ASPECTS OF TEACHING LEARNING IN HIGHER EDUCATION

Dr. Anil Kumar

Aspects of Teaching Learning in Higher Education

Aspects of Teaching Learning in Higher Education

Dr. Anil Kumar (Associate Professor)
M.Ed., Ph.D. (Education), M.A. (Political Science),
NET (Education) Faculty of Education, Tantia University, Sri Ganganagar

Aspects of Teaching Learning in Higher Education
Dr. Anil Kumar

Contents

Preface

"Aspects of Teaching and Learning in Higher Education" provides a comprehensive examination of the intricacies involved in educating students at the tertiary level. The book begins by delving into the fundamental principles of effective teaching, emphasizing pedagogical strategies that promote student engagement, critical thinking, and deep learning. Through insightful discussions and practical examples, educators are equipped with the tools necessary to create dynamic and inclusive learning environments that cater to the diverse needs of today's learners.

Moreover, the text addresses the evolving landscape of higher education, including the integration of technology and online learning platforms. It explores how digital tools and resources can be leveraged to enhance teaching effectiveness, facilitate collaborative learning experiences, and expand educational opportunities beyond traditional classroom settings. By embracing innovative pedagogical approaches, educators can adapt to the changing needs and preferences of modern learners while fostering a culture of lifelong learning.

Another key focus of the book is curriculum design and development in higher education. It examines the process of crafting curricula that are aligned with academic standards, learning outcomes, and the needs of diverse student populations. Through case studies and practical examples, educators gain insights into designing curricular frameworks that promote interdisciplinary learning, critical inquiry, and real-world application of knowledge.

Furthermore, "Aspects of Teaching and Learning in Higher Education" addresses the importance of assessment and evaluation in gauging student learning outcomes and informing instructional practices. It explores various assessment methods and tools, highlighting the value of formative feedback and authentic assessment tasks in promoting student growth and development. By adopting a comprehensive approach to assessment, educators can accurately measure student achievement while fostering a culture of continuous improvement and reflective practice.

The text also delves into the role of faculty development programs and professional learning communities in enhancing teaching effectiveness and promoting faculty growth and innovation. By providing opportunities for collaboration, mentorship, and ongoing professional development, higher education institutions can empower faculty members to stay abreast of emerging trends and best practices in teaching and learning. Through workshops, seminars, and peer observations, educators can engage in reflective dialogue and exchange ideas to improve their instructional practices and enhance student learning outcomes.

Moreover, the book addresses the importance of fostering a supportive and inclusive learning environment in higher education. It examines strategies for promoting diversity, equity, and inclusion in the classroom, ensuring that all students feel valued, respected, and empowered to succeed. By embracing culturally responsive teaching practices and creating opportunities for meaningful dialogue and collaboration, educators can cultivate a sense of belonging and promote academic excellence among diverse student populations.

"Aspects of Teaching and Learning in Higher Education" offers a comprehensive exploration of the key principles, practices, and challenges associated with educating students at the tertiary level. By providing insights into effective pedagogy, curriculum design, assessment, faculty development, and inclusive teaching practices, the book equips educators with the knowledge and tools necessary to foster student success and promote excellence in higher education. Through ongoing reflection, collaboration, and innovation, educators can adapt to the evolving needs of learners and cultivate a culture of lifelong learning and academic achievement in higher education settings. This book explores diverse facets of teaching and learning within higher education, offering valuable insights for educators navigating the complex landscape of academia.

–Author

1

Opportunities for Higher Technical Education

India's university system continues to be the main sources of S&T manpower development in India. Apart from more than 300 universities (governed by University Grants Commission) and institutions with deemed university status and seven Indian Institutes of Technology (IITs) of international standards, almost every state has several publicly and privately run technical and engineering colleges and polytechnics. These are administered as per the policy guidelines of the Ministry of Human Resource Development by the All India Council for Technical Education (AICTE) established as an advisory and statutory body by an act of Parliament in 1987. For details of the programmes and activities please see the web site of AICTE).

University Grants Commission (UGC)

The University Grants Commission (UGC) is a statutory organization established by an Act of the Parliament in 1956 for the coordination and maintenance of standards of university education. The commission consists of the Chairman, Vice chairman and ten members appointed/nominated by the Central Government. The Secretary heads the Commission's Secretariat.

The total Budget for the year 2002-2003 was ₹ 5597.6 million. As of 31.03.2003 there were 300 universities including 18 Central Universities, 81 Deemed Universities and 15,343 Colleges including 1650 Women Colleges. Total enrollment in all courses and levels [under graduate (89.16 per cent; Post graduate (9.17 per cent; Diploma/Certificate courses (1.00 per cent and

Research (0.67 per cent)] had been 9.228 million including 3.696 million women students constituting 40.05 per cent. The total number of Research Degrees (PhD) awarded during 2001-2003 was 11,899. Out of this, the Faculty of Arts was 4545 and the Faculty of Science was 4012 accounting for 72 per cent of the total number of PhD degrees awarded.

UGC provides financial assistance to teachers in Universities and Colleges to undertake research projects in specified subject areas. UGC approved 620 Major Projects and 830 New Minor Projects during 2001-2003 with an outlay of ₹ 22.9 million.

In addition UGC provides travel grant schemes, *etc.* and spent ₹ 7.551 million Rupees during 2002-2003. Expenditure towards assisting Universities and colleges to organize seminars/workshops/conferences was ₹ 14.7 million.

UGC has a scheme of Junior Research Fellowships for research for foreign nationals. It provided 20JRFs in 2002-2003 to Foreign Nationals at a cost of ₹.260 million. Under the Scheme of Research Awards for permanent Teachers in the Universities to devote full time in research in their respective filed of specialization, 84 research wards were given at a cost of ₹ 17.1 million. Other schemes supporting research are covered under schemes for Emeritus Fellows (₹ 9.579 million); Visiting Professors/Fellows (₹ 2.172 million) and travel grants (22.284 million).

UGC has also initiated a collaborative working with the Council of Scientific Industrial Research (CSIR) to enhance the quality of higher education, training and research in the Universities. The UGC is now in the process of formulating an institutional policy and framework for the creation and management of intellectual property rights and how to take the fruits of the research carried out in the universities and colleges to industries. This is further elaborated in the Section on Approaches to industry-academia interaction and management of IPR.

Scientific Academies in India

Among the various scientific associations in India, Indian Science Congress Association (ISCA), Calcutta is by far the oldest with a membership above 10,000 mark. It has been holding its annual sessions since its inception in 1914.

The other prominent academies are:
- Indian National Science Academy (INSA), New Delhi
- Indian Academy of Sciences, Bangalore
- National Academy of Science, Allahabad

Higher Technical Education in India at the Crossroads

Since 1947, when independence was achieved, India has been one of the few developing countries to invest extensively in both Science and Technical education. The results, though impressive in terms of quantity, have a mixed track record in terms of quality.

As a result, specific initiatives to close this gap between India and the developed world in terms of quality are now needed. India's technical education

landscape was initially dominated by the Indian Institutes of Technology (IIT), which had good faculty and facilities and the Indian Institute of Science (IISc) which had a good three-year Bachelor of Science diploma/degree programme in engineering.

However, the growth of IITs and IISc, in terms of both scalability and accountability, seemed to have gradually declined beginning in the late 1960's. In fact, no IIT or IISc was again put in place until 1995, which clearly indicates a failure on the part of the Indian government.

The IISc discontinued the diploma/degree courses in the engineering disciplines between the 1960's and 1980's and the concept of scalability (*i.e.*, having a large student intake and a higher student to faculty ratio as is obtainable in reputed pubic universities in the U.S) was never addressed.

A large number of private engineering colleges with poor facilities and unqualified faculty thus came about after 1970; constituting nearly 75 percent of the total intake of engineering students. These colleges now number approximately 1,100 compared to the seven IITs and one IISc, causing the IT industries, et al., to deem only about 20 percent of first degree holders employable. Thus, technical education developed a distorted image; graduating over 230,000 Bachelor's degree students, 20,000 Master's degree students, and 1,000 Ph.D. degree students in 2006. By contrast, according to a December 2008 report from the Indian Institute of Technology in Bombay, IITs and IISc graduate only 1 percent of this number at the Bachelor's level, 4 percent at the Master's level, and 40 percent at the Ph.D. level. For a mere 3,000 seats in IITs there are close to 300,000 applicants.

Experience has shown that at least 10-15 percent of those applicants are of IIT quality and comparable to the students at major public universities in the U.S., A direct consequence of this was an enormous, but unfortunate growth of coaching institutes where many students enrolled for two years prior to taking the IIT entrance exam. The fact that a large number of non-IIT students turn out to be equally competent and innovative was largely ignored until about a decade ago.

A comparison between India and China in this regard shows that China has developed the technical education sector much more rapidly than India. China has produced more than 5,000 Ph.D. holders per year compared to India's 1,000. China has also successfully implemented the concept of scalability as it currently has fifteen IITs (eight of which have only recently started), though it is still not clear how the newer IITs will be staffed with qualified faculty as in the existing IITs.

India's desperate shortage of faculty with post graduate degrees throughout the country has to be addressed almost on an urgent basis without appointing more committees if the country is to compete with countries like China and South Korea. In order to do so, various issues must be individually addressed.

Scalability

When addressing the issue of scalability, several reports regarding technical education or the AICTE guide lines state a figure of 15:1 as the desired student

to faculty ratio. While this figure is perhaps the norm in Ivy League schools in the U.S., it is not so in reputed public universities such as Berkeley, Illinois where the ratio is more than 20:1.

These are primarily research universities with huge undergraduate enrollments where postgraduate students are involved in various aspects of faculty assistance. Tier I institutions in India must adapt this model and concentrate more on research. Enrollment into the existing IITs can be doubled within a year or so if incremental investments in infrastructure are made.

In terms of hostel space, room sharing should be considered except for Ph.D. scholars, as is common in non-IIT schools and was the prevalent model before 1947 as well. One can make efficient use of classroom space during the daytime, run labs during both mornings and afternoons, and admit students in both semesters. Thus, more than 20,000 quality IIT undergraduate students can be generated in a four year time frame while some of the Tier II institutions can be upgraded to IIT status with no difference in undergraduate quality.

Accountability

India's recent addition of eight IITs in the current plan, with twenty more in the future, naturally raises the question of recruitment and availability of qualified Ph.D. faculty as the number of Ph.D.s produced in the country is about 1,000 per year.

This is well short of the number needed to man the engineering colleges, let alone the future IITs. The creation of new IITs cannot be delinked from faculty development. Research must be accorded top priority by the existing IITs and encouraged in other central universities and NITs. If India was to follow the criteria held in U.S., public universities – in which roughly one Ph.D. is produced per faculty member every other year – each IIT should produce about 150 Ph.D.s in engineering per year as opposed to the current forty; a target achieved by IIT Bombay in 2007. When the eight newer IITs are functional, they too should help the country achieve a target of 5,000 Ph.D.s per year by 2015 as a reasonable goal.

Restructuring the Post Graduate Programme

In a suggestion similar to the one endorsed by all three science academies in India of making the Master of Science and Ph.D. programme into a dual degree programme, IITs must have a similar dual M.Tech-Ph.D. programme where the M.Tech programme has a duration of one calendar year. There is no evidence that the current two-year programme results in any good research as only more courses are taken.

Eventually other institutions could also follow a one calendar year M.Tech programme and those who wish to quit after one year of the M.Tech programme would be free to do so. Thus, IITs would put a higher emphasis on research, and for the sake of uniformity, both science and engineering degrees could be called M.S.

IISc and IISER

It is important that IISc and the new Indian Institutes of Science Education and Research (IISER) also consider starting undergraduate and postgraduate programmes in selected areas of engineering similar to the IITs. Both science and engineering Bachelor's degree programmes can have a duration of four years in line with the recommendations of the science academies. In emerging areas of science and technology, such as nano-technology, alternative energy, and biotechnology, science and engineering faculty cannot work in isolation if meaningful breakthroughs are to be achieved.

Higher Education Opportunities in India

India is a vibrant country, with an estimated population of young people aged between 18 to 23 years to be around 150 millions.

The sher size of the market offers huge opportunities for development of the higher education sector in India. India now boasts of having more than 33,000 colleges and 600 universities, which has been quite a remarkable growth during the past 60 plus years, post independence. The year 2012 witnessed a whopping 21.4 million enrollments, which makes India the 3rd largest educational system in the entire world.

Unfortunately, the educational infrastructure of India is inadequate to handle such huge volumes. In spite all the government spending in the educational sector, it is just too insufficient to meet the growing requirements. Therefore, higher Education sector has now been identified as one of the promising areas for private and foreign investments. It offers immense investment opportunities in both non-regulated and regulated segments. Some of the major drivers of education market in India are low rate of literacy, increase in the per capita income, and rapid urbanization. Government of India is also pushing for Foreign Direct Investment to encourage investments from private educational organizations from across the world. The Education Bill has been tabled in the parliament to push for more educational reforms. The second highest potential for investments is seen in the higher education sector. Steps are being taken to reduce the complexities that are associated with the FDI governance, in order to attract international investors.

Today, India offers abundance of high quality talent pool to the world. Since the country has been able to provide educated human resource in huge numbers, it has become one of the fastest growing economies among all the countries in the world. The difference has been quite noticeable after the 90s, when liberalization took place. The importance of education has always been emphasized by the founding leaders of the nation, and the same principles have been carried forward by the governments that came to power subsequently. Over 60 plus years of independence, we have seen significant importance being given to bring about better educational standards. During the time of independence, there were just around 500 colleges and 20 universities across the nation. With the growth in population, the numbers have also increased quite exponentially.

