
GC 2012-5631: INTERNATIONAL COLLABORATION IN CURRICULUM AND LABORATORY DEVELOPMENT

Dr. K. P. Isaac, All India Council for Technical Education (AICTE)

Prof. (Dr.) Kuncheria P. Isaac, Ex-Director of Technical Education, Govt. of Kerala has taken charge as Member Secretary of All India Council for Technical Education on June 2, 2011 after a long 32 years of service in the academic field in Kerala.

He holds a Bachelors degree in Civil Engineering from College of Engineering, Trivandrum (Third rank in the University of Kerala), a Masters Degree in Transportation Engineering (Civil Engineering) from IIT Madras (Gold Medalist) and Ph.D from Bangalore University. He joined as Lecturer in the Technical Education Department of Kerala and rose to the position of Director of Technical Education. Most of his career, he has served at College of Engineering, Trivandrum as a faculty member in the Department of Civil Engineering.

He specializes in Transportation Engineering and is instrumental in establishing a Transportation Engineering Division at College of Engineering, Trivandrum. He is a leading consultant and researcher in this area of specialization.

He has been active with his involvement with industries. He developed the process of Manufacturing Manufactured Sand 'M Sand' an alternative to river sand. He was the coordinator of State Technical Agency for PMGSY scheme in Kerala. He has coordinated a large number of training programmes for the engineers of Kerala in the Design, Construction and Maintenance of Roads.

He has more than 50 publications in National and International journals and conferences to his credit.

He has coordinated several research projects and supervised research works leading to Ph.D. He is still active in research with four students are working under his supervision.

As Principal and Director of Technical Education he is instrumental in establishing the Centre for Engineering Research and Development in Kerala, Research Park at the College of Engineering Trivandrum and several new initiatives for the development of Technical Education in the State of Kerala.

INTERNATIONAL COLLABORATION IN CURRICULUM AND LABORATORY DEVELOPMENT

Dr. K. P. Isaac

Member Secretary, All India Council for Technical Education, India

kpisaac@yahoo.com

Abstract

The aim of any country's higher education system is sustainable development and achieving higher growth rates. India aims to increase the higher education enrolment rate from about 12 percent at present to 30 percent over a decade. Technical education at all levels in India is witnessing a consistent growth by establishing new institutions, addition of courses and increase in seats mainly with private participation.

The All India Council for Technical Education (AICTE), a statutory body of Govt. of India is the national level apex body with its mission of developing and promoting quality technical education in the country has been constantly giving importance to improvement of quality by constantly upgrading the curriculum. AICTE brings out model curriculum in all specializations and programmes governed by it viz, Engineering, Management, MCA, Pharmacy, Hotel Management and Architecture.

The curriculum development in India is done keeping the outcome based approach or the competency based approach. The National Institute of Technical Teachers Training and Research (NITTTR) located at four different places in India carry out research and assistance to institutions and universities in developing the competency based curriculum for engineering courses at various levels viz, Diploma, Degree and Post Graduate.

The use of Information Communication Technology in the teaching learning process is promoted in India through a nationally coordinated project – National Project on Technology Enhanced Learning. As part of this project, e-contents are developed for various courses and virtual laboratories are being established across the country.

This paper discusses the above and similar practices in achieving quality education in India and the areas of mutual collaboration with other countries.

1.0 INTRODUCTION

The higher education in India has been gaining importance since its independence in 1947. Considerable increase in terms of access has occurred since 1980 due to liberalized view of the Government of India's major shift in policy by opening technical education to the private sector. The number of institutions and number of seats in engineering education as at the end of 2011 is 2356 and 23,23,030 respectively.

The technical education has improved in terms of access, but attendant problems in terms of quality are bound to happen due to the exponential growth. Simultaneously, the universities and apex bodies like UGC (University Grants Commission) and AICTE (All India Council for Technical Education) have taken steps to improve the quality of education.

AICTE brings out model curriculum in all specializations and programmes governed by it viz, Engineering, Management, MCA, Pharmacy, Hotel Management and Architecture through its boards. There are ten boards in technical education, out of which there are two boards in engineering; one dealing with undergraduate education and the other with post graduate education.

The use of Information Communication Technology in the teaching learning process is promoted in India through a nationally coordinated project – National Project on Technology Enhanced Learning. As part of this project, e-contents are developed for various courses and virtual laboratories are being established across the country.

