

RECOMMENDATIONS OF THE TASK FORCE ON SCIENCE AT UNIVERSITIES OF THE MUSLIM WORLD

A) RECOMMENDATIONS FOR ACADEMIC INSTITUTIONS AND UNIVERSITIES

A1) Rethink science curricula at universities (i.e. ‘what should be taught?’)

- **Adopt a broad-based, general-education curriculum** for students majoring in all science and engineering disciplines. Complement students’ technical education by adding humanities topics of direct relevance to science (Philosophy of Science, History of Science, Ethics of Scientific Research, etc.), basic social sciences, and communication skills (languages and verbal and written communication).
- **Re-orient universities towards their student-centric missions:** create endowment funds for students who might be prevented from pursuing science majors due to lack of financial means; improve the capacity of graduate programmes to attract talented students by addressing issues such as attrition rates, time to degree, funding, and alignment with student career opportunities and national interests; etc.
- **Encourage multi-disciplinarity in training as well as in the choice of courses** for science majors, such as connecting science programmes with both engineering and social science programmes.
- **Implement internships in science fields for students at the end of their junior year,** allowing this experience to be incorporated in final (senior-year) projects (link with industries and local community companies, research institutions, etc.).
- **Engage undergraduates in faculty research** to give them early exposure to how scientists think, formulate problems, and create and implement strategies to solve them.

A2) Adopt effective teaching pedagogies for science (i.e. ‘how should it be taught?’)

- **Adopt IBSE/Active-Learning teaching methods,** e.g. “clickers”, group learning setups, and other approaches that develop critical thinking, e.g. analyzing science papers from the literature (see samples of annotated papers from *Science*), newspaper articles about scientific topics, etc.¹
- **Adopt and popularize the notion of Discipline-Based Education Research (DBER)** in creating, experimenting with, and delivering science instruction in the classroom².
- **Re-train the faculty on modern and new pedagogical approaches** that develop in students creative thinking, critical inquiry, and rejection of “the argument from authority”.

¹ See <http://scienceintheclassroom.org/>.

² See <http://www.nap.edu/catalog/13362/discipline-based-education-research-understanding-and-improving-learning-in-undergraduate>.

- **Enable and encourage faculty members to use modern technological tools**, such as new media approaches, learning management systems, simulations, etc. for a better and more enriching learning experience and to make science instruction fun, where possible.
- **Develop contextualised curricula** by enabling and encouraging faculty members to develop new courses, write textbooks and develop curricula that take into account local conditions and contexts.

A3) Transform universities into meritocracies (i.e. ‘hire, incentivize, and empower’)

- **Attract quality faculty – particularly expats – and create productive networks around them.** Universities (and departments), it is said, are built around individuals not physical assets or buildings. Muslim expats living and working in the West could be a starting point for such an exercise. Several high-income Muslim countries such as those in Persian Gulf and South East Asia should be able to do even better.
- **Provide intellectual and administrative autonomy**, freedom of thought and expression, and the ability to pursue one’s interests. People in academia self-select to a life of relative autonomy and freedom, and this forms a very critical part of their intrinsic motivation system.
- **Support faculty research through ‘early career grants’ and ‘merit-based competitive research grants.’** This could be done through endowment funds or partnerships with industry actors. Even if the amounts are small, they provide an impetus, the first exposure, and a foothold on which to build one’s independent research career and serve as starting points for young faculty to go out and raise more money.
- **Support Pedagogical Innovation** through an institutional small grants programme focused on curricular and pedagogical innovation. These grants could be used to fund faculty time to develop such approaches, attend training programmes, or buy equipment needed to implement new approaches.
- **Institute a system of rewards, recognition, and promotion that measures faculty performance in teaching, research, and outreach.** Rewarding and recognizing quality teaching – ideally through the promotion system – is critical to ensuring that faculty will spend time and effort to be better at it. Recognition (through teaching awards, for instance) is one important way to encourage faculty to focus serious attention and time on this essential university mission.