Administration of Science and Technology in India

Traditionally strategic sectors of atomic energy and space are vested with the Prime Minister. The Principal Scientific Advisor to the government is at the helm of the Scientific Advisory Committee to the Cabinet (SACC) in which the secretaries of scientific departments are ex-officio members. The SACC has no executive authority and therefore the implementation of its recommendations is left to various Ministries or State governments.

Department of Science and Technology is the nodal Department of the Ministry of Science and Technology to deal with issues relating to the promotion and development of Science and Technology in the Country. It has three subordinate Departments *viz.* India Meteorological Department (IMD), National Atlas and Thematic Mapping Organisation (NATMO) and Survey of India (SOI) under its Administrative Control. In addition to it, the Department also supports 21 autonomous research institutions/S&T professional bodies, which are working in diverse areas for the promotion of Science and Technology. The DST is involved in S&T Policy formulation, funding of S&T projects in institutions not only under its control but also disburse funds to science workers in other institutions and simultaneously foster academia-industry interactions through its programmes.

Department of Scientific and Industrial Research (DSIR)

The Department of Scientific and Industrial Research (DSIR) is a part of the Ministry of Science and Technology, which was announced through a Presidential Notification, dated January 4, 1985. The mandate for DSIR is to carry out activities relating to indigenous technology promotion, development, utilization and transfer. The Department is also responsible for coordination of the activities of the Council of Scientific and Industrial Research (CSIR) and two public enterprises, namely National Research Development Corporation (NRDC) that is responsible for commercialisation of indigenous technologies and Central Electronics Limited (CEL).

The NRDC also provides consultancy services to academics, industry entrepreneurs to protect their Intellectual Property Rights, transfer technologies, strike licensing deals for various inventors, entrepreneurs, *etc.* Through such activities NRDC supports and facilitates effective industry-academia interactions that result in commercialization of developed technologies.

NRDC as a Facilitating Agency

NRDC makes arrangements for preparation of feasibility and project reports, provides basic design and engineering through consultants and arranges finances not only for joint technology development for setting up pilot plants but also for commercial level plants. NRDC provides nominal financial assistance by way of interest-free development loans or by participation in the equity of new ventures. NRDC generally invests upto 26 per cent of the total equity of the

licensee company, which in exceptional cases may go up to 50 per cent. It also facilitates the procurement of Venture Capital Fund Assistance from the Technology Development Board, the Industrial Development Bank of India, Risk Capital and Technology Finance Corporation Ltd., Technology Development and Information Company of India Ltd. or term loans from the State Financial Institutions.

The corporation finances up to 50 per cent of the expenditure involved in putting up pilot plants, building of prototypes, establishment of demonstration units to make the laboratory know-how suitable for commercial exploitation and to fill the gaps in the existing technologies. The contribution from NRDC is meant to be utilised for purchase of plant and machinery for the project. On successful completion of the developmental project, the know-how so developed is released to the collaborating partner on concessional terms. When this know-how is to be licensed to other entrepreneurs, a part of the premium and royalty so collected is passed on to the collaborating partner according to the terms and conditions negotiated in advance.

In the event of the collaboration project being successful, the collaborating partner has to pay back to NRDC the expenditure incurred by the Corporation on the project in accordance with the negotiated mode of payment. In case the development work is not successful, NRDC will write off its own share of the expenditure incurred on the project. The equipment bought for the development work is disposed off and the proceeds shared between NRDC and the collaborating agency in the ratio of their financial contribution.

Council of Scientific and Industrial Research (CSIR)

The Council of Scientific and Industrial Research (CSIR), established in 1942, is an autonomous body registered under the Societies Act, 1860, with a broad agenda for promotion and development of science and technology. At present, CSIR has a network of 39 laboratories and several field stations/extension centres/regional centres all over India to undertake R&D in several disciplines. The areas of activity vary from molecular biology to leather, from seismicity to computer modeling, from aerospace to ocean sciences, from glass to steel, from micro-electronics to a range of test facilities and so on. The extension and regional centres have been established to disseminate information and awareness on the R&D capabilities and technologies developed at the national laboratories. The CSIRs role in the overall industrial development of the country has been in terms of providing technical know-how for upgrading existing technologies and generating fresh technologies as an answer to the growing needs of the industry.

In recent years CSIRs has taken an aggressive and strategic stance in the identification of projects and commercialization of its technologies in collaboration with leading industries of global repute. It has also formulated and implemented its IPR Policy and has set up a systematic system for the management of its IPR that is well integrated with R&D project management.

CSIR is also closely working with various indegeneous industries, private and public sector undertakings to develop and commercialise its R&D results and technologies. By virtue of vast sophisticated infrastructure along with world-class expertise and competence in diverse fields of science and technology, CSIR today is in an enviable position to offer a range of training opportunities for amateur scientists and technicians both within the country and outside, particularly from other developing countries.

Department of Ocean Development

India's coastline sprawls over a distance more than 7,500 km long, and its territory includes 1,256 islands. Its exclusive economic zone covers about an area of 200 m sq. km and the continental shelf stretches up to 350 nautical miles from the coast.

The domain for the development of oceanic resources and preservation of the marine environment extends from the coastal land and islands to the Indian Ocean. The Government of India has established the Department of Ocean Development in 1981, to promote and co-ordinate the many endeavours required to accomplish the task, as well as to develop the emerging frontier of Antarctic research and deep seabed mining.

There are two premier research institutions in the country in the area of ocean research namely The National Institute of Ocean Technology (NIOT) set up in 1993 functioning in co-ordination with Indian Institute of Technology, Madras and The National Institute of Oceanography (NIO) established in 1966, under CSIR.

The key objectives of these institutes is to develop the science-knowledge base and technologies related to physical, chemical, biological, geological and engineering aspects of the seas around India including development projects for exploration and utilisation of natural resources of the seas and to develop necessary technologies for the concept of Coastal Zone Management for comprehensive and sustainable development of the coastal belt and islands of the country

Department of Biotechnology (DBT)

The responsibilities of the Department of Biotechnology (DBT), include identification of specific R&D programmes in biotechnology and biotech related manufacturing, establishing infrastructure support at the national level, *etc.* among other things such as policy guidelines bio-safety.

DBT has been supporting a wide range of R&D projects in various academics and research institutions throughout the country, which include the following areas of Vaccines development, Contraceptive research, Development of genebanks, PCR based diagnostics, Bioinformatics, Genome analysis, Biofertilisers and biopesticides and Bioremediation.

DBT also has the following two autonomous institutions under its control namely National Institute of Immunology (NII), New Delhi and National

Facilities for Animal Tissue and Cell Culture (NFATCC), Pune DBT is also involved in setting up the National Policy on Biotechnology including the formulation of the Bioinformatics Policy of India (2004). The policies have explicitly emphasised the promotion of Entrepreneurial development with industry participation and building academia-industry interface.

Department of Electronics (DOE)

Department of Electronics (DOE) has helped bring the benefits of electronics to all walks of life and is responsible for making the Indian Electronics Industry a global player. It plays a promotional role in the development and use of electronics for socio-economic purposes. Application of electronics in fields like agriculture, health and service sectors has been paid special attention. A multi-pronged approach has been adopted for result-oriented research and development with extra emphasis on microelectronics, telematics, and high performance computing and software development.

The Department of Electronics supports and funds technology development through its councils set up in several spheres, such as, the Technology Development Council (TDC) for areas like components, computer communication and instrumentation, *etc.,* the National Radar Council (NRC) for radars, navigational aids, sonars, underwater electronics systems, laser and infra-red based detection/ranging systems, *etc.* These councils also provide inter-ministerial forum for all-round development including generation of production capabilities in their respective fields.

Param, the parallel super computer developed indigenously by C-DAC. Time bound projects in particular areas are implemented through separate scientific societies like Centre for Development of Advanced Computing (C-DAC) which has conceived, designed and delivered parallel super computer with peak computing power of 1 G Flops. Their second project is aimed at a super computer of 100 G Flops speed. The Centre for Materials for Electronics Technology (C-MET) has been established to provide technology for several electronic materials.

The Standardisation, Testing and Quality Certification (STQC) Programme provides standardisation, testing, calibration and certification support to Indian electronics industries meeting national/international norms through its network of 21 labs throughout the country. STQC has also established dedicated training institutes like Centre for Electronic Test Engineering under Society for Electronic Test Engineering and Indian Institute of Quality Management. STQC has MOUs with leading safety testing and certification organisations like UL USA and VDE Germany. The test reports/certificates issued by STQC are recognised by these organisations, as by the member countries of IECEE, which can facilitate Indian industries to compete in the global market.

Department of Atomic Energy (DAE)

The Indian Atomic Energy Commission was first set up in August 1948 in the then Department of Scientific Research, which was created a few months

earlier in June 1948. The Department of Atomic Energy (DAE) was set up on August 3, 1954 under the direct charge of the Prime Minister through a Presidential Order. Subsequently, in accordance with a Government Resolution dated March 1, 1958, the Atomic Energy Commission (AEC) was established in the Department of Atomic Energy. The then Prime Minister also laid a copy of this Resolution on the table of the Lok Sabha on March 24, 1958.

The Department of Atomic Energy (DAE) is an organization incorporating. Research Centres and closely linked industrial units and provides conditions for fulfilling scientific enquiry and technology development and transfer. The DAE has been responsible for the successful execution of comprehensive R&D programmes in nuclear sciences including the deployment of technologies.

This has been a crucial factor in building a self-reliant capability in all aspects of the nuclear fuel cycle and strengthen India's ability to carry forward with further domestic developments of advanced technologies, so as to remain immune from technology denial regimes and tailor our programme to be in tune with our nuclear resource profile.

In parallel to the above programmes, the units of DAE lay strong emphasis on basic research in nuclear sciences and allied areas. This covers frontier areas in physics like condensed matter physics, nuclear physics, theoretical physics, molecular and optical sciences, plasma physics, astrophysics, cosmic ray and high energy physics, accelerator and laser physics; in chemistry like radiation and photo-chemistry, laser chemistry, interfacial chemistry and chemical dynamics; in biology like molecular biology, cell biology, radiation biology, genetics, cancer research; in agricultural sciences and food technology; and in mathematical and computer sciences.

DAE encourages and promotes scientific research in universities, institutes and laboratories in the areas of relevance to DAE through the Board of Research in Nuclear Sciences (BRNS) and the National Board for Higher During the year 2003-04, the Board approved 134 new research projects at a total financial assistance of ₹ 120 million. Financial sanctions involving an expenditure of ₹ 97.9 million were also committed for various ongoing research projects.

Under the UGC-DAE Consortium for Scientific Research, DAE and the University Grants Commission (UGC) had signed a MoU in 1989 for setting up Inter-University Consortium of DAE Facilities (IUC-DAEF) at Indore. The Consortium functions under the control of UGC. The scope of cooperation was broadened to include all programmes pursued by DAE in the area of physical, chemical, life and engineering sciences. The name was also changed to UGC-DAE Consortium for Scientific Research. DAE also has several industrial units under it namely Indian Rare Earth Ltd., Mumbai to produce minerals like zircon for Nuclear Power Programme and also produces rare earth products; Electronic Corporation of India Ltd., Hyderabad to produce electronics and Instrumentation for Atomic Power Plants, computers, military systems and consumer electronic products; Uranium Corporation of India Ltd., Jaduguda involved in mining Uranium Ore and produces Uranium Concentrate used as fuel in Nuclear Power

Programme. The corporation operates uranium mines at Jaduguda and Narwapahar in the state of Bihar. It processes the ore to produce Uranium concentrate at its mill in Jaduguda.

DAE has a unique chain of institutions that are ideally placed to generate technologies in house and also through collaborations with diverse R&D Centres in India including the Universities and transfer them to the industries run by DAE or to private industries

Defence Research and Development Organisation (DRDO)

The research wing of the Ministry of Defence, known as Defence Research and Development Organisation (DRDO) is engaged in the pursuit of self-reliance in critical technologies for national security. DRDO works through a network of 50 national laboratories/establishments under its control and maintains close partnership with a large number of academic and research institutions as well as private and public sector companies. The effective technology development in various government-funded laboratories and in private industries in defence related areas are funneled through the DRDO into the national programmes which manifest themselves in the successful defence related products.

The projects addressed by DRDO cover a wide range of disciplines such as aeronautics, rockets, missiles, electronics and instrumentation, armament technology including explosives, computer science, material science, food and agriculture, biological and behavioural sciences, *etc.*

Department of Space (DOS)

The Indian Space Research Organisation (ISRO) is the research and development wing of Department of Space (DOS), Government of India and is responsible for the execution of the national space programme

The Indian Space Programme is directed towards the goal of self-reliant use of space technology for national development, its main thrust being:
   (a) Satellite communication
   (b) Satellite remote sensing for resources survey and management, environmental monitoring and meteorological services.
   (c) Development and operationalisation of indigenous satellite and launch vehicles for providing these space services.

The most outstanding impact of INSAT has been in the impressive expansion of television, which with 650 TV transmitters and direct reception sets now provides access to over 80 per cent of the countrys population. Special inexpensive hardware has been developed to promote an effective interactive educational system through satellites; the system was successfully experimented in various states.

Using INSAT series of satellites, innovative interactive training programmes are being regularly conducted in various states in the following areas:
   • Training for farmers,
   • Education in rural development with programmes On development of women and children in rural areas

- Watershed development.
- Programmes on Panchayati Raj for elected women members
- GRAMSAT

The concept of dedicated GRAMSAT satellites has evolved, keeping in mind the urgent need to eradicate illiteracy in the rural belt, necessary for the all-round development of the nation. The GRAMSAT will also assist in providing continuing education for special groups to ensure that their technical skills are periodically updated to overcome technological obsolescence. The GRAMSAT may employ six to eight high power C-band transponders.