This paper discusses the above and similar practices in achieving quality education in India and the areas of mutual collaboration with other countries

2.0 DEVELOPMENT OF TECHNICAL EDUCATION IN INDIA

Engineering education, like other types of professional education in India has not had long history. The few engineering colleges those were established in the 1850's include Thomason College in Roorkee, Government College of Engineering in Pune, Bengal Engineering College in Howrah and Engineering College in Madras. During the early 20th century, a few more institutions were established and in 1945, the All India Council for Technical Education (AICTE) was established by the Govt. of India to supervise all technical institutions in the country.

At that time, mandate of AICTE basically covered only programs in Engineering and Technology.

The growth of industries in the Country, just after independence, also demanded the need for qualified professionals in other fields, such as Business Management, Architecture, Hotel Management, Pharmacy etc. Although the diverse elements of Management such as Commerce, Economics, Finance, Psychology and Industrial Sociology were being taught for a long time, the need for Management Education in a formal way was felt in India only in the fifties. The Government of India decided in 1954 to set up a Board of Management Studies under AICTE to formulate standards and promote Management Education. Other major initiatives taken in Management Education include: setting up of the Administrative Staff College of India at Hyderabad in the late fifties, National Productivity Council and Indian Institution of Management in the early sixties. Architecture was covered under the Architects' Act, 1972. Subsequently, for better coordination of the Professional Courses, Architecture Education was also placed under the purview of AICTE.

Hotel Management Education had a modest beginning with short programs in Nutrition and Food Science, which started in the late fifties. The National Council of Hotel Management and Catering Technology were set up in 1982, to which all the Institutions of Hotel Management run by the Government are affiliated. Education in other professional fields such as, Pharmacy, Applied Arts & Crafts has also undergone similar developments during the post-independence period. Programs for Technical Education, during the first three Five Year Plans, were devoted to expansion of Technical Education to meet the growing demand for technical personnel at Diploma, Degree and Post-Graduate Levels. From the fourth Five Year Plan onwards, the emphasis was shifted to the improvement of quality and standard of Technical Education. This was done through implementation of the Quality Improvement Program consisting of three major components that provided for M.E. / M. Tech and Ph. D Programs, Establishment of Curriculum Design and Development Cells, and Short Term Training Programs.

Meanwhile expansion of Institutions and intake remained at a low level in the Government, Private-aided and University sectors. The policy shift during eighties towards involvement of Private and Voluntary Organizations in the setting up of Technical and Management Institutions on self-financing basis ushered in an era of unprecedented expansion of the Technical Education System, a trend which had continued during successive Five Year Plans.

It was in this context that AICTE was given statutory powers by the AICTE Act of Parliament in 1987, with a view to ensure the proper planning and coordinated development of Technical Education System throughout the Country. Technical Education in this context includes fields of Engineering and Technology, Architecture, Town Planning, Management, Pharmacy and Applied Arts & Crafts.

Due to efforts and initiatives taken during the successive Five Year Plans and particularly due to policy changes in the 80's to allow participation of private entities in setting up technical institutions on self financing basis, growth of technical education has been phenomenal. The growth in AICTE approved institutions in the last five years is given in Table-1 and the growth of intake in various institutions in the last five years is given in Table-2.

Table: 1

Growth of AICTE approved Technical Institutions in last five years

Year	Applied Arts And Crafts	Architecture And Town Planning	Engineering And Technology	Hotel Management And Catering	Management	MCA	Pharmacy	Grand Total
2007-08	56	96	3056	111	1718	1333	1207	6110
2008-09	59	99	4022	120	2326	1615	1342	7583
2009-10	61	112	4954	130	3472	1819	1421	9044
2010-11	65	138	5738	141	3934	1936	1487	10195
2011-12	55	146	5779	129	3942	1861	1446	10155

Table: 2

Growth of intake in AICTE approved Technical Institutions in last five years

Year	Architecture And Town Planning	Engineering And Technology	Hotel Management And Catering	Management	MCA	Pharmacy	Grand Total
2007-08	4746	967571	7157	142279	80505	80063	1282321
2008-09	5275	1302209	7670	190094	99842	89653	1694743
2009-10	6237	1697758	8360	272553	112607	96727	2194242
2010-11	8548	2138857	9646	373046	125327	126926	2782350
2011-12	10945	2428142	10181	424978	134308	146793	3155347

