

From Mathematics to Technology: A Bridge through Physics and Engineering

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The deaf and the dumb equations of *mathematics* are made to speak through *physics*¹, which is the formulation of general laws applying, mainly, inductive logic. *Engineering* is modeling from the general laws to create practical systems. *Technology* is the implementation and the adaptation of a laboratory model to create a working system, which could be mass-produced. The journey from *mathematics* to *technology* could be considered as a journey from the abstract to the concrete, *mathematics* being in books, in the minds of philosophers, *physics* making contact with outside world, *technology* becoming the stage, where one enjoys the blessings. The training of mathematicians² and physicists³ should inculcate creative thinking and make them capable to critically analyze problems⁴, taking them from various stages of concept building to equip them with problem-solving skills⁵. Problem solving in the classroom should prepare them to problem solving in the laboratories, and, eventually, problem solving in the industry. This paper illustrates how simple activities, like measurement of height and determination of safe-viewing distance for watching television could reinforce concepts and techniques from various disciplines, including mathematics, physics, chemistry, biology, engineering, health and safety. Mathematics curricula should give students the practical skills needed by a prospective employer. The paper describes the behavior-based interview format for teachers in mathematics, elaborating technical and performance skills needed for these jobs and examines if the recently-prepared mathematics curricula^{6,7} for BS, MS and PhD by Higher Education Commission, Government of Pakistan are preparing students in this regard and whether they are, properly, interfaced with the pre-university curricula⁸⁻¹⁰.

Keywords: Curriculum development, concept building, problem solving

¹Siddiqui KA & Kamal SA, "Physics makes the deaf and the dumb equations of mathematics to speak", *Proceedings of the Second Workshop on Teaching of Physics*, Edited by Hasnain AF, Karachi, Pakistan, 1986, pp 40-49, full text:

<http://www.ngds-ku.org/Papers/C25.pdf>

²Kamal SA, "Mathematics research, teaching and community outreach in University of Karachi: challenges and opportunities", *Informative Mathematical Event*, Karachi Mathematical Association and Department of Mathematics, University of Karachi, 2005, abstract: <http://www.ngds-ku.org/pub/confabst.htm#C63>:

³Kamal SA & Siddiqui KA, "Basic requirements to train a physicist", *Physics Education (India)*, April- June 1989, pp 53-61, full text: <http://www.ngds-ku.org/Papers/J09.pdf>

⁴Kamal SA & Siddiqui KA, "How to develop creative thinking and critical analysis?", *Proceedings of the Second Workshop on Teaching of Physics*, edited by Hasnain AF, Karachi, Pakistan, 1986, pp 51-56, full text:

<http://www.ngds-ku.org/Papers/C24.pdf>

⁵Kamal SA, "The training of a physicist: from concept building to problem-solving skills (concluding talk + recommendations of conference)", *the Second International Conference on Physics Education*, Center of Physics Education, National Center for Physics & Department of Physics, University of Karachi, 2003, full text:

<http://www.ngds-ku.org/Papers/C57.pdf>

⁶Kamal SA (Editor), "Mathematics— Revised Curriculum (BS, MS and PhD Schemes of Studies)", Convener, National Curriculum Revision Committee in Mathematics, *Higher Education Commission*, Islamabad, Pakistan, 2005, full text: <http://www.ngds-ku.org/hec/math-booklet-final-2005.pdf>

⁷Kamal SA (Editor), "Mathematics— Revised Curriculum (BS Scheme of Studies)", Convener, National Curriculum Revision Committee in Mathematics, *Higher Education Commission*, Islamabad, Pakistan, 2008, full text:

<http://www.ngds-ku.org/hec/math-booklet-final-2008.pdf>

⁸Kamal SA (National Advisory Committee), "National Curriculum for Mathematics— Grades I-XII", Member, Expert Panel, National Curriculum Council, *Ministry of Education, Government of Pakistan*, Islamabad, Pakistan, 2006

⁹Kamal SA (National Advisory Committee), "National Curriculum for General Mathematics— Grades IX-X", Member, Expert Panel, National Curriculum Council, *Ministry of Education, Government of Pakistan*, Islamabad, Pakistan, 2007

¹⁰Kamal SA (National Advisory Committee), "National Curriculum for General Mathematics— Grades XI-XII", Member, Expert Panel, National Curriculum Council, *Ministry of Education, Government of Pakistan*, Islamabad, Pakistan, 2008

Full paper: <http://www.ngds-ku.org/Papers/C70.pdf>

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HTML version: <http://www.ngds-ku.org/pub/confabst.htm#C70>:

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