ISRO supports the following autonomous institutions:
- Space Centres and Units
- Vikram Sarabhai Space Centre (VSSC),
- ISRO Satellite Centre (ISAC),
- Space Applications Centre (SAC) Ahmadabad,
- SHAR Centre, Sriharikota
- Liquid Propulsion Systems Centre (LPSC),
- National Remote Sensing Agency (NRSA), Hyderabad,
- The National Mesosphere, Stratosphere, Troposphere Reader Facility (NMRF)

The DOS with ISRO is another example where there has been intense and focused academia-industry interaction to deliver ground level results in India.

Indian Council of Agricultural Research (ICAR)

From a nation dependent on food imports to feed its population, India today is not only self-sufficient in grain production, but also has a substantial reserve and has of late started exporting appreciable quantities of wheat and rice. The progress made by agriculture in the last five decades has been one of the biggest success stories of free India. Agriculture and allied activities constitute the single largest contributor to the Gross Domestic Product, almost 33 per cent of it. Agriculture is the means of livelihood of about two-thirds of the workforce in the country. The apex body for education, research and extension education in the field of agriculture is the Indian Council of Agricultural Research (ICAR) established in 1929. India's transformation from a food deficit to a food surplus country is largely due to ICAR's smooth and rapid transfer of farm technology from the laboratory to the land. ICAR discharges its responsibilities through 43 research institutes, four national research bureaus, 20 national research centres, nine project directorates, 70 all-India coordinated research projects, and 109 Krishi Vigyan Kendras (farm science centres). Besides, the programme of Agricultural Education is coordinated by ICAR with the curricula and other normative guidance given to the 26 Agricultural Universities and four National Research Institutes.

Indian Council of Medical Research (ICMR)

Indian Council of Medical Research (ICMR) is the apex body in the country to formulate, promote and coordinate biomedical and health research. It carries

out its intramural research through 21 permanent research institutes/centres and 6 regional medical centres. The Council promotes biomedical research in the country through intramural as well as extramural research. Over the decades, the base of extramural research and also its strategies have been expanded by the Council.

The research activities of ICMR include communicable and non-communicable diseases, contraception, reproductive biology and maternal and child health, nutrition, environmental and occupational health, traditional medicine and basic medical research. In the field of communicable diseases, research is conducted on tuberculosis, leprosy, malaria, filaria, leismaniasis and diarrhoral diseses.

Extramural research is promoted by ICMR throughL:
  i.   Setting up Centres for Advanced Research in different research areas around existing expertise and infrastructure in selected departments of Medical Colleges, Universities and other non-ICMR Research Institutes.
  ii. Task force studies which emphasise a time-bound, goal-oriented approach with clearly defined targets, specific time frames, standardized and uniform methodologies, and often a multicentric structure.
  iii. Open-ended research on the basis of applications for grants-in-aid received from scientists in non-ICMR Research Institutes, Medical colleges, Universities, *etc.* located in different parts of the country.

In addition to research activities, the ICMR encourages human resource development in biomedical research through:
  •   Research Fellowships
  •   Short-Term Visiting Fellowships.
  •   Short-Term Research Studentships.
  •   Various Training Programmes and Workshops conducted by ICMR Institutes and Headquarters.

Higher Education in India: Opportunities Aplenty, Development Unlimited!

The role of higher education in the growth and progress of a nation has been well recognized for centuries. Thankfully for India the input, in terms of the number of people entering the system, has never been an issue. Instead, the urgent need has been to address the shortcomings of the entire process of converting youth into educated and well groomed citizens.

With about 50 per cent of the Indian population below the age of 25 years, and an estimated 150 million people in the age group of 18-23 years, India is a "young nation with high aspirations". Having realised the importance of the education sector, the Government has increased its focus to introduce a number of reforms to iron out some key irritants, discussed later in this article. There are currently around 20 separate education bills awaiting approval in the Indian Parliament, with the majority of them focused on higher education.

In the last six decades, the higher education sector in India has witnessed exponential growth, both in terms of the number of institutions and the rate of enrolment. From just 30 universities and 700 colleges in 1951, today there are

over 600 universities and 33,000 colleges. Similarly, with over 21.4 million enrolments in 2012, India has become the third largest education system in the world, after China and the U.S.

Market Size

Despite the recent growth, the Gross Enrolment Ratio (GER) in higher education in India is still about 18 per cent, which is far lower than the global average of 26 per cent. Therefore, the Government has set itself an aggressive target of achieving 30 per cent GER by 2020.

According to estimates, the target entails an additional investment of $190 billion (including capital and operating expenditure) in the next seven years to enrol an additional 25 million students. The National Knowledge Commission, a high-level advisory body to the Prime Minister, has projected a requirement of 1500 universities to achieve this target. Between 2010 and 2015, the market size of the higher education sector is expected to register a compounded annual growth of 25 per cent, thus making it worth $57 billion by 2015. Indian students have been one of the top spending groups when it comes to pursuing higher education overseas, with a collective spend of over $14 billion, as recorded in the year 2010.

Higher Education Market

Although the sector has been largely dominated by government institutions, the role of the private sector has witnessed a substantial increase in the last decade. The private sector's share of student enrolment has grown from 33 per cent in 2001 to 59 per cent in 2012. This growth can be attributed mainly to the inability of the government to meet the large demand-supply gaps, poor quality infrastructure in existing institutions, demand for quality world-class education and rising disposable income of the Indian middle class.

Opportunities for Foreign Investment

The total allocation of funds for the education sector, under the 12th Five Year Plan (2012-17) is about $82 billion; out of which the share of higher education is only 24 per cent. The remaining share is spread across the primary and secondary education segments. Given the government's limited resources, the higher education sector holds an immense opportunity for private and foreign investors. Further, in its approach paper to the 12th Five Year Plan, the Planning Commission has advocated the need to re-examine the current 'not-for-profit' approach in higher education and consider a more pragmatic manner to attract investment. All these steps are indicative of the sector's future growth prospects.

The opportunities for foreign investment include:

- Establishing formal educational institutes in collaboration with the Indian private sector
- Twinning arrangements/academic and financial collaborations with Indian institutions

- Providing infrastructure services including construction development
- Setting up an Indian subsidiary for course content development, training and other unregulated offerings
- Establishing foreign universities/technical institutions campuses in India

Recent Developments and the Way Forward

In order to address concerns around the quality of education, the University Grants Commission (UGC), the apex body that regulates the universities and colleges in India, has introduced regulations that make accreditation mandatory for all non-technical institutions. This is a positive step to increase transparency and improve the quality of higher education in India. Deloitte India's discussions with the government indicate that the technical institutes (engineering, business schools, *etc.*), that are not currently covered by these regulations, will also be brought within the ambit of mandatory accreditation in the near future.

In addition, the long-awaited Foreign Education Providers Bill is expected to be approved in the near future. This will permit foreign educational institutions to set up campuses in India and award degrees. The bill is expected to transform Indian higher education by bringing global best practices to the country. It has recently been approved by a Parliamentary Standing Committee, consisting of members from key political parties, and now awaits approval from the Lower and Upper house. There is no doubt that the sector offers unparalleled opportunity for growth to foreign investors. Recent reforms indicate the government's intention to radically transform the sector by introducing global best practices. In view of the regulatory complexity involved, it would be advisable to enter the market with a well thought-out strategy and a long-term approach. Deloitte has been working with a number of organisations to explore such approaches and associated implications.

Deloitte India's Education Practice

Given the increased focus on the education sector, Deloitte in India has set-up a dedicated education practice. The practice has been set up as an IMO (Integrated Market Offering), wherein, all bouquet of services such as consulting, strategy, tax, regulatory, financial advisory and audit are offered collectively under the leadership of the practice's leader.

Being a regulated sector, Deloitte has been actively working with the government to introduce reforms by providing assistance in drafting higher and technical education policies, state education plans and skill development initiatives. We have also been advising foreign educational institutions and companies to conceptualise and implement India-entry strategy through greenfield projects or acquisitions/tie-ups by providing advice on strategy, partner identification, tax and regulatory, operations, IT, human resource and financial advisory. As part of our initiative to apprise foreign educational institutions and companies about the huge scope offered by the Indian higher education sector, we organised a

road show in London on 14 March, 2013. The objective of the road show was to provide an overview of the sector including opportunities for foreign investors, market size, tax and regulatory framework, our insights and key considerations. In order to provide the government's perspective, a senior member from the Indian High Commission also briefed the attendees. Given the interest in this subject and the success of the event, the team will organise similar events in other countries in the near future.

Technology Enabled Technical Education in the New Learning Paradigm

Institutions of higher technical education are facing new challenges as well as opportunities in delivery and access of education, due to a variety of factors. While political, social and economic factors have always remained relevant to the issue, recent developments in technology, globalization and changing demand for new skill sets in the job market have necessitated a need for a new teaching and learning paradigm. In a democratic society, making higher technical education accessible to all without time, space, gender, and class barriers is a noble goal.

Policy, finance, role of state and institutional management are some of the critical issues that have to be addressed for developing a sustainable model of education for achieving this goal.

The scope of issue of access and delivery of higher technical education goes beyond the question of funding. Widening access to higher technical education is more than just an economic necessity. UNESCO3, for instance has related the issue with diversification of education, through diversification of:

- *Contents* to avoid monolithic model,
- *The types and paths* of education, as regards systems and structures, so that they spread virtually through out the life of each individual
- *The method and places* of learning, notably for practical tasks

This chapter aims to emphasize the need for a new learning paradigm of open and flexible learning that enables wider and equitable access to higher technical education, and highlight the role of technology in implementing open learning. In section 2, the factors that are driving the learning environment are briefly listed. Section 3 describes salient features of new learning paradigm, and open learning and e-learning are discussed.

In section 4 challenges and concerns in implementing e-learning are examined. In section 5 different approaches for implementation of e-learning are suggested. In Section 6, an attempt has been made to demonstrate how the use of technology can help in introducing open learning concept in a university setting, with the help of a case study. The paper concludes with some suggestions for implementation of a technology enabled open learning model.

Access and Delivery: The Perspective

Some of the limitations of the conventional education model have been described as, geographic and time inequality, unsuitability for lifelong learning,

high cost of infrastructure, shortage of faculty, high cost of staff, inefficiency in assessment system, cost of cost material. One can add lack of flexibility and customization, failure to use analytical and exploratory capability of the students to the list. There is also a need to look at the issue of access and delivery of higher technical education in a new perspective, which is characterized by 4 -

- The Knowledge Society and need for life long learning.
- Globalization.
- Changing role of the state in higher education.
- Quality and customer focus in delivery of educational services.
- Developments in information and communication technology and its potential for delivery of education.
- Emergence to new jobs, frequent changes in job requirements in one's life time and consequent demand for different skills.

The New Learning Paradigm

To prepare knowledge workers and make higher education widely accessible, a new paradigm has been suggested with flexible, open, self paced, student centred learning based on collaborative two way processes. In a learning society, learning is an essential part of life. Learning takes place at all points of time and space.

The facility for learning should be accessible to everyone, everywhere and at all the time. The balance of convenience should be in favour of the learner. Therefore, education should be made available as per the specification of the learner. The time, location and pace of learning should also be decided by the learner.

Hariharan has compared the two learning models in the following table:

Traditional Learning Environment	New Learning Environment
Teacher-centered instruction	Student-centered learning
Single sense stimulation	Multi-sensory stimulation
Single path progression	Multi path progression
Single media	Multimedia
Information Delivery	Information exchange, Knowledge development
Isolated work	Collaborative work
Passive learning	Active inquiry based learning
Factual thinking	Critical thinking & decision making
Reactive response	Proactive planned action
Isolated, artificial context	Authentic, real-world context
Classical method of assessment : Testing of bookish knowledge	Test of knowledge, skills, problem environment
Geared to predefined jobs	Adaptable to new job requirement in a rapidly changing knowledge economy

The contents are guided by the needs of the society, which largely vary from person to person, and also need frequent changes. Therefore, there should be a gradual shift from standard education to customized service. Flexibility would permit the students to learn at a convenient time and place., and also allow them to define their own learning needs.

Open learning, resource-based learning and e-learning approaches have been advocated which can address these requirements.

2

Higher Education: Meeting Challenges in 21st Century

THE EDUCATION AND CONTINUAL UPGRADING

With its diverse population and changing demographics, the United States can capitalize on its multiracial, multi-ethnic society to compete successfully – domestically and in the global marketplace. To do so, all citizens must be equipped with the skills and knowledge they need to succeed in and contribute to the new economy. The country is facing a shortage of workers prepared to meet the needs of the competitive marketplace and the economy will surely suffer if that shortage is not addressed. This is particularly true in New Jersey and other states where industries are intensely knowledge-dependent. The education and continual upgrading of the workforce and citizenry to sustain the economy and quality of life are dependent to a large degree on higher education.

Colleges and universities prepare entry-level workers, middle management and corporate executives, while providing essential civil and social foundations. Enrolment in higher education across the nation is increasing and the trend is expected to continue. More Americans are graduating from high school and according to the U.S., Department of Labour, in 1998, 57 percent of the high school graduates entered college the following fall.

In the past 50 years, enrolment in U.S., higher education institutions has grown from 2.5 million to more than 14 million. Here in New Jersey, college and university

enrolment increased 160 percent since 1965, rising from 127,000 students to over 330,000. More than one-third (123,000) of these students are enrolled in two-year community colleges. Over 140,000 attend senior public institutions, with 62,000 at the three research universities and 78,000 at the state colleges and universities. About one-fifth (67,000) of the students attend independent colleges and universities, including 14 public-mission institutions, 3 proprietary institutions and 8 theological institutions. Since 1965, graduate enrolment in New Jersey doubled from 25,000 to 50,000, undergraduate enrolment grew from 100,000 to 280,000 and part-time enrolment grew from 58,000 to 1,41,000.