The major functions of AICTE are as follows:

- Approval of Diploma / Degree / Post Graduate Degree / Post Graduation / Post Diploma / Post Graduate Diploma Level programs in Technical Institutions.
- Approval of variation / increase in intake, additional programs in technical Institutions
- Quality Assurance through Accreditation.
- Participation in the process of granting Deemed University status by MHRD.
- Approval for Foreign Collaborations / Twinning Programs.
- Promotion of Industry-Institution Interaction.
- Development of Model Curricula through All India Boards of Studies.
- Faculty Development Programs in Technical Institutions.
- Research and Institutional Development through Modernisation and Removal of Obsolescence (MODROBS) / Research Promotion Schemes (RPS)
- Post Graduate Grants and GATE Scholarship
- Networking of Technical Institutions.
- Assessment of National Technical Manpower through National Technical Manpower Information System (NTMIS)
- Promotion of Autonomy in Technical Institutions.
- Connecting Technical Institutions through EDUSAT Network-Live transmission of M.E. / M. Tech programs
- Providing facilities under INDEST
- Steps for Stopping Commercialization of Technical Education.

3.0 CURRICULUM DEVELOPMENT

The AICTE has established ten boards of studies namely:-

- i) Board of Architecture
- ii) Board of Hotel Management
- iii) Board of Information Technology
- iv) Board of Management Studies
- v) Board of PG Education and Research
- vi) Board of Pharmaceutical Education
- vii) Board of Town and Country Planning
- viii) Board of Technician Education
- ix) Board of Undergraduate Studies in Engg and Tech
- x) Board of Vocational Education

Out of the ten boards, two boards deal with engineering education. The boards advise the Executive Committee of AICTE on academic matters falling in its area of concern including norms, standards, model curricula, model facilities and structure of courses. The Council revises the model curriculum from time to time.

India is a provisional signatory to the Washington Accord. The aim of the Washington Accord was to recognize the substantial equivalence of accreditation systems of various organizations and engineering education programmes in the signatory countries. To achieve substantial equivalence, the curriculum has to be outcome based or competency based. The AICTE, NBA, universities and the NITTR's in the country are giving necessary guidance in revising the curricula as outcome based to achieve the equivalency with other countries.

4.0 NATIONAL MISSION ON EDUCATION THROUGH ICT (NMEICT)

In the light of the increasing demand for education, the continuously increasing number of students, and the paucity of infrastructure, it is felt necessary to include Information Communication Technique on the higher education by the Ministry of Human Resource Development, Government of India. The project is named as National Mission on Education through Information Communication Technology (NMEICT). The content portion of this Mission would have an ambitious vision of catering to the learning needs of more than 50 crore Indians (working population) and of providing a one stop solution to all the requirements of the learning community. In order to bolster our knowledge resources, to obtain and maintain the competitive edge in the world, we require a system of identification and nurturing of talent and lifelong learning. Knowledge modules based on the personalized needs of the learner would need to be delivered to him /her at the right time with the right content interactively to take care of his / her aspirations. In due course of time there would be a need to develop and maintain the knowledge and capability profile of every individual learner / worker. Such a system would have to be developed in a cost effective manner over a period of time, integrating the objectives. The objectives of the mission are given in Annexure A

The Mission would also endeavour to blend soft skills with knowledge modules and inculcate a discipline of holistic thinking in the learners so as to make them job creators rather than job seekers.

5.0 VIRTUAL LABORATORIES

Modelling, simulation and visualization have been used by engineers to analyse physical phenomena and design complex engineering problems(1). The same methodology is now being extended as virtual laboratories to conduct laboratory experiments on computer screens with necessary hardware and software to link the computers to the physical experimental set up. Virtual laboratories can be classified as recreative or interactive or immersive or collaborative. The hierarchy of virtual laboratory development is shown in Fig. 1.

