

Indo-US Collaboration on Science-Technology-Engineering-Mathematics (STEM) Education and Research in India

Training the Next Generation of STEM Faculty at Higher Education Institutions

Under the Indo-US 21st Century Knowledge Initiative supported by the US-India Education Foundation (USIEF), a highly successful 5-year pilot project is nearing completion, as the joint collaboration between the Ohio State University (OSU) and the Aligarh Muslim University (AMU) to train world-class STEM faculty at Indian universities. **We propose continuation and extension of the ongoing project involving proposals from selected universities and institutions across India.** An outline of the accomplishments and objectives of the pilot project, and salient features of the proposed program modeled after the OSU-AMU partnership, are as follows. Jointly with OSU, each participating institution would develop a similar program as AMU tailored to their needs.

1. A **Center of Excellence in STEM Education and Research (STEM-ER)** has been established at AMU.
2. OSU and AMU have developed a **novel and unique Dual-Degree program**, with a graduate degree (viz. Ph.D.) from AMU and a newly designed two-year Masters of Education degree with STEM specialization from OSU, with **equal emphasis on advanced research and education**. This program is unique, as it elevates STEM-ER to its highest level – training graduate students to become the world-class researchers and teachers at the university level.
3. In addition to the USIEF award, OSU committed over \$1M in cost share to launch the project. Interdisciplinary OSU research faculty are from STEM departments in the Colleges of Education, College of Biological, Mathematical and Physical Sciences, College of Engineering and College of Medicine. The program is administered by the College of Education and Human Ecology and the Office of International Affairs.
4. A pioneering group of **four highly qualified research graduate students in science and engineering at AMU was selected in the first-year batch**. In Summer 2014 they enrolled as bona fide OSU students for 2 years. They joined the main campus in Columbus Ohio for two semesters, Autumn 2014 and Spring 2015, for graduate courses in state-of-the-art teaching methodologies and advanced scientific research in their respective STEM disciplines. While at OSU they also retained their status as AMU PhD students.
5. The pioneering batch of students continued their research under **OSU faculty advisors**, chosen to match, complement, and advance their research into new disciplines and topics, with projects ranging from cancer research to atomic astrophysics. Their research constituted an extension of their **PhD program, carried out jointly under AMU and OSU advisors**.
6. During the second year of the program, the **students returned to AMU for field experience in undergraduate teaching**, implementing the acquired training in advanced pedagogical techniques, including digital instruction, while continuing the remainder of their doctoral research. All four students taught full undergraduate courses in their respective departments

for the Autumn 2015 semester, monitored by their advisor from the OSU College of Education and AMU professors as research advisors.

7. During the current and final year of the project in 2016-2017, a **second batch of 4 AMU students** were also supported by the USIEF grant for one semester of research in respective STEM disciplines under the supervision of OSU faculty advisers.

Special features of the ongoing and proposed OSU-AMU program are:

8. **No Brain Drain:** The program is focused on the most qualified graduate students from Indian universities as highly trained prospective STEM research faculty, who would return to serve Indian institutions rather than seek positions abroad, thus **avoiding brain drain a priori**.
9. **National Potential:** The broader aim of the project is to expand into an **Indo-US STEM-ER consortium of Indian and U.S. universities**. Proposed extension would encompass higher education institutions across India, for world-class research faculty training within 2 years.
10. This is **the broadest and deepest collaboration between** India and the U.S. in STEM education, research, and capacity building in world-class university faculty.
11. The proposed program would be implemented by administrative units at OSU and participating universities in the Indo-US consortium.
12. **STEM faculty appointments:** Upon completion of the dual degree program, the newly trained postdoctoral fellows would be immediately ready for faculty appointments. In collaboration with OSU and their current faculty, participating universities will sponsor and select the best qualified graduate students.
13. **Local, State and National STEM Education Outreach:** The STEM-ER Centers established at participating universities would engage in outreach activities at all levels, such as STEM education for school children from disadvantaged background, and STEM workshops and conferences. Outreach activities will be jointly organized by the trainees under this program and visiting OSU faculty, using the most advanced pedagogical and digital methodologies.
14. **Globalization and International Outreach:** We envisage participating universities to emerge stronger as a global institutions, following STEM faculty capacity buildup partnership with OSU.
15. **Long-Term Indo-US STEM Research Collaboration:** The future prospective faculty members from participating universities will build up world-class research programs and laboratory facilities in India in collaboration with OSU researchers and Indian institutions.

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