The growth of the nation's population certainly explains part of the increase in participation in higher education. Enrolment growth, however, is influenced also by labour market requirements, which have increased steadily. Put simply, the information-based economy is skills-intensive and knowledge is essential for growth. High-tech industries account for a significant portion of the new jobs being created across the nation. In New Jersey, technology is the fastest growing sector, requiring specific skills and ongoing training and development.

Nationally, occupations that require a college degree are growing twice as fast as others and the value of those degrees continues to increase. In 1979, the average college graduate earned 38 percent more than the average high school graduate; by 1999, it had jumped to 71 percent more. While the fastest growing jobs do require a college degree, many jobs being created require specific skills but less than an associate degree. For individuals with training and those with a degree, life-long learning to upgrade skills and prepare for multiple careers over a lifetime is now a standard expectation. The dynamic economy and global marketplace have significantly increased the demand for higher education and training at New Jersey colleges and universities. The institutions are expanding their capacity to meet increasing enrolment and needs, enhancing flexibility to serve students effectively through non-traditional means and strengthening parity among all minority groups in respect to enrolment, academic performance, faculty retention and graduation rates. As colleges and universities strive to provide both access and success for all potential students, government support for institutions is crucial.

Given the key role higher education plays in preparing future citizens and leaders and sustaining the economy and well-being of the state, the return on investment in colleges and universities is high. Operating support from state and local governments provides the very foundation on which New Jersey's 31 public institutions exist; the state also provides financial support to the 14 independent institutions with a public mission. The state's targeted support for student assistance; higher education facilities, technology and equipment; special programmes; and research and development is also fundamental to sustaining a higher education system prepared to meet the challenges of the future.

Access to Knowledge and Opportunity

In FY 1999 New Jersey made a commitment to significantly increase funding for its 19 community colleges. The commitment is consistent with the state's

long-range plan for higher education, which calls for an increase in the state's share of operating costs for public institutions to better balance the funding partnership. New Jersey students were paying considerably more to attend community colleges than their counterparts nationally, even after adjusting for cost of living. As a result of the state's annual funding increases, average tuition increases at the two-year colleges have been minimal since FY 1999 and several institutions have frozen tuition. The state's share of operating costs increased from 24.8 percent in FY 1998 to 28 percent in FY 2000. The additional funding provided in the current year and in FY 2002 will continue to increase the state share.

Increased state funding is working to help the community colleges rebalance the partnership among students, the state and counties. But, it takes time and a commitment from the institutions to moderate both expenditure and tuition increases. It also requires a commitment from all county governments to move towards their one-third share of operating expenses. Currently support from counties varies considerably, with some paying well above one-third and some paying much less. The average percentage share for countries has decreased, however, from 34 percent in FY 1995 to 31 percent in FY 1999.

Shares of Operating Aid

While all students benefit, the minimal increases in community college tuition since FY 1999 have had the greatest impact on the state's most disadvantaged, low-income students. For them, access to higher education is particularly dependent on reasonable tuition levels, which better enable students to complete their degrees expeditiously and to move into the workforce or to a four-year college. Continued effort to reduce the student share of the partnership to one-third will help attain the desired parity in enrolment and opportunity. New Jersey's community colleges strive to provide a convenient and efficient transfer route for baccalaureate seekers, reducing overall tuition outlays. They are often the only route to higher education for many economically and academically disadvantaged students, as well as many older returning students who seek to upgrade their skills. The community colleges are also a principal source of human capital at the technical level, which is highly desired by the state's high-tech industries.

Like the community colleges, the state's 12 senior public institutions play a major role in preparing students to contribute to the workforce and society. The state's three public research institutions comprise the land grant university, the comprehensive health sciences university and the technology research university. In addition to preparing future members of the workforce, these institutions play a significant role in research and development. The state is also advantaged to have nine state colleges and universities that collectively prepare a major portion of the state's workforce at the baccalaureate level. Each of these nine institutions has a distinctive mission, encompassing a variety of educational emphases, including science and technology, education and teacher preparation,

service to urban populations, adult and continuing education and undergraduate and graduate programmes in the liberal arts, fine arts and business disciplines. The state's long-range plan for higher education calls for a two-third state share of operating costs for the senior public institutions, with student tuition covering the other one-third.

Preliminary figures for FY 2000 indicate the state's share was approximately 57 percent. The long-range plan also stresses the need for institutions to be increasingly diligent in holding down costs, enhancing instructional and research productivity and collaborating with their peers, as well as in raising external funds to assist in meeting some non-recurring costs. External funds have increased somewhat at the senior public institutions. On average the institutions also have held down expenditure increases over the past five years while taking steps, when necessary, to meet the demand for new students, expand and improve offerings and facilities and upgrade technology and library collections. The percentage increases in expenditures from FY 1994 to FY 1999 are indicated below. Salaries account for approximately 72 percent of these increased expenditures, with contractual salary increases, which are negotiated by the state in most cases, as the primary driver.

The state should strongly consider a significant increase for the senior public institutions in FY 2002 to cover inflationary and salary programme increases and assist with improvement efforts and growth to accommodate the increasing numbers of students seeking to enrol. Additional funding will move the state closer to the desired two-thirds share of state support, reduce the need for tuition increases to cover increasing operational and debt service expenses and have a significant impact on the continued affordability, adequate capacity and overall quality of the public four-year institutions. Restraint in tuition increases in this sector will also enhance access to higher education opportunities for citizens, reduce time to degree completion and expedite entrance into the workforce.

At the same time, additional state funding will assist the colleges and universities in developing a high-tech workforce to support New Jersey's industry, economy and societal needs. The state's colleges and universities must be competitive with the best in the nation. They require excellent faculty who are equipped with the latest technology and other resources to prepare students for the rapidly changing workforce that fuels the economy. Additional state support for the 12 four-year public colleges and universities will help them to meet these challenges without relying on students to pay an increasingly larger share of operating and debt service costs and without limiting access and opportunity for middle- and low-income students. It will also assist the institutions in further enhancing their reputations and attracting more students from within and outside New Jersey.

In order to help maintain a strong sector of independent institutions that offers both access and choice, New Jersey's Independent College and University Assistance Act (ICUAA) provides state funding to the 14 independent institutions with a public mission.

The act reaffirmed the state's commitment to the development and preservation of a planned and diverse system of higher education that encompasses both public and independent institutions. Subject to the availability of funds, the ICUAA calls for state aid to this sector based on the number of full-time equivalent New Jersey undergraduates enrolled multiplied by 25 percent of the level of direct support for the state college and university sector. This support recognizes the major contribution of the independent colleges and universities to the state's citizens and economy. These 14 institutions enrolled more than 56,000 students in 1999 and over 75 percent of their undergraduates were from New Jersey. Approximately 14 percent of New Jersey's undergraduate students and 34 percent of its graduate students attend public-mission independent institutions. Like the public two- and four-year colleges, the independent institutions also require high-quality faculty and infrastructure to help fuel the economy by preparing leaders and a labour force to meet the challenges of the future. In 1995, the Commission's report on funding higher education called for the state to move towards full funding of the ICUAA statute. Consistent with that goal, the Commission recommends an FY 2002 appropriation for the independent institutions that will move the state towards the statutorily prescribed funding level for ICUAA, thereby strengthening the public-private partnership and the institutions' contributions to New Jersey.

Equitable Access and Student Support

Given that minority groups will make up nearly one-half of the population and immigration is expected to account for almost two-thirds of the population growth, the nation cannot afford to underutilize any segment of the talent pool. All must be integrated into the workplace, recognizing issues of equity and the shortage of skilled workers at all levels. Diversity is undoubtedly the nation's greatest opportunity for the future.

Among the industrialized countries in the world, the United States is a leader in providing access to higher education. However, less educated workers of all racial groups continue to fall behind in earnings. All Americans must be equipped with the skills and knowledge needed to succeed. Endeavours to achieve this goal and expand access to higher education and the opportunities it offers must be intensified. The demand for increased skills and life-long learning require even greater efforts to include workers who have been left behind and not shared in the prosperity.

Nationally, educational attainment is rising, but gains vary considerably across racial and ethnic lines. According to the U.S., Department of Labour, 1997 was the first time the high school graduation rate for African Americans was statistically on par with the graduation rate for whites. However, the high school graduation rate for Hispanics, the fastest growing segment of the population, was more than 20 percent lower, with little increase shown in the 1990s. Programmes designed to achieve parity in higher education enrolment, academic performance and graduation rates are central to capitalizing on the nation's

diversity. New Jersey has a highly educated and diverse populace. Demographic reports indicate that the state is and will continue to be one of the most diverse in the nation. Approximately 87 percent of the residents over age 25 have a high school diploma and close to 31 percent have obtained a bachelor's degree or higher. This is well above the national average of 25 percent.

The attainment rates among New Jersey minority groups exceed national averages. Minority enrolment in college has increased steadily over the past 20 years, consistent with the national trend. Following a brief decline in the early 1980's, African American enrolment increased from 9.6 percent in 1986 to 12.5 percent in 1999. Hispanic enrolment grew from 4.4 percent in 1979 to 11.3 percent in 1999 and Asian enrolment grew from 1.2 percent in 1979 to 7.1 percent in 1999. While more students from all racial groups are attending college, African Americans and Hispanics continue to lag behind in college attendance and transfer and graduation rates in New Jersey as they do nationally.

New Jersey has a long-standing commitment to state student assistance programmes that keep higher education affordable for all residents. The state is ranked second in the nation in the percentage of full-time undergraduates receiving need-based grant aid and in need-based dollars per student; it is sixth in financial aid of any kind as a percentage of total state higher education funding. A recent report in *Post-secondary Education Opportunity* cited New Jersey as one of the top three states in the nation in regard to providing opportunities for college enrolment for students from families with annual incomes below $25,000. The report acknowledges New Jersey as a state where a student's chances to attend college have significantly increased over the past seven years.

Tuition Aid Grants (TAG): The state's primary need-based aid is provided through the Tuition Aid Grant programme, which significantly reduces tuition costs for nearly one-third of all undergraduates attending public and independent colleges and universities in New Jersey. In FY 1999, nearly half of the 57,400 TAG recipients were from families with incomes under $18,000 a year. Without the support of TAG, along with Educational Opportunity Fund grants, most of these low-income residents would likely be shut out of higher education and the career opportunities it affords.

In FY 2002, increasing TAG to maximum current year tuition levels for full-time students will help ensure access and affordability and continue the state's long-standing commitment to need-based aid. In recent years, support has escalated to extend TAG to the most economically disadvantaged part-time students as well, without limiting funds for those who attend full-time. The Higher Education Student Assistance Authority completed a study on resources and needs of part-time students. After discussing that study, the Authority adopted a recommendation to support funding to extend eligibility under the TAG programme to part-time students in accordance with specific tenets established by the Authority. The Commission concurs with the Authority's recommendation and supports their intention to consider award values, funding and expenditures for a part-time TAG programme separately from the same considerations for the full-time TAG programme.

Education Opportunity Fund (EOF)

Although minority enrolment continues to increase, the state must ensure that all New Jerseyans are able to contribute to and participate in our economic prosperity. The Educational Opportunity Fund Programme exemplifies the state's commitment to higher education access and success. Since 1968 the programme has assisted students who must overcome economic and educational disadvantages in order to achieve their academic potential. Recognized as one of the nation's premier state programmes to enhance higher education access and opportunity, EOF provides supplemental financial aid to help defray college costs and expenses as well as campus-based academic support services.

In FY 2001, student grants were increased, providing an additional $100 per student at public institutions and $200 for those attending independent colleges and universities. Considering the academic and social hurdles EOF students must overcome, EOF's counselling, tutoring, academic, career exploration, pre-freshman and other support programmes are also absolutely vital to their success at the college level. It is the link between financial aid and intensive academic and student support services that distinguishes EOF from other student assistance programmes. The EOF programme has demonstrated significant achievement, easing access to college for roughly 12,400 students annually and improving short-term student retention.

For example, third semester retention rates among EOF students at the state colleges increased from 64 percent in fall 1986 to over 80 percent by fall 1998. Given New Jersey's growing number of immigrants and minorities and the increasing importance of a college degree in our high-tech economy, EOF must build on this success to help more students overcome disadvantaged backgrounds to succeed in college and achieve their educational goals. As we begin the 21st century, the EOF community is committed to narrowing the gap between transfer and graduation rates for low-income and minority students and those who do not face educational or economic disadvantages. Addressing this challenge will not only ensure a brighter future for more New Jerseyans, but will also enhance the state's overall economic prosperity and quality of life by narrowing the gap between the "haves" and the "have-nots."

To this end and consistent with the recommendation of the Fund's Board of Directors, increased state funding to strengthen the capacity of campus EOF student services is a top priority for FY 2002. State Article IV funding for the campus-based support programmes requires a partnership with institutions, which must provide at least a dollar-for-dollar funding match. An increase in state Article IV programme support will enable the individual campus programmes to enhance student support services and have a greater impact on transfer and graduation rates.

The Fund's Board of Directors also stresses the ongoing challenge to ensure that finances are not a deterrent to college attendance for EOF students. While Article III academic year grants did increase in FY 2001, some students and their families continue to face extraordinary costs relative to their incomes, even when EOF, TAG and federal Pell grants are considered.

College Bound: Efforts directed towards the educational advancement of disadvantaged children prior to entering college have proven effective across the nation. New Jersey's College Bound Grant Programme was established in 1986 to address the educational needs and aspirations of disadvantaged, at-risk youth in grades six through twelve.

Without a funding increase in the past 10 years, this exemplary programme has supported pre-college enrichment activities to help students in Abbott school districts complete secondary school and successfully pursue a Post-secondary education in the sciences, mathematics, or technology. Like EOF, the programme has proven to have an enduring effect on participants' future academic and career pursuits.

