

## **THE DEVELOPMENT OF VIRTUAL LABORATORIES IN THE INDIAN HIGHER EDUCATION SYSTEM, A NEW FRONTIER OF UNIVERSITY RESEARCH**

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The 2012 IEEE International Conference on Technology Enhanced Education, held at Amrita University's headquarters in Amritapuri, India on 3-5 January 2012, focused on the use and implementation of virtual laboratories in high schools and universities as a tool of didactic support for improving interactivity in the framework of online education.

The conference theme Educational Technology for Societal benefit is one of the main aims that Amrita University pursues as a reflection of the technological development occurring in the region which highlights the role of innovation in sustainable applications of technology. Utilizing innovative methodologies like virtual labs that improve learning achievements, Amrita University is a pioneering higher education and research institution within the Indian context.

With particular regard to engineering and scientific education, the laboratory experience allows students to develop practical and crucial skills such as real world problem solving, designing, communication, team work, independent thinking and creativity. Being aware of the massive importance of virtual labs, Amrita University launched in 2010 the VALUE (Virtual Amrita Laboratories Universalizing Education) initiative with the aim to enable experimentation beyond the boundaries of traditional laboratories. Actually this project responds to the need of sharing costly equipment across the country and, in very rural areas, of enabling students to perform experiments that they would not otherwise have access to. In such a way graduate and undergraduate college and university students, especially those belonging to geographically remote and economically constrained institutes, are provided with the opportunity to perform their required laboratory experiments using only a standard computer and Internet connection. From a didactic point of view, this project stimulates students curiosity by providing them with the chance to learn both basic and advanced concepts through remote experimentation. Laboratory equipments can be accessed online through a user-friendly graphical interface to execute experiments similar to those conducted in labs. The data collated from the experimentation can be recorded online, reviewed and graded by

teachers located anywhere, anytime.

With the purpose of modernizing Indian education, Amrita University has also launched CREATE - Center for Research in Advanced Technologies for Education, which is an educational initiative envisaging the application of innovative digital solutions for all. This project intends to advance research on innovative pedagogy, architectural frameworks and implementations of both e-Learning and m-Learning systems with an emphasis on personalized assessment and learning. In this framework the center has built a Simulation Lab for STEM (Science, Technology, Engineering and Maths) skills to develop and deploy immersive educational experiences using innovative 2D and 3D simulations. This way the researchers work on technological frameworks that address education, systems architecture, content aligned to curricula and multi-modal approaches for various learner types. This project has allowed the development and deployment of an Intelligent tutoring and Adaptive assessment program in over 45 Indian schools in rural and small city neighbourhoods. For six years, the center has been a change agent for training women. It has provided free training to hundreds of women teachers in both city and rural schools in the use of ICT and computer aided learning methodologies. It has also provided training for women in language skills, thereby empowering them to get better jobs. Small and medium scale statistical studies have definitely validated Amrita's achievement in bridging the digital divide and creating more inclusiveness in societal development.

Both VALUE and CREATE are just some examples of the worldwide initiatives that show the increasing value of virtual laboratories in merging virtualization, applications, and workflow technologies with educational concepts.