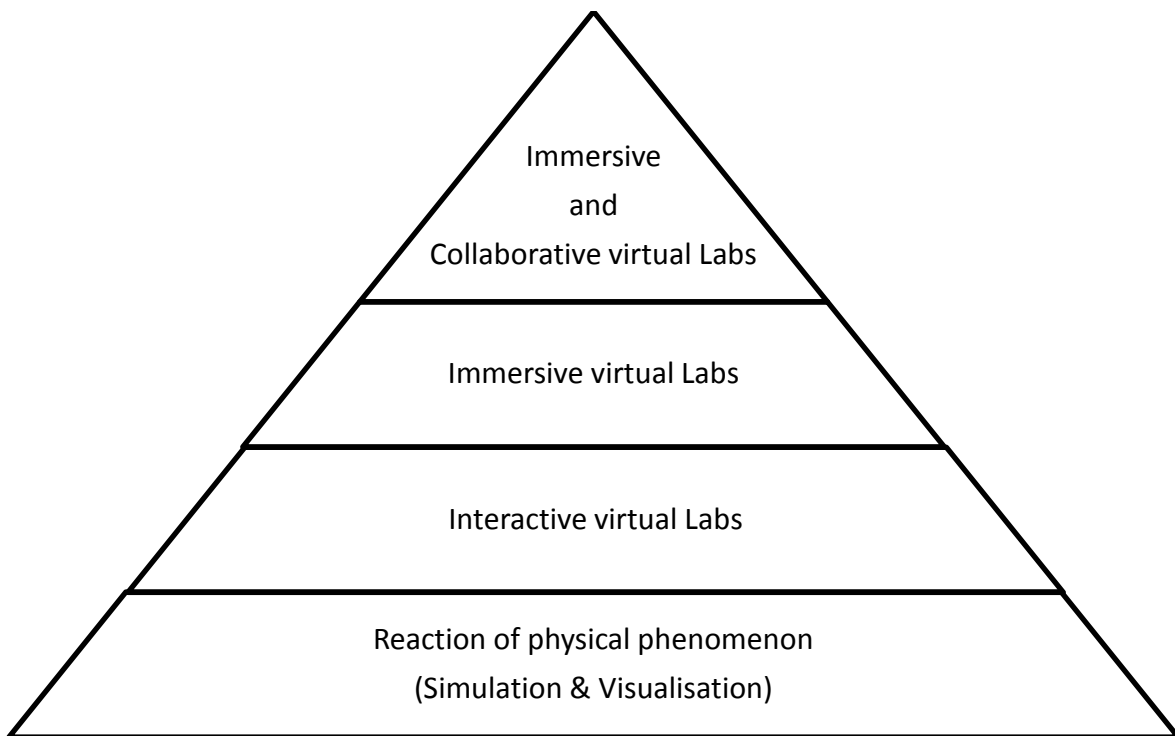


Fig. 1 Hierarchy of virtual lab development

At the bottom of the pyramid are recreative laboratories, a term coined to indicate that modeling, simulation and visualization have been used to recreate a physical phenomenon in the virtual domain.

Physical distances and the lack of resources make us unable to perform experiments, especially when they involve sophisticated instruments. Also, good teachers are always a scarce resource. Web-based and video-based courses address the issue of teaching to some extent. Conducting joint experiments by two participating institutions and also sharing costly resources has always been a challenge. With the present day internet and computer technologies the above limitations can no more hamper students and researchers in enhancing their skills and knowledge. Also, in a country such as ours, costly instruments and equipment need to be shared with fellow researchers to the extent possible. Web enabled experiments can be designed for remote operation and viewing so as to enthuse the curiosity and innovation into students. This would help in learning basic and advanced concepts through remote experimentation. Today most equipment has a computer interface for control and data storage. It is possible to design good experiments around some of this equipment which would enhance the learning of a student. Internet-based experimentation further permits use of resources – knowledge, software, and data available on the web, apart from encouraging skillful experiments being simultaneously performed at points separated in space (and possibly, time

The objectives of the Virtual Laboratories component of the project of MHRD under the NMEICT project and its salient features are given in Annexure B.

The following twelve institutes are participating in the development of virtual labs: IIT Delhi, IIT Bombay, IIT Kanpur, IIT Kharagpur, IIT Madras, IIT Roorkee, IIT Guwahati, IIT Hyderabad, Amrita University, Dayalbagh University, NIT Karnataka, and College of Engineering, Pune. The developments in various stages are the details are available in www.vlab.co.in.