The College Bound programme currently serves approximately 2,100 students in 15 programmes run by New Jersey colleges and universities. Students from low-income families face many barriers to attending college. Nationally, only about one student in four from a low-income family background makes it to college at all between the ages of 18 and 24 years. To help New Jersey students overcome these obstacles, the College Bound programmes reinforce the state's school reform efforts in Abbott districts. The per student cost of College Bound is significantly less than comparable programmes at the federal level. In FY 1999, the state's contribution to the programme was $1,381 per student, whereas the federal government's contribution to Upward Bound was $4,164 per student. Nevertheless, the College Bound programmes have achieved success; over 80 percent of the seniors participating in the programme in 1999 attended college upon high school graduation.

An increase in FY 2002 will increase and improve services, allowing for additional campus-based programmes and expanding the number of Abbott district students served. Further, it will provide for an adequate investment in the computer hardware and software and scientific equipment needed to support high-quality pre-college exposure and enrichment in the sciences, mathematics and technology. According to a 1999 U.S., Department of Commerce report, the gap in Internet access between those in the highest and lowest income levels grew by 29 percent from 1997 to 1998. College Bound helps to bridge that gap with after-school, weekend and summer programmes that allow students to understand and benefit from the Internet and become skilled in the technology that drives the future.

When College Bound helps disadvantaged, at-risk students stay in school, do well and go to college, New Jersey reaps vast benefits. These students will become part of the state's educated citizenry. They will be more employable, earn higher incomes, pay more taxes and contribute to their communities.

Increased investment in College Bound also will enable the programmes to leverage funding from other sources, such as the federal government, foundations and corporations. Last year the state appropriation for College Bound and institutional contributions provided a match to enable the Commission to obtain a five-year $10 million federal GEAR UP grant.

Capital and Related Support

Establishing and preserving a safe and adequate physical plant are critical to educating the populace, recruiting and retaining students, fostering research and development and enhancing the overall quality of higher education. Colleges and universities across the nation are faced with the challenge of keeping facilities and equipment current in order to prepare students for the rapidly changing workplace and to contribute to the research and development that underlies the nation's economy and future.

Funding for institutional facilities, technology infrastructure and other equipment is essential to the nation's success in the information-based economy. To meet the challenge of maintaining modern facilities and providing students with access to world-class instruction and technology, New Jersey currently supports five targeted capital programmes for higher education: In this book for community colleges, the Higher Education Facilities Trust Fund, the Equipment Leasing Fund, the Technology Infrastructure Fund and the newly created Capital Improvement Fund to address deferred maintenance and renewal at the four-year institutions. Each of these programmes helps to keep the colleges and universities current, competitive and responsive to student and research needs. The state's recognition of the need to renew and possibly expand these programmes as needed is vital.

The FY 2001 commitment to renew the $100 million Equipment Leasing Fund allows institutions to make significant new investments to keep up with the fast-paced emergence of new equipment and technology. Recognizing the need to continually replace and upgrade today's high-tech equipment, consideration should be given to raising the cap on this fund and issuing an additional $100 million in bonds within the next two to three years. The need for increased assistance in procuring equipment is driven by high-tech workforce needs and rapidly obsolescing equipment and staggering the availability of dollars from the Equipment Leasing Fund will avoid the six to seven year lag in availability of state assistance.

The return on the state's investment in capital programmes is considerable. A noteworthy example is the $50 million Higher Education Technology Infrastructure Fund, which was established in 1997. The 45 eligible institutions expeditiously moved to enhance their campus technology infrastructures, enabling advanced student and faculty connectivity and growth in distance learning capabilities. A centralized electronic library (VALE) was established to allow the colleges and universities to share full-text, reference databases and provide access to journals, business directories and government publications. Perhaps most important, an unprecedented collaborative effort was undertaken to establish a broadband, systemwide telecommunications network, which is close to realization.

Support for these enhancements to campuses are crucial to institutional quality and economic advancement. However, an annual appropriation to assist the state's senior public institutions with capital maintenance and renewal is also a necessary and sound investment that will benefit students and the state. New

Jersey is located at the heart of the nation's most prosperous and culturally rich marketplace. The state is a global pioneer and leader in science and research, communications, pharmaceuticals, computer technology and biotechnology. Clearly, the state's prominence contributes greatly to the robust economy and the resulting good it produces. On the other hand, such prominence also carries with it responsibilities and challenges relative to higher education's role in the economy. Continued investment in facility and equipment infrastructure is essential to developing the workforce and research required to meet the high-tech, rapidly advancing needs of employers.

Investment in Excellence

New Jersey's system of higher education aspires to be among the best in the world, embracing excellence, access and affordability. The 1999 update of the long-range plan for higher education cites the considerable progress made since 1996 in addressing the critical state issues around which the plan is designed. It also calls for more deliberate planning and bold action to achieve the goal of being among the best.

Over the past several years, many states have significantly increased investments in higher education institutions, recognizing that knowledge is the principal engine of economic growth and societal well-being. Initiatives designed to enhance excellence within the colleges and universities while directly addressing statewide economic development and societal goals provide dual dividends: students benefit from the enhanced quality of programmes and the state benefits from higher education's efforts to address critical state needs. Annual state investments targeted to such needs will strengthen New Jersey's overall competitiveness in the global economy.

High-tech Workforce Excellence Grants

The FY 2001 $165 million economic development package, *New Jersey Jobs for the New Economy*, is designed to increase the state's competitiveness in the creation of high technology jobs and ensure that all citizens share in the state's technology advances and economic success. Recognizing the central role higher education plays in advancing technology and economic growth, the initiative includes a High-tech Workforce Excellence Grant programme, which build on the strengths of New Jersey's colleges and universities.

As a result of the $15 million competitive grant programme, nine outstanding high-tech education projects received funds to create a pipeline of graduates to meet future workforce needs. At the same time, the top quality technology-related programmes will help to create, attract and retain high-tech companies and jobs in New Jersey. The nine programmes, ranging from sophisticated engineering and biomedical programmes to improved training for math and science teachers, demonstrate the synergy that exists between higher education and New Jersey's high-tech workforce. An appropriation for a second round of grants in FY 2002 will further develop outstanding high-tech academic programmes that are essential to meet the demands of New Jersey's highly competitive marketplace.

The excellence grants are consistent with *New Jersey's Plan for Higher Education: 1999 Update*, which calls for state resources to assist institutions in the pursuit of excellence in areas that coincide with state priorities. There is great promise that in addition to spurring the economic well-being of the state, higher education excellence grants will significantly help to move New Jersey's colleges and universities into the upper echelon nationally. As the excellence programme evolves in future years, other academic disciplines that are related to state goals should be targeted. The grant programme has the potential to attract students and faculty to New Jersey institutions by enhancing programmes in a wide range of academic disciplines. For many students and faculty, the strength of disciplines and programmes, the quality of faculty and institutional reputation play a primary role in choosing a college or university.

By investing in excellence at selected colleges, the state will help them become institutions of choice for more New Jersey resident students and attract those from out of state. Similarly, it will attract talented faculty and enhance institutional prominence among the business and government communities. The excellence grants will provide a significant return on investment over time.

Teacher Preparation and Development

The preparation of the state's future leaders and workforce begins at an early age and is influenced enormously by teachers from preschool through high school. Teacher quality is recognized as important across the nation. However, after more than a decade of school reform efforts, the nation still has not succeeded in making systemic improvements in teaching and learning. Reform efforts have focused primarily on addressing core content standards, student assessment and other equally important areas, with little attention to teacher preparation, professional development, or teacher standards.

Over the past three years, however, there has been an unprecedented convergence of opinion on the need to improve teacher quality in order to effect true school reform. The National Commission on Teaching and America's Future reported in 1996 saying, "What matters most as Americans prepare for a new century is the quality of teaching in American schools." The American Council on Education recently stated that the nation will effectively adapt to the new economy only if the quality of teachers entering the profession improves. And the American Association of State Colleges and Universities called upon higher education institutions to accept responsibility for ensuring they produce excellent teachers.

As states across the nation and the federal government place teacher quality at the top of the agenda, colleges and universities face an enormous challenge and responsibility. The consensus around the need to renew teacher education programmes and ensure the quality of all teachers comes at a time when the nation estimates the need for more than two million new teachers over the next decade to meet enrolment increases, fill vacancies due to retirements and replace thousands of teachers who leave each year in search of new careers. Higher

education must therefore prepare more teachers and ensure that they are prepared to effectively undertake their role as educators in a new economy that depends more than ever on knowledge and its application.

The level of need for new teachers will vary among states; New Jersey's population is not expected to increase as much as many other parts of the nation. Nevertheless, the state will experience a significant demand for new teachers. While there will be comparatively modest enrolment increases, there will be large-scale retirements and continuing resignations. In addition, New Jersey faces the need for large numbers of new teachers for three- and four-year-olds to meet the state's Supreme Court mandate growing out of the *Abbott v. Burke* decision. In fact, the effort to improve the quality of education in the state's most disadvantaged school districts will require more and better-prepared teachers in all grades in the Abbott districts. Like other states, New Jersey also faces pressures to decrease class sizes in the early grades and to address shortages in bilingual education, foreign language, special education and math and science. The state also faces aggressive recruiting competition. Many states are already offering signing bonuses and recruiting aggressively beyond their own borders.

Concurrent with this increased demand are the findings of a number of large-scale studies that provide evidence that the most significant factor in student achievement is the quality of the teacher. There is widespread agreement that teachers must be well prepared in subject areas, understand their students and what they need and master the professional skills required to make learning come alive. Unfortunately, this is not always the case as evidenced by the significant inequities in teacher quality that currently exist. Recent studies show that poor and minority children – those who are most dependent on their teachers – are more likely to have ineffective teachers, which contributes mightily to the achievement gap between poor and minority children and others.

The challenge, then, goes beyond preparing two million new highly qualified teachers. The nation must also aggressively overcome inequities in teacher quality – deepening knowledge of subjects and how to teach them. The recent report from the American Council on Education, *To Touch the Future,* calls upon the institutions to transform the way teachers are taught.

New Jersey's future prosperity is inextricably linked to its success in preparing high-quality teachers who can provide all citizens with the learning foundation to be productive members of society.

State efforts are under way to improve teacher quality in several ways:

- The State Department of Education (DOE), working with the P-12 and higher education systems, is in the process of reviewing and revising the state regulations for teacher education programmes and certification of educational professionals.
- The grade-point average necessary for teacher certification was recently raised to 2.75.
- The DOE is engaged in state-supported teacher recruitment efforts.
- A two-year beginning teacher-mentoring programme is getting under way.

- Teachers are now required to complete 100 hours of approved professional development every five years.
- Professional development schools received additional state funding to expand existing and establish new P-16 partnerships.
- The state continues to implement an NSF Statewide Systemic Initiative (SSI) grant to improve science and mathematics instruction.
- Individual colleges continue to undertake various initiatives to enhance teacher preparation and professional development programmes.

Higher education plays a role in most of the above initiatives – in some cases a very significant role. Each of these initiatives is important in building a quality teaching corps. Additional efforts must be considered to expand the capacity of colleges and universities to prepare high-quality teachers; expand the recruitment and retention of minority teachers; address the critical teacher shortages in preschool, special education and mathematics and science; recruit and retain effective teachers in disadvantaged areas; and raise the overall desirability of teaching as a profession. The New Jersey Commission on Higher Education and Department of Education are working jointly to develop a series of related initiatives to comprehensively address these teacher quality and shortage issues.

Much of the responsibility for improving the quality of the educators in our nation's schools depends heavily upon the strength and effectiveness of teacher preparation and development programmes provided by colleges and universities in collaboration with the elementary and secondary schools. In many states, special support is now directed specifically to teacher preparation and professional development programmes to assist the colleges and universities as they address the challenge of training and retraining more and better-prepared teachers for the 21st century.

With overall enrolment growth in higher education and widely ranging responsibilities and concerns, the state is working in tandem with the institutions to ensure that teacher quality resides atop the state's educational agenda. A special state appropriation in the FY 2002 budget would help colleges and universities that have teacher preparation programmes to construct a comprehensive approach to change, with a focus on four primary goals:

(1) Moving the education of teachers to the top of institutional agendas and articulating the centrality of teacher preparation to the roles and missions of institutions, with a focus on the role of arts and sciences faculty.

(2) Increasing the state's capacity to produce highly effective teachers to fulfil ever- growing demands and shortages.

(3) Improving teacher preparation and professional development in a manner that links knowledge and performance expectations for teachers with the content standards for P-12 students.

(4) Expanding collaborative efforts with P-12 schools in areas such as curriculum development, mentoring, induction and professional development.

Such an initiative would strike at the very core of teacher quality by assisting the institutions in their move towards comprehensive programme improvement and increased capacity to prepare highly effective educators. It has the potential to become the linchpin programme in the state's efforts to improve teacher quality, which in turn will lay the groundwork for parity in educational opportunity and workforce preparedness for all racial, ethnic and socio-economic groups.

Recognizing the diversity among the institutions, a state incentive grant to be used over one to three years should be provided to each college or university with a teacher preparation programme. The Commission and Department of Education are working with the state colleges and universities and representatives from other institutions that have teacher education programmes to define criteria that will guide disbursement and use of the grant funds. Each institution will develop a plan to address the above goals and funds will be available for use following a review by the Commission, in consultation with the Commissioner of Education. Special emphasis should be placed on implementation of practices and programmes proven to be effective and enhanced efforts to facilitate the smooth transfer of teacher candidates from two- to four-year colleges should also be a priority. Ongoing state support for senior public institutions is recommended through additional state-funded positions that are necessary in order to increase the institutions' capacity to meet the growing demand for more teachers. In addition, the senior public institutions may request that a portion of their grant funds be included in their base budgets to assist in supporting ongoing salaries for new faculty hired to increase capacity.

