating from private engineering colleges, the newer Indian Institutes of Technology (IIT) and universities colleges lack the basic skills that are required by industry.

What is the importance of STEM research in India?

- **STEM** – It is the umbrella term used to group together the distinct but related technical disciplines of science, technology, engineering, and mathematics.
- **STEM Graduates** - India contributes 31.7 per cent of the total STEM graduates in the world, and has one of the world's largest STEM job markets.
- **Skill Development** - STEM equips students with all of the knowledge, skills, and abilities required for success in industries like engineering, computing, computer science, and biotech.
- **Tech Contribution** - India has made strides in STEM research, becoming an influential player in areas like space technology, biotechnology, and pharmaceuticals.
- **Increase in Women Participation** – Women account for over ***43% of all (STEM) graduates*** in **India**, one of the highest in the world.
- 40% women enrolment in STEM field a world record for India, says UGC Chairman
- **Startups and Unicorn –** Most of the startups come from the STEM sector.

> *India is the third largest unicorn hub and ranks 39th in the Global Innovation Index.*

- **Ideas Innovator -** Innovation in the field of education goes through a radical change with more Indians becoming innovators rather than consumers.
- **Provides Employment** – STEM provides new jobs in science and technology field in various sectors.

> *According to the National Science Foundation, it is estimated that 80 per cent of the jobs created in the next decade will require some form of math and science skills, and India's young need to equip them to attain desired skill.*

What are the issues in STEM education and research in India?

- **Shortage of Skilled Faculty -** Teaching institutions often grapple with faculty shortages, which impacts the quality of STEM education and limits opportunities for student mentorship.

- **Deficiency in Teaching** - Many faculty members are products of their own institutions and are often pressured to chase papers and patents for their colleges to maintain their rankings, often at the expense of scholarship and pedagogy.
- **Inadequate Capacity of Graduates -** A significant portion of India's STEM graduates are not industry-ready.
- **Dwindling Students** - Number of students pursuing higher education has been dwindling.
- The number of STEM jobs are outstripping the number of STEM graduates in the country with 2020 witnessing a 44 % increase in STEM job postings.
- **Inequities in Educational Access -** It allows only a small number of people access to quality STEM education.
- **Less Enrollment in Premiers Institutes** - Only about *5% of STEM students* come from premier institutions like the Indian Institutes of Technology (IITs), the National Institutes of Technology (NITs), and the Indian Institute of Science (IISc).
- **Ill Method of Ranking Institutions** - Ranking teaching institutions and their faculty members based heavily on research output, such as papers and patents.
- **Lack Of Research Culture -** Limited resources get redirected from teaching quality to maintaining a research facade, affecting both education quality and STEM research output.
- **Lack Of Collaboration -** Most institutions work in isolation, with minimal engagement with research organizations.
- It limits exposure to cutting-edge research for students diminishing the quality of research output from these institutions.

What are the government measures?

- **National Education Policy (NEP) 2020 -** It emphasizes interdisciplinary studies, critical thinking, and a focus on research.
- **Anusandhan National Research Foundation (ANRF) -** The ANRF's Partnerships for Accelerated Innovation and Research (PAIR) program is designed to foster collaboration between research and teaching institutions.
- This initiative encourages joint research projects and faculty exchange programs to enhance research quality and exposure.
- **Government Funding in Key STEM Areas -** Investment in initiatives such as quantum computing, cybersecurity, and artificial intelligence reflects the country's ambition to strengthen its STEM capabilities.
- **Vigyan Jyoti Scheme for Schoolgirls –** Schools to conduct lectures at regular intervals and science camps to develop scientific temper among female students between 9th to 12th standard.
- **WISE-KIRAN -** To enhance women participation in the field of Science and Technology (S&T) to bring gender parity.
- **Gender Advancement for Transforming Institutions (GATI) -**To bring gender parity in higher education and research centers.
- **Consolidation of University Research for Innovation and Excellence (CURIE) -** It aims at assisting the research and development facilities at women's universities.
- **SERB-POWER** - The Science and Engineering Research Board provides financial aid in the form of grants and fellowships.

- **Biotechnology Career Advancement and Re-orientation Programme (BioCARe)** – Aims to increase women participation biotech research.
- **Women in Engineering, Science, and Technology (WEST) -**It was launched in 2022 to provide a platform for scientifically inclined women researchers and scientists.
- **I-STEM** - (Indian Science, Technology, and Engineering facilities Map) is an initiative by Office of Principal Scientific Advisor to link Researchers and Resources.

What needs to be done?

- **4A**- Accessibility, Affordability, Availability, Adaptability are keys to STEM success
- **Focus On Pedagogical Training -** Teaching institutions should prioritize pedagogical skills over research output for faculty promotions.
- **Capacity Building of Faculties** - Faculty development programs, mentorship, and continuous evaluation should become integral to STEM education.
- **Separate rankings for teaching and research institutions –** Ranking teach institutions majorly based on teaching quality.
- This approach can alleviate the pressure on faculty to produce low-quality research and shift focus toward effective teaching methods.
- **Collaborative Degree Programs -** Establishing joint degree programs between research and teaching institutions can enhance student quality and foster meaningful collaboration.
- **Creation of Teaching Tracks -** Establishing a dedicated teaching track within institutions to focus on pedagogy without pressure to publish research.
- **Leveraging Technology for Education and Research -** Online platforms and virtual laboratories can enhance access to quality education, allowing students from under-resourced institutions to participate in advanced learning.

Reference

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