6.0 SUGGESTIONS

- A study to identify the need of the industries should be conducted with the help of ASEE in coordination with other Asian countries such as China, Malaysia, Japan and Korea to identify the changes required in the curriculum and structure of the courses .
- Periodical workshops and seminars are to be conducted to share the international best practices in the area of curriculum and laboratory development.
- Engineering education curriculum has to be modified to suit the local needs of the Indian states keeping in mind the global requirements.
- Mobility of engineering graduates can be ensured if a uniform curriculum is designed as per the global needs.
- A system of switching over to outcome based programmes needs to be developed with the active cooperation of the member countries.

7.0 CONCLUSION

The engineering education in India is undergoing a major shift in terms of access which can be seen from the growth of the educational institutions over the last five years. This has been made possible due to the liberal policy of the All India Council for Technical Education in granting approval for establishing new institutions and allowing existing institutions to start additional programmes and courses. Any exponential increase in number is likely to result in deterioration in quality. But the Ministry of Human Resource Development and AICTE have taken proactive steps in circumventing such problems by enforcing stricter norms and standards and implementing projects like NMEICT and virtual laboratories.

REFERENCE

1. Bryden, M and MaCorkle, D “Virtual Engineering”, Nov., 2005 pp 38-42
2. Bernardino, J., and Quadrado, J. C., “Simulation and Visualization Enhanced Engineering Education—Development and Implementation of Virtual Experiments in a Laboratory Course”, 1st World Engineering Education Flash Week, Lisbon, Portugal, September 27-30, 2011
3. www.aicte-india.org – the official website of All India Council for Technical Education, India
4. www.sakshat.ac.in/ - the web portal of Ministry of Human Resource Development, Govt. of India

ANNEXURE A

http://www.sakshat.ac.in/OBJECTIVES_OF_NMEICT

1. Effective utilization of intellectual resources, minimizing wastage of time in scouting for opportunities or desired items of knowledge appropriate to the requirement,
2. Certification of attainments of any kind at any level acquired through formal or non formal means in conventional or non conventional fields,
3. Any-time availability of desired knowledge at appropriate levels of comprehension to all for self paced learning,
4. Platform for sharing of ideas and techniques and pooling of knowledge resources.
5. Systematically building a huge database of the capabilities of every individual human resource over a period of time,
6. Scholarship / Talent management including identification, nurturing and disbursement electronically.
7. Nurturing of scholars and learners.
8. Support to all the learners / workers for any of their perceived learning needs,
9. Extensive leveraging of the advancements in the field of ICT for taking the knowledge resources to the door steps of the learner,

10. Capability to handle the user base which would ultimately be expected to cross 50 crore in the long term.
11. Use e-learning as an effort multiplier for providing access, quality and equality in the sphere of providing education to every learner in the country.
12. Provide for Connectivity & access devices, content generation, personalization & mentoring, testing & certification and encouragement of talent.
13. Bringing efforts of different interested agencies working in the field of e-learning under one umbrella and establishing logical linkages between various activities.
14. Capacity building in this sphere and utilizing dormant capacities of various organizations. Creating infrastructural facilities for long term utilization and making sustained efforts for content generation & connectivity including access devices production.
15. Encouraging research in spheres covered by Mission activities. Creating a large number of networks of experts in various fields to carry forward the gigantic vision under this Mission.
16. Providing e-books & e-journals, utilizing the repository of contents generated so far and the automation of evaluation processes. Creating a high impact brand for e-Journals in leading disciplines with a provision for good incentive-based payment to the researchers publishing their high quality papers in these e-Journals.
17. Spreading Digital Literacy for teacher empowerment and encouraging teachers to be available on the net to guide the learners.
18. Multi-lingual content development for the learners more comfortable in those languages.
19. Voice support for educational material delivery and interactivity for the content on the portal.
20. Development of interfaces for other cognitive faculties which would also help physically challenged learners. These efforts may cut across all the content generation activities.
21. Conversion of existing educational tapes into indexed formats compliant with the internationally accepted standards such as SCORM (Sharable Content Object Reference Model).
22. Launching a national movement for content and question generation.