The Department of Education is working with representatives from the state colleges and universities and with the Commission to shape two related initiatives. The first is a targeted effort to recruit highly qualified, undergraduate and post-baccalaureate teacher candidates of colour, as well as highly skilled candidates for areas of shortage such as math, science, special education and preschool.

3

Secondary School Teaching Methods

Teaching secondary school requires a variety of teaching methods to address different learning levels, styles and intelligence of secondary school students. Some of the most important teaching methods for secondary school include proper classroom management, motivation and a welcoming classroom environment, plus a curriculum and activities that address a multitude of learning styles.

ENVIRONMENT AND MOTIVATION

A classroom environment should promote equality, diversity and independent learning. Environments that promote equality allow secondary school students to feel safe and secure in their own skins, which allows them to open up and

participate more in learning activities. Diverse classroom environments give students a sense of uniqueness and exposes students to different cultures without social stigmas and prejudices. A classroom that promotes independent learning allows students to take pride in their accomplishments and instills a desire for knowledge. When coupled with the classroom environment, motivation allows secondary students to continue learning and take an interest in their progress.

LEARNING STYLES

Secondary school teachers should create lessons that address all three of the basic learning styles: auditory, visual and kinesthetic. Auditory learners learn by hearing the concept explained, visual learners learn by seeing the concept demonstrated and kinesthetic learners learn by physically interacting with the concept. Addressing each student's learning needs engages students in the lesson and promotes better memory retention and advancement. This teaching method is also an effective way to calm an active class and channel its energy into a productive result.

CLASSROOM MANAGEMENT

The goal of classroom management techniques is to promote a safe, productive and organized classroom. Good management keeps the teacher in control of the classroom and keeps students paying attention. Some suggested methods include picking students' names out of a hat so not one student feels picked on and more are likely to participate, flashing lights on and off to grab students' attention or signal the end of an activity or having the students turn their desks towards the back of the classroom when there are behavioural issues so the teacher can see everything they are doing. These teaching methods keep classrooms in control and allow the teacher to focus on learning instead of behavioural problems.

TEACHING METHOD

A teaching method comprises the principles and methods used by teachers to enable student learning. These strategies are determined partly on subject matter to be taught and partly by the nature of the learner. For a particular teaching method to be appropriate and efficient it has to be in relation with the characteristic of the learner and the type of learning it is supposed to bring about. Suggestions are there to design and selection of teaching methods must take into account not only the nature of the subject matter but also how students learn. In today's school the trend is that it encourages a lot of creativity. It is a known fact that human advancement comes through reasoning. This reasoning and original thought enhances creativity.

The approaches for teaching can be broadly classified into teacher centered and student centered. In Teacher-Centered Approach to Learning, Teachers are the main authority figure in this model. Students are viewed as "empty vessels" whose primary role is to passively receive information (via lectures and direct

instruction) with an end goal of testing and assessment. It is the primary role of teachers to pass knowledge and information onto their students. In this model, teaching and assessment are viewed as two separate entities. Student learning is measured through objectively scored tests and assessments. In Student-Centered Approach to Learning, while teachers are an authority figure in this model, teachers and students play an equally active role in the learning process. The teacher's primary role is to coach and facilitate student learning and overall comprehension of material. Student learning is measured through both formal and informal forms of assessment, including group projects, student portfolios, and class participation. Teaching and assessments are connected; student learning is continuously measured during teacher instruction. Commonly used teaching methods may include class participation, demonstration, recitation, memorization, or combinations of these.

METHODS OF INSTRUCTION

Howard Gardner identified a wide range of modalities in his Multiple Intelligences theories. The Myers-Briggs Type Indicator and Keirsey Temperament Sorter, based on the works of Jung, focus on understanding how people's personality affects the way they interact personally, and how this affects the way individuals respond to each other within the learning environment.

Lecturing

The lecture method is just one of several teaching methods, though in schools it's usually considered the primary one. The lecture method is convenient for the institution and cost-efficient, especially with larger classroom sizes. This is why lecturing is the standard for most college courses, when there can be several hundred students in the classroom at once; lecturing lets professors address the most people at once, in the most general manner, while still conveying the information that he or she feels is most important, according to the lesson plan. While the lecture method gives the instructor or teacher chances to expose students to unpublished or not readily available material, the students plays a passive role which may hinder learning. While this method facilitates large-class communication, the lecturer must make constant and conscious effort to become aware of student problems and engage the students to give verbal feedback. It can be used to arouse interest in a subject provided the instructor has effective writing and speaking skills.

Demonstrating

Demonstrating is the process of teaching through examples or experiments. For example, a science teacher may teach an idea by performing an experiment for students. A demonstration may be used to prove a fact through a combination of visual evidence and associated reasoning.

Demonstrations are similar to written storytelling and examples in that they allow students to personally relate to the presented information. Memorization

of a list of facts is a detached and impersonal experience, whereas the same information, conveyed through demonstration, becomes personally relatable. Demonstrations help to raise student interest and reinforce memory retention because they provide connections between facts and real-world applications of those facts. Lectures, on the other hand, are often geared more towards factual presentation than connective.

Collaborating

Collaboration allows students to actively participate in the learning process by talking with each other and listening to other points of view. Collaboration establishes a personal connection between students and the topic of study and it helps students think in a less personally biased way. Group projects and discussions are examples of this teaching method. Teachers may employ collaboration to assess student's abilities to work as a team, leadership skills, or presentation abilities. Collaborative discussions can take a variety of forms, such as fishbowl discussions. After some preparation and with clearly defined roles, a discussion may constitute most of a lesson, with the teacher only giving short feedback at the end or in the following lesson.

Classroom Discussion

The most common type of collaborative method of teaching in a class is classroom discussion. It is the also a democratic way of handling a class, where each student is given equal opportunity to interact and put forth their views. A discussion taking place in a classroom can be either facilitated by a teacher or by a student. A discussion could also follow a presentation or a demonstration. Class discussions can enhance student understanding, add context to academic content, broaden student perspectives, highlight opposing viewpoints, reinforce knowledge, build confidence, and support community in learning. The opportunities for meaningful and engaging in-class discussion may vary widely, depending on the subject matter and format of the course. Motivations for holding planned classroom discussion, however, remain consistent. An effective classroom discussion can be achieved by probing more questions among the students, paraphrasing the information received, using questions to develop critical thinking with questions like "Can we take this one step further?;" "What solutions do you think might solve this problem?;" "How does this relate to what we have learned about..?;" "What are the differences between... ?;" "How does this relate to your own experience?;" "What do you think causes.... ?;" "What are the implications of.... ?"

It is clear from "the impact of teaching strategies on learning strategies in first-year higher education cannot be overlooked nor over interpreted, due to the importance of students' personality and academic motivation which also partly explain why students learn the way they do" that Donche agrees with the previous points made in the above headings but he also believes that student's personalities contribute to their learning style.

Debriefing

The term "debriefing" refers to conversational sessions that revolve around the sharing and examining of information after a specific event has taken place. Depending on the situation, debriefing can serve a variety of purposes. It takes into consideration the experiences and facilitates reflection and feedback. Debriefing may involve feedback to the students or among the students, but this is not the intent. The intent is to allow the students to "thaw" and to judge their experience and progress towards change or transformation. The intent is to help them come to terms with their experience. This process involves a cognizance of cycle that students may have to be guided to completely debrief. Teachers should not be overly critical of relapses in behaviour. Once the experience is completely integrated, the students will exit this cycle and get on with the next.

Classroom Action Research

Classroom Action Research is a method of finding out what works best in your own classroom so that you can improve student learning. We know a great deal about good teachingin general, but every teaching situation is unique in terms of content, level, student skills and learning styles, teacher skills and teaching styles, and many other factors. To maximize student learning, a teacher must find out what works best in a particular situation. Each teaching and research method, model and family is essential to the practice of technology studies. Teachers have their strengths and weaknesses, and adopt particular models to complement strengths and contradict weaknesses. Here, the teacher is well aware of the type of knowledge to be constructed. At other times, teachers equip their students with a research method to challenge them to construct new meanings and knowledge. In schools, the research methods are simplified, allowing the students to access the methods at their own levels.

EVOLUTION OF TEACHING METHODS

Ancient Education

About 3000 BC, with the advent of writing, education became more conscious or self-reflecting, with specialized occupations such as scribe and astronomer requiring particular skillsand knowledge. Philosophy in ancient Greece led to questions of educational method entering national discourse.

In his literary work *The Republic*, Plato described a system of instruction that he felt would lead to an ideal state. In his dialogues, Plato described the Socratic method, a form of enquiry and debate intended to stimulate critical thinking and illuminate ideas.

It has been the intent of many educators since, such as the Roman educator Quintilian, to find specific, interesting ways to encourage students to use their intelligence and to help them to learn.

Medieval Education

Comenius, in Bohemia, wanted all children to learn. In his *The World in Pictures*, he created an illustrated textbook of things children would be familiar with in everyday life and used it to teach children. Rabelais described how the student Gargantua learned about the world, and what is in it.

Much later, Jean-Jacques Rousseau in his *Emile*, presented methodology to teach children the elements of science and other subjects. During Napoleonic warfare, the teaching methodology of Johann Heinrich Pestalozzi of Switzerland enabled refugee children, of a class believed to be unteachable, to learn. He described this in his account of an educational experiment at Stanz.

19th Century - compulsory Education

The Prussian education system was a system of mandatory education dating to the early 19th century. Parts of the Prussian education system have served as models for the education systems in a number of other countries, including Japan and the United States. The Prussian model required classroom management skills to be incorporated into the teaching process.

20th Century

Newer teaching methods may incorporate television, radio, internet, multi media, and other modern devices. Some educators believe that the use of technology, while facilitating learning to some degree, is not a substitute for educational methods that encourage critical thinking and a desire to learn. Enquiry learning is another modern teaching method.

A popular teaching method that is being used by a vast majority of teachers is hands on activities. Hands-on activities are activities that require movement, talking, and listening, it activates multiple areas of the brain. "The more parts of your brain you use, the more likely you are to retain information," says Judy Dodge, author of 25 Quick Formative Assessments for a Differentiated Classroom.

METHODS OF TEACHING IN THE CLASSROOM

INSTRUCTIONAL TECHNIQUES

Having decided which of the basic formats a lesson will involve, you must next decide which of many instructional techniques would be most appropriate for the particular situation. Issues such as the developmental level of the students, the instructional venue (indoors, outdoors, individual desks, tables and chairs for group work, *etc.*), and the subject matter to be presented must be considered. Generally speaking, there are eight categories of techniques from which a teacher might choose. As has previously been the case, the teacher may well determine that a combination of techniques would be most appropriate.

As you read through the techniques, consider that we have arranged them in terms of increasing sophistication of the thinking required of students. This is not to say that any one of the techniques is inappropriate for particular ages. After all, you can probably remember being lectured to by your parents at one time or another in your life, and you likely discovered some things on your own even as a young child.

However, when planning for educational experiences, teachers need to identify the level of cognitive processing they want to engage and select the technique that best encourages that level of thinking. Our list of techniques parallels Bloom's Taxonomy, the *Taxonomy of Educational Objectives Handbook I: Cognitive Domain*.

The taxonomy begins with the least sophisticated level of processing, that being the recall of knowledge and facts, and progresses to the highest level, thinking that involves evaluative processes.

Table. The Taxonomy of Educational Objectives: Cognitive Domain.

Cognitive Skill	Verbs that characterize the skill
Knowledge	Label, list, match, recall, select, state, underline
Comprehension	Describe, explain, interpret, summarize, paraphrase
Application	Complete, organize, solve, calculate, compute, use
Analysis	Categorize, classify, find patterns and relationships, compare
Synthesis	Compose, create, formulate, hypothesize, write
Evaluation	Judge based on criteria, support, conclude

DIRECT INSTRUCTION

We list direct instruction in the teaching of skills as the lowest level of our taxonomy of instructional techniques because in this case the teacher decides what is important for the students to know and specifically explains or demonstrates a skill, and the student attempts to replicate it. There is very little abstraction involved here, though that is by no means intended to imply that the task is a simple one.

As children struggle to reproduce the letters of the alphabet, they need all the concentration and control they can muster. Similarly, the high school student performing the steps of an experiment can be very focused and intent. Nonetheless, the demands for deep understanding and recombining of information on the part of the student are minimal in a direct instruction format. The emphasis is clearly on the acquiring of information or procedural skills.

DRILL AND PRACTICE

One level up from direct instruction is drill and practice. Though it might seem that this technique is even more rote in nature than direct instruction, the implication is that something has already been learned, or at the very least been presented, and now the emphasis is on repetition to hone the skill or provide a strong link to the information to improve remembering it.

With this particular technique there is not a great emphasis on abstraction or on the synthesis of new understanding. Your own experience with multiplication tables would be an example of drill and practice.

There was not much mathematical theory being taught when you were required to memorize those products.

LECTURE

The mainstay of a traditional college education, the lecture, shows up third in our instructional technique hierarchy. What does that tell you about the thinking that lectures require of a student? We are by no means denigrating the lecture approach, but the simple fact is that lectures in their pure form serve only to offer information from one person to another in a one-way verbal transaction.

It needs to be mentioned that many times teachers will follow up a lecture with some sort of discussion session.

However, lectures can be, and often are, presented without any opportunity for an intellectual exchange between student and teacher. Its strength is that a large amount of information can be conveyed to a large group of people in a short amount of time with a concomitant personal touch.

QUESTION AND ANSWER

At this point we begin considering techniques that actually require reflection on the part of the student and thus involve evaluation and the synthesis of new information, the two highest levels of Bloom's Taxonomy. Reflection requires that a student receive information and then consider it with regard to his or her own experiences and interpretations. The question-and-answer technique supposes that to one degree or another the teacher and the student share a common body of knowledge. This does not mean that the student has the same depth of knowledge or understanding, but there are sufficient elements to the common core that allow the student and teacher to make consideration of the topic a two-way exchange.