A4) Revive the universities’ social contract with society (i.e. ‘relevance and service’)

- **Connect universities to schools** – primary, secondary, and high schools – to ensure conceptual and curricular continuity.
- **Create public outreach and science engagement programmes** that enhance the citizen’s engagement with and appreciation of science and the scientific method.
- **Ensure that STEM curricula make reference to national and social agendas**, e.g. health and medical programmes (obesity and diabetes epidemics, cancer prevention and detection, etc.).

The Task Force invites interested universities from around the Muslim world to engage, substantively, in a conversation around the above set of recommendations and seeks nominations by a ‘coalition of the willing’ to endorse and adopt these recommendations and become partners in an “*implementation programme*” presented below.

B. RECOMMENDATIONS FOR NATIONAL POLICYMAKING AND IMPLEMENTATION BODIES (E.G. MINISTRIES, REGULATORS)

B1) Provide greater autonomy and flexibility to universities for:

- **Designing innovative curricula and research programmes**, and supporting a pedagogical innovation fund
- **Relaxing often cumbersome and restraining regulations** so as to enable universities to transform themselves into meritocracies that reward performance. Define career paths that young scientists find meaningful, attractive, and challenging.

B2) Support a university culture of accountability, evaluation, and best practices:

- **Produce extensive data** (for as many universities as possible, cross-sectional and longitudinal) on science graduates, curricula, pedagogy, languages of instruction, as well as employment rates and work profiles of science teachers/faculty, science graduates, etc.
- **Improve the quality of higher education regulation and certification, and adopt a zero tolerance policy towards academic fraud.** Consider effective mechanisms of signaling quality, where market information fails to do, such as national and regional rankings of institutions with similar missions, setting up information clearinghouses, etc.
- **Engage with academies of sciences, where possible, to create oversight panels that ensure that quality science education is delivered.**

B3) Address national policy issues in a timely and effective manner:

- **Ensure sustained funding for higher education institutions** that approach international norms (about 30 % of all government spending on education). The higher education spending should also include funds for development and research. The funding policy may encourage, through inducement and incentives, universities to gradually raise endowments to support faculty research and student scholarships.
- **Address the issue of the language of instruction by undertaking rigorous research on the question and examining the pros and cons of various propositions (bi-lingual, etc.).** In parallel, create national science translation projects to ensure the availability of up-to-date scientific content in national languages, including articles, special issues, and books on science education
- **Adopt and implement a full-system approach to enhancing STEM education within the society**, by ensuring that what is taught within schools is well-integrated with university curricula. Develop consistency in both what is taught (syllabus) and

how it is taught (pedagogy) throughout the educational continuum. Conduct re-training workshops for science teachers to bring them to date with new tools and knowledge.

C) RECOMMENDATIONS FOR KEY STAKEHOLDERS (E.G. SCIENCE ACADEMIES, INDUSTRY, CIVIL SOCIETY, CORPORATES, ETC.)

C1) To enable important stakeholders within the society to constructively engage with universities:

- **Create greater linkages between academies of science and university programmes** to ensure currency in terms of content and pedagogical approaches.
- **Establish multi-stakeholder advisory boards and curricular committees for each science programme**, bringing together educators, policymakers (administrators, officials), business, industry leaders, and other civil society actors.
- **Create Science-to-Action councils** at every university to engage scientists and science students in tackling local problems and challenges.

C2) To enhance the national profile of sciences and STEM careers:

- **Encourage students to take part in international competitions and scholarships**, such as Intel Science and Engineering Fair (ISEF), the International Science Olympiads, the Meetings of Nobel Laureates, etc.
- **Engage the media in its various forms** in promoting scientific culture, values, and role models within the society.
- **Popularize science and provide routes for the successful commercialization of its relevant discoveries.**

C3) Enhance the representation within STEM of minorities:

- **Involve youngsters in the dynamics of science**, e.g. by creating and supporting national and regional young academies of science along the lines of Pakistan's National Academy of Young Scientists (NAYS), the Arab World Academy of Young Scientists (ArabWAYS), etc.
- **Stress gender neutrality of science** by highlighting, in equal measure, bright examples of scientific success among young women (and men). Create special programmes to attract young women to STEM education and STEM careers, where such a deficit exists.