23. Development of GIS (Geographical Information System) based resource inventory as a knowledge base (for subjects and skills where ever possible / feasible) for educational and planning purposes.
24. Improving teachers' training and course curriculum.
25. Providing Digital/Information Literacy for teacher empowerment.
26. Creating a clearinghouse cum rating agency for various web based learning contents for guiding Indian learners.
27. Establishing a credible rating institution for knowledge content available on the Internet utilizing the large expert base, which would get collaboratively networked through one of the sub Missions of this National Mission.
28. Preparation of metadata and timed index preparation for educational video / audio content on tape or other media. SECRET
29. Credit based flexible module formulation for openness to qualifications and easy transfer of credits from one programme / course to another.
30. ERP (Enterprise Resource Package) and e-Governance for education.
31. Development of pedagogical techniques based on edu-entertainment.
32. Customisation of Open Source Tools etc.
33. Development of robust models of networking to encourage community participation at local levels.
34. Content delivery through EduSAT and narrowcasting of TV signals. Providing 1000 DTH (Direct to Home) channels on 40 transponders [to be availed through the Department. of Space] so that a separate DTH channel is available for every subject for every class in various languages to the extent possible.
35. Development of DTH platform for EduSAT and cheaper equipments for two way connectivity through satellites.
36. Providing e-Learning support to every higher education institution for technology assisted learning.
37. Setting up virtual labs and lab centers and finishing schools for quality enhancement.
38. Development of cheap access devices to make them affordable for every individual.
39. Making broadband affordable for every learner.

40. Developing reliable identification systems for learners and examiners and also developing model testing centers to test the learners under controlled environment.
41. Developing very low cost, low power consuming wireless mesh [Institution of Electrical and Electronics Engineering (IEEE) 802.11 standard or better] or point to point long range communication [IEEE 802.16 standard or better] capable robust video servers to act as communication and computational hubs at educational institutions.
42. Development of devices for achieving convergence among connectivity technologies.
43. Standardisation & Quality Assurance of e-Content.
44. Facilitating development and deployment of ultra low cost physical tool kits for engineering and science students to encourage project and design based learning complementary to the e-learning.
45. Deriving lessons from our ancient knowledge base.
46. Reducing ill-effects of internet / web based learning.
47. Guidance to learners through various psychological / personality tests.
48. Coordination and synergisation of knowledge related activities of different Ministries and organizations.

The objectives of the National Mission on Education through ICT shall include (a) the development of knowledge modules having the right content to take care of the aspirations and to address to the personalized needs of the learners; (b) research in the field of pedagogy for development of efficient learning modules for disparate groups of learners; (c) standardization and quality assurance of contents to make them world class; (d) building connectivity and knowledge network among and within institutions of higher learning in the country with a view of achieving critical mass of researchers in any given field; (e) availability of eknowledge contents, free of cost to Indians; (f) spreading digital literacy for teacher empowerment (g) experimentation and field trial in the area of performance optimization of low cost access/devices for use of ICT in education; (h) providing support for the creation of virtual technological universities; (i) identification and nurturing of talent; (j) certification of competencies of the human resources acquired either through formal or non-formal means and the evolution of a legal framework for it; and (k) developing and maintaining the database with the profiles of our human resources.

ANNEXURE B

OBJECTIVES AND SALIENT FEATURES OF VIRTUAL LABORATORIES

OBJECTIVES

- To provide remote-access to Labs in various disciplines of Science and Engineering. These Virtual Labs would cater to students at the undergraduate level, post graduate level as well as to research scholars.
- To enthuse students to conduct experiments by arousing their curiosity. This would help them in learning basic and advanced concepts through remote experimentation.
- To provide a complete Learning Management System around the Virtual Labs
- where the students can avail the various tools for learning, including additional web-resources, video-lectures, animated demonstrations and self evaluation
- To share costly equipment and resources, which are otherwise available to limited number of users due to constraints on time and geographical distances.

SALIENT FEATURES

- Virtual Labs will provide to the students the result of an experiment by one of the following methods (or possibly a combination)
- Modeling the physical phenomenon by a set of equations and carrying out simulations to yield the result of the particular experiment. This can, at-the-best, provide an approximate version of the 'real-world' experiment.
- Providing measured data for virtual lab experiments corresponding to the data previously obtained by measurements on an actual system.
- Remotely triggering an experiment in an actual lab and providing the student the result of the experiment through the computer interface. This would entail carrying out the actual lab experiment remotely.
- Virtual Labs will be made more effective and realistic by providing additional inputs to the students like accompanying audio and video streaming of an actual lab experiment and equipment.
- For the 'touch and feel' part, the students can possibly visit an actual laboratory for a short duration.