There are several approaches to using the question-and-answer technique. In one approach, the students may question the teacher. The teacher needs to be sufficiently knowledgeable of the subject matter to provide appropriate responses without knowing the questions in advance or having the opportunity to look things up.

A teacher cannot have all of the answers, but being prepared to deal with the unexpected is part of being a teacher, not something that happens once in awhile. Children come to school thinking about the same questions that they have heard their parents discuss at home. They may not always understand those questions, but the idea of asking the teacher for an answer is typically considered to be a good one.

The other side of question and answer is the situation in which the teacher asks questions of the students. You are certainly familiar with this approach!

However, our concern now is with the reason for those questions. One purpose would be for giving the students practice with the recall (and perhaps application) of particular information.

Another would be for assessing the students' acquisition of particular information. In either of these cases, techniques such as providing think-time and challenging initial responses will be valuable skills to improve the use of question-and-answer sessions. Indeed, in her classic study of the effects of wait time, Mary Budd Rowe (1978) found that providing students additional time to think increased the number and quality of responses and decreased discipline situations.

Yet a third purpose for the use of this instructional technique is to stimulate thought and encourage divergent thinking (as opposed to the convergent thinking of the previous two examples). In this situation the teacher is challenging students to apply prior knowledge and then use that as a basis for synthesizing new knowledge. The challenge presented to the teacher is that when such questions are asked, a wide range of answers is possible. The teacher must be prepared for whatever might come along, and this involves finding ways to identify merit in virtually any response. If a teacher is willing to open up the classroom to divergent thinking and the opinions of the students, then he or she must be ready to help students formulate and reformulate their ideas without diminishing the value of the original idea. Asking students for their opinions and then telling them they are wrong is one of the surest ways to bring original thinking in the classroom to a halt. The amount of innovative and creative thinking that a teacher can initiate, in virtually any subject area, is empowering both for students and teachers.

DISCUSSION

A step higher on our taxonomy of instructional techniques is discussion. This differs from the previous level in that neither the teacher nor the student holds the upper hand. In this situation the teacher is concerned with a very different treatment of information than possible using the previous methods. Discussions involve the exchange of ideas. With this approach a teacher hopes to develop greater depth of thinking and perhaps to foster the manipulation of information for solving problems rather than just the acquisition of knowledge.

Some might argue that discussion is not the most appropriate term for what teachers wish to accomplish. In fact, discussion does refer more to the arguing of points of view whereas dialogue refers to an exchange of ideas. In either case, the instructional intent is to take students beyond "just the facts" and to engage them in a more poignant treatment of the subject matter.

MENTAL MODELING

Mental Modeling (Culyer, 1987) and a variation of it, the "I wonder..." model (Bentley, Ebert, & Ebert, 2000), are techniques specifically intended to enhance students' ability to direct their own learning by modeling the use of cognitive processes in the solving of some problem. This might sound "elementary" at

first, and it is quite effective when working with young children, but it is a process that you may well have been exposed to in your secondary and now higher education experiences.

For example, during an elementary school lesson about using maps a teacher might say,

I'd like to find my way to Sarah's house. I know the address, but I don't know how to get there from the school. I think I'll use the map of our city to find the way there. First I'll check the street index to find out where to look on the map. Then I'll use the numbers from the index to find the street.

In this way a teacher demonstrates how to sequence steps and put information to work in solving a problem. Students are then able to practice the same procedure.

The "I wonder..." model uses the same approach, though in the context of science education. Bentley, Ebert, and Ebert (2000) consider this to be one of the best ways of initiating the information-seeking process. An otherwise unobservable process, this technique attempts to verbalize the thinking that goes on. Here's an example from The Natural Investigator that a teacher might use with elementary level children:

This morning I looked outside and noticed that it wasn't very sunny. I observed lots of gray clouds. I wondered if it was going to rain today. I could have just carried an umbrella in case it did rain and not thought about it anymore. However, I was planning to wear my new shoes, and I really didn't want to get them wet and dirty the first time I wore them. So I checked the newspaper and the weather channel. The paper predicted...

In this scenario, the children are exposed to the steps of listing observations, formulating a question, and identifying possible sources of information. These steps are not confined to elementary instruction. For instance, in college-level science courses you are encouraged to go through the same three steps. Your chemistry professor probably will talk you through conducting an experiment to prepare you for what might occur.

Mental modeling is a powerful technique that is on a high cognitive level. Precisely for that reason, it is something that you should try to use with your students at every opportunity. But practice first! The keys to using this technique are modeling thinking that your students can understand and then providing them with immediate opportunities to apply what they have learned. Having your students explain their own mental models or "I wonder..." models aloud will help clarify the process for them and allow you to assess their understanding.

DISCOVERY LEARNING

Discovery learning is an approach to instruction that focuses on students' personal experiences as the foundation for conceptual development. It is unlikely that children will walk into your classroom with all of the necessary experiences

that relate to the concepts you want to teach, so the challenge is to provide your students with the opportunities for experiences they need in the context of discovery. That is, allowing students to find the information for themselves by virtue of some activity you have provided. The students in your class will then share a common experience that you can develop as it relates to the concept under consideration. In essence, we are cheating just a bit because, from an instructional perspective the idea is to have children discover what we want them to discover. It's new to them, of course, but it is all part of the strategy for the teacher.

Discovery learning channels the natural inquisitiveness of children (and the natural inquisitiveness that remains in adults) by providing structure to the experience without imposing unnecessary structure on the thinking. That is, unlike the science experiments that you did in high school that were "wrong" if they didn't come out the way the book said they should, discovery learning encourages children to engage in the activity and document what does happen.

Even with structured activities in the classroom, twenty students will experience the activity in twenty different ways. Because of that, for discovery learning to be pedagogically sound it must be accompanied by a structure that goes beyond the discovery phase of the exercise. Such a structure, or framework, is intended to clarify the experience in terms of the concept being taught.

Four-Phase Learning Cycle:

1. *Introduction:* A question, challenge, or interesting event that captures the students' curiosity.
2. *Exploration:* The opportunity for students to manipulate materials, to explore, and to gather information.
3. *Concept Development:* With a common experience to relate to, terminology is introduced and concepts developed in class discussion.
4. *Application:* This could take the form of an enrichment activity, an opportunity to apply what has been learned, or a test to assess learning.

An example might be packaging an egg to withstand being dropped from a height of ten feet or so. After posing the question to the students about how this might be done (Introduction), students are provided time to devise various packaging strategies (Exploration). Instruction about packaging is not provided before the egg is dropped; the students are on their own at this stage. Discussions of forces, mass, acceleration, and so forth do not yet enter into the picture. It is only after the eggs have been packaged, dropped, and checked for survival that the lesson moves to a discussion of what has been found. With the common experience of this trial-and-error activity, students are prepared to have a meaningful lesson about the topics relating to forces and motion (Concept Development). Finally, the students might be challenged to package another egg (or something else) to apply what they have learned (Application). You can see that this entire lesson, though arranged by the teacher, is centered on the students' thinking. In fact, the students' thinking will drive the lesson as the teacher assesses and accommodates the various perspectives that the students will have.

ENQUIRY

We have placed enquiry at the highest level of our taxonomy not only because it involves the use of prior knowledge and the discovery of new knowledge, but because it also involves generating the question to be answered. It is no coincidence that the tendency to ask questions is characteristic of children as well as of adults at the top of their professions. Scientists, professors, writers, politicians, and others are people who frame questions and then go about finding solutions. Children, with their natural curiosity, are compelled to ask questions and take delight in finding answers.

The task for professional educators is to channel that inquisitiveness in ways that are beneficial to the individual and perhaps even to the world at large. Suddenly our discussion has come a very long way from rudimentary direct instruction. Teaching changes lives, and it changes the world!

The teacher who uses an enquiry approach has a considerable amount of preparation to do and also must be prepared to teach the students how to use enquiry. Foremost among the concerns would be helping the student frame a question in a manner that can be investigated. For example, what would your response be if a child were to ask, "Why do birds fly?" Would you say that birds fly because it's faster than walking? Because they enjoy being in the air? Just because? Why birds fly is a legitimate question, but likely one to be addressed by theologians or philosophers. A more appropriate question might be "How do birds fly?" This is a question that can be investigated in the context of school. Students could even investigate what factors allow one type of bird to fly faster or higher than another or, in the case of ostriches and chickens, not at all. Helping to frame an appropriate question, without diminishing the validity of the initial question, is a primary challenge the teacher faces.

A chief strength of the enquiry approach is that it can integrate the curriculum by involving many disciplines in meaningful ways. Children can read, write, calculate, engage in scientific investigations, address social concerns, and use the arts, all in the context of answering their own questions. While the amount of lecturing that a teacher does is significantly reduced, the intellectual challenge for a teacher preparing and conducting such activities is considerable, and considerably rewarding.

A teacher may use combinations of all of the techniques we have discussed in the course of a single lesson. A lesson plan may begin with a question-and-answer session that stimulates student interest and thinking and then proceed to a discovery-learning experience that will be followed by a discussion of what was learned. It is important for you to understand that teaching is a task that requires considerable instructional flexibility, and we still have not even considered the topic of knowing the subject matter!

If you were an astute observer of the nature of each technique that we have discussed, you may have already noticed that the first three levels represent approaches in which the teacher does the most talking or directing of student activity. The middle two levels transition to a dialogic approach in which the

teacher and student share more of a partnership. The teacher continues to direct the activity, if only by virtue of having planned the whole experience, but the exchange of ideas is of central concern with these levels. But notice what happens as we move to mental modeling and the levels beyond. See how the emphasis changes now to the thinking that students will do? At these levels students are not only investigating academic topics but ultimately are also asking their own questions and finding ways to seek answers and solve problems. You have probably heard that education is a process that seeks to develop lifelong learners. The teacher who uses all levels of the taxonomy with an eye towards leading students to these highest levels and allowing them to develop their critical and creative thinking abilities will be the teacher whose students develop that love of learning that we all wish to impart.

WHAT ARE THE DIFFERENT STYLES OF TEACHING?

The following list of teaching styles highlights the five main strategies teachers use in the classroom, as well as the benefits and potential pitfalls of each respective teaching method.

Authority, or Lecture Style

The authority model is teacher-centered and frequently entails lengthy lecture sessions or one-way presentations. Students are expected to take notes or absorb information.

- *Pros:* This style is acceptable for certain higher-education disciplines and auditorium settings with large groups of students. The pure lecture style is most suitable for subjects like history that necessitate memorization of key facts, dates, names, *etc.*
- *Cons:* It is a questionable model for teaching children because there is little or no interaction with the teacher.

Demonstrator, or Coach Style

The demonstrator retains the formal authority role while allowing teachers to demonstrate their expertise by showing students what they need to know.

- *Pros:* This style gives teachers opportunities to incorporate a variety of formats including lectures, multimedia presentations and demonstrations.
- *Cons:* Although it's well-suited for teaching mathematics, music, physical education, arts and crafts, it is difficult to accommodate students' individual needs in larger classrooms.

Facilitator, or Activity Style

Facilitators promote self-learning and help students develop critical thinking skills and retain knowledge that leads to self-actualization.

- *Pros:* This style trains students to ask questions and helps develop skills to find answers and solutions through exploration; it is ideal for teaching science and similar subjects.

- *Cons:* Challenges teacher to interact with students and prompt them towards discovery rather than lecturing facts and testing knowledge through memorization.

Delegator, or Group Style

The delegator style is best-suited for curriculum that requires lab activities, such as chemistry and biology, or subjects that warrant peer feedback, like debate and creative writing.

- *Pros:* Guided discovery and enquiry-based learning places the teacher in an observer role that inspires students by working in tandem towards common goals.
- *Cons:* Considered a modern style of teaching, it is sometimes criticized as newfangled and geared towards teacher as consultant rather than the traditional authority figure.

Hybrid, or Blended Style

Hybrid, or blended style, follows an integrated approach to teaching that blends the teachers' personality and interests with students' needs and curriculum-appropriate methods.

- *Pros:* Achieves the inclusive approach of combining teaching style clusters and enables teachers to tailor their styles to student needs and appropriate subject matter.
- *Cons:* Hybrid style runs the risk of trying to be too many things to all students, prompting teachers to spread themselves too thin and dilute learning.

Because teachers have styles that reflect their distinct personalities and curriculum — from math and science to English and history — it's crucial that they remain focused on their teaching objectives and avoid trying to be all things to all students.

WHAT YOU NEED TO KNOW ABOUT YOUR TEACHING STYLE

Although it is not the teacher's job to entertain students, it is vital to engage them in the learning process. Selecting a style that addresses the needs of diverse students at different learning levels begins with a personal inventory — a self-evaluation — of the teacher's strengths and weaknesses. As they develop their teaching styles and integrate them with effective classroom management skills, teachers will learn what works best for their personalities and curriculum.

Our guide encapsulates today's different teaching styles and helps teachers identify the style that's right for them and their students.

Browse through the article or use these links to jump to your desired destination.

- What is a teaching style inventory, and how have teaching styles evolved?
- What teaching method is best for today's students?
- How does classroom diversity influence teachers?

Emergence of the Teaching Style Inventory

How have teaching styles evolved? This is a question teachers are asked, and frequently ask themselves, as they embark on their careers, and occasionally pause along the way to reflect on job performance. To understand the differences in teaching styles, it's helpful to know where the modern concept of classifying teaching methods originated.

The late Anthony F. Grasha, a noted professor of psychology at the University of Cincinnati, is credited with developing the classic five teaching styles. A follower of psychiatrist Carl Jung, Grasha began studying the dynamics of the relationship between teachers and learning in college classrooms. His groundbreaking book, "Teaching with Style," was written both as a guide for teachers and as a tool to help colleagues, administrators and students systematically evaluate an instructor's effectiveness in the classroom.

Grasha understood that schools must use a consistent, formal approach in evaluating a teacher's classroom performance. He recognized that any system designed to help teachers improve their instructional skills requires a simple classification system. He developed a teaching style inventory that has since been adopted and modified by followers.

- *Expert:* Similar to a coach, experts share knowledge, demonstrate their expertise, advise students and provide feedback to improve understanding and promote learning.
- *Formal authority:* Authoritative teachers incorporate the traditional lecture format and share many of the same characteristics as experts, but with less student interaction.
- *Personal model:* Incorporates blended teaching styles that match the best techniques with the appropriate learning scenarios and students in an adaptive format.
- *Facilitator:* Designs participatory learning activities and manages classroom projects while providing information and offering feedback to facilitate critical thinking.
- *Delegator:* Organizes group learning, observes students, provides consultation, and promotes interaction between groups and among individuals to achieve learning objectives.

Although he developed specific teaching styles, Grasha warned against boxing teachers into a single category. Instead, he advocated that teachers play multiple roles in the classroom. He believed most teachers possess some combination of all or most of the classic teaching styles.

How does Differentiated Instruction Impact Teaching Styles?

Carol Ann Tomlinson, a professor at the University of Virginia, is an early advocate of differentiated instruction and a pioneer in the development of learning-based teaching styles. If Grasha laid the groundwork for 20th-century teachers to adopt styles tailored to match their personalities and strengths, Tomlinson has advanced this theme into the 21st century by focusing on differentiated instruction.

In the simplest terms, differentiated instruction means keeping all students in mind when developing lesson plans and workbook exercises, lectures and interactive learning. These student-focused differences necessitate instructional styles that embrace diverse classrooms for students at all learning levels and from various backgrounds without compromising the teacher's strengths.

WHAT TEACHING STYLE IS BEST FOR TODAY'S STUDENTS?

Whether you're a first-year teacher eager to put into practice all of the pedagogical techniques you learned in college, or a classroom veteran examining differentiated instruction and new learning methodologies, consider that not all students respond well to one particular style. Although teaching styles have been categorized into five groups, today's ideal teaching style is not an either/or proposition but more of a hybrid approach that blends the best of everything a teacher has to offer.

Here is a recap from the list of teaching methods described earlier.

- *Authority, or lecture style:* This traditional, formal approach to teaching is sometimes referred to as "the sage on the stage."
- *Demonstrator, or coach style:* This style retains the formal authority role while allowing teachers to demonstrate their expertise by showing students what they need to learn.
- *Facilitator, or activity style:* This approach encourages teachers to function as advisors who help students learn by doing.
- *Developer, or group style:* This style allows teachers to guide students in a group setting to accomplish tasks and learn what works or doesn't.
- *Hybrid, or blended style:* This approach incorporates different aspects of the various styles and gives teachers flexibility to tailor a personal style that's right for their coursework and students.

The traditional advice that teachers not overreach with a cluster of all-encompassing teaching styles might seem to conflict with today's emphasis on student-centered classrooms. Theoretically, the more teachers emphasize student-centric learning the harder it is to develop a well-focused style based on their personal attributes, strengths and goals. In short, modern methods of teaching require different types of teachers — from the analyst/organizer to the negotiator/consultant. Here are some other factors to consider as teachers determine the best teaching method for their students.

Empty vessel: Critics of the "sage on the stage" lecture style point to the "empty vessel" theory, which assumes a student's mind is essentially empty and needs to be filled by the "expert" teacher. Critics of this traditional approach to teaching insist this teaching style is outmoded and needs to be updated for the diverse 21st-century classroom.

Active vs. passive: Proponents of the traditional lecture approach believe that an overemphasis on group-oriented participatory teaching styles, like facilitator and delegator, favour gifted and competitive students over passive children with varied learning abilities, thereby exacerbating the challenges of meeting the needs of all learners.

Knowledge vs. information: Knowledge implies a complete understanding, or full comprehension, of a particular subject. A blend of teaching styles that incorporate facilitator, delegator, demonstrator, and lecturer techniques helps the broadest range of students acquire in-depth knowledge and mastery of a given subject. This stands in contrast to passive learning, which typically entails memorizing facts, or information, with the short-term objective of scoring well on tests.

Interactive classrooms: Laptops and tablets, videoconferencing and podcasts in classrooms play a vital role in today's teaching styles. With technology in mind, it is imperative that teachers assess their students' knowledge while they are learning.

The alternative is to wait for test results, only to discover knowledge gaps that should have been detected during the active learning phase.

Constructivist teaching methods: Contemporary teaching styles tend to be group focused and enquiry driven. Constructivist teaching methods embrace subsets of alternative teaching styles, including modeling, coaching, and test preparation through rubrics scaffolding. All of these are designed to promote student participation and necessitate a hybrid approach to teaching. One criticism of the constructivist approach is it caters to extroverted, group-oriented students, who tend to dominate and benefit from these teaching methods more than introverts; however, this assumes introverts aren't learning by observing.

Student-centric learning does not have to come at the expense of an instructor's preferred teaching method. However, differentiated instruction demands that teachers finesse their style to accommodate the diverse needs of 21st-century classrooms.

The 'Sage on the Stage' Meets the 'Tiger Mom'

The objective of blending teaching styles to leverage the teacher's strengths while meeting the demands of diverse students has become increasingly difficult, as parents take a decidedly proactive role in child-learning techniques. The traditional authoritative/expert, or "sage on the stage" lecture style, has come under attack by some parents — and contemporary educational leaders — who emphasize that a more diverse approach to teaching is necessary to engage students.

This is compounded by the rise of "tiger moms," a term made popular by parents devoted to improving the quality of education with laser-precision focus on A-list schools and a highly competitive job market.

Age of the Proactive Parent

Regardless of what style a teacher adopts, it's important for teachers to develop positive attitudes, set goals and establish high expectations for students.

"Assume students can excel!" education authors Harry and Rosemary Wong declare. As former teachers with a combined 80-plus years of educational experience, the Wongs emphasize in their best-selling book, "The First Days of

School: How to Be an Effective Teacher" and their more recent, "The Classroom Management Book" that successful teachers share three common characteristics:

- Effective classroom management skills
- Lesson mastery
- Positive expectations

All instructors, when developing their teaching styles, should keep in mind these three goals, as well as the primary objective of education: student learning.

HOW DOES CLASSROOM DIVERSITY INFLUENCE TEACHERS?

It is abundantly clear that today's teachers are responsible for students with a diverse range of learning abilities. The 21st-century teacher does not have the luxury of "picking the low-hanging fruit" and then leaving the rest of the tree for experts who specialize in children with behavioural issues or learning disorders. Today's teachers must develop instructional styles that work well in diverse classrooms. Effective teaching methods engage gifted students, as well as slow-learning children and those with attention deficit tendencies. This is where differentiated instruction and a balanced mix of teaching styles can help reach all students in a given classroom — not just the few who respond well to one particular style of teaching.

The wonderment of teaching, what author/educator Dr. Harry Wong refers to as "that ah-ha moment" when a child "gets it," is one of the most rewarding and seemingly elusive benefits of becoming a teacher. This transference of knowledge from expert to student is an art form and a skill. Fortunately, both can be learned and perfected.

Knowing how to engage students begins with selecting the teaching style that's right for you. And remember, even though you may prefer one teaching style over another, you must find the style that works best for your students! Try different styles to meet different objectives, and always challenge yourself to find ways to reach each student.

DIFFERENT TEACHING METHODS: A PANACEA FOR EFFECTIVE CURRICULUM IMPLEMENTATION IN THE CLASSROOM

To educate is to impact knowledge, positive judgement and a well developed wisdom to the learner through a learning process. Formal education is the application of pedagogy, a body of theoretical and applied research relating to teaching and learning.

Imparting of knowledge lately comprises a complex mingling of factors as political, social, economic and cultural, due to the fact that the logistics of education are constantly changing, and education presently engages creatively with the transformation of the society, and partakes in it. Therefore, it is necessary that this aspect of modern education be reflected in the models of teaching with its constant evolving needs.

Teaching is a deliberate activity done in a professional manner to bring a positive change on the learner; in order to teach well. Teachers are guided by certain principles of teaching and learning which have great implication for teaching. The role of the teacher is very essential in the effective implementation of the curriculum. The teacher amongst other things must be abreast with the fundamental principles of teaching that will enable him/her to be efficient and productive in the discharge of his/her duties. Teachers challenge the 3 domains of cognitive, affective and the psychomotor domain of learners. The teacher's task is not complete until he/she evaluates to determine if the set objectives have been achieved.

Method of teaching denotes the strategy by which a teacher delivers his/her subject matter to the learners based on some predetermined instructional objectives in order to promote learning in the students. For a teacher to effectively adopt any teaching method, some factors must be considered. The effective implementation of any curriculum depends to a large extent on the availability of various methods of teaching. Thus to teach is to impact knowledge, an attempt to help the learner have a change of attitude and acquire skills through a series of planned activities.

This chapter presents the reader with some methods of teaching and how these methods of teaching can be incorporated within the framework of changing patterns of education. It is hoped that the content of this paper fosters a better understanding of teaching for the teachers and other readers.

THE CONCEPT OF TEACHING

Teaching is an attempt to bring about desirable changes in human learning, abilities and behaviour in order to contribute to better living. Teaching helps people to gain the knowledge, skills and attitudes they need to be responsible citizens. It is also a means of passing knowledge to the next generation. Awotua-Efebo (2001) sees teaching as an interaction between a teacher and a student under the teacher's responsibility, in order to bring about the expected change in the students behaviour.

According to Gagne & Briggs, 1989 in Awotua-Efebo (2001), the purpose of teaching, are to help students to:
- Acquire, retain and be able to use knowledge
- Understand, analyse, synthesize and evaluate skills
- Establish habits and
- Develop attitudes

Omieibi-Davies (2011) sees the changes in behaviour that occurs as a result of teaching as follows:
a. An increased store of useful information and the understanding of basic principles in the subject matter.
b. An acquisition of psychomotor skills, abilities and habits.
c. Possession of desirable attitudes and ideas, such as developing satisfaction about learning outcomes.

COMPONENTS OF TEACHING

In order to come up with an effective teaching approach, three major components of teaching have been identified namely:-

1. *Preparation:* Here the teacher plans the lessons he/she intends to teach including all the activities needed to put the lesson together.
2. *Execution:* Here the teacher is involved in communicating the lesson to the students as prepared in the lesson notes using the designed teaching model/strategies. The classroom management is also involved here.
3. *Evaluation:* Here the teacher does all it takes to ensure that the lesson is effective considering the teaching model used for a particular class. Students are evaluated here through tests, and other quizzes, etc
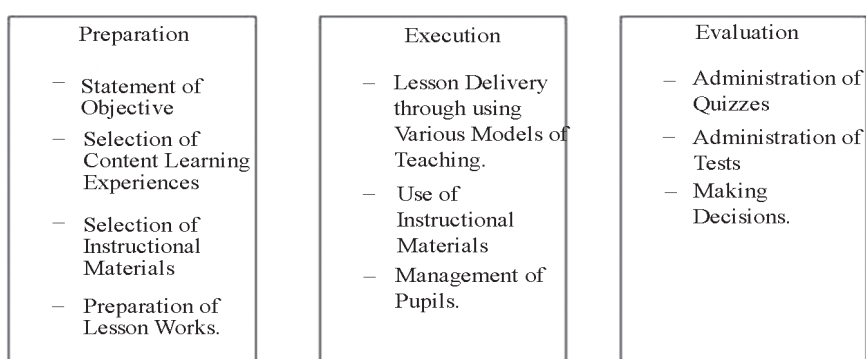
Preparation	Execution	Evaluation
– Statement of Objective	– Lesson Delivery through using Various Models of Teaching.	– Administration of Quizzes
– Selection of Content Learning Experiences	– Use of Instructional Materials	– Administration of Tests
– Selection of Instructional Materials	– Management of Pupils.	– Making Decisions.
– Preparation of Lesson Works.		

Fig. Components of Effective Teaching – Awotua- Efebo 2001.

TEACHING PRINCIPLES

In order to carry out an effective teaching task below is a list of helpful guide for a successful teaching.

1. *Planned teaching results in more learning:* The teacher must be clear in his/her mind right from the start on what he/she intend to do. Teachers are encouraged to plan their lessons extensively; such defined goals helps the teacher to determine the methodology appropriate to the subject matter to aid teaching and learning.
2. Teachers should be able to guide students effectively to achieve the objectives of lessons taught.
3. Students tend to achieve in ways they are tested, teachers are encouraged to test students in different ways to enhance their achievement rates in various domains.
4. *Students learn from one another:* Encourage students to work in groups while solving problems as this goes a long way to enhance learning.

THE TEACHER

A teacher is expected to have a total commitment in giving the children the type of education that trains them to growth and development. A teacher is a

person who is qualified in every way as a professional teacher to teach in schools especially in his/her area of specialization. A teacher's personality type should be divergent, enduring and stable enough to help learners solve their problems. No educational system can be stronger than the calibre of the teaching staff. In recognition of this fact, the Federal Republic of Nigeria National Policy on Education (2004) stated, "All teachers in our educational institutions, from pre-primary o university, will be professionally trained. The teacher is the sole implementer of the curriculum in the classroom.

The main focus of the implementation of the curriculum is the learner, while the most important person in curriculum implementation is the teacher. The teacher is the prime mover of the educational system. Aghanta (1991) conceptualizes that as an input operator into the educational system, the teacher plays a major role in the conversion of raw materials particularly students into finished products *e.g.,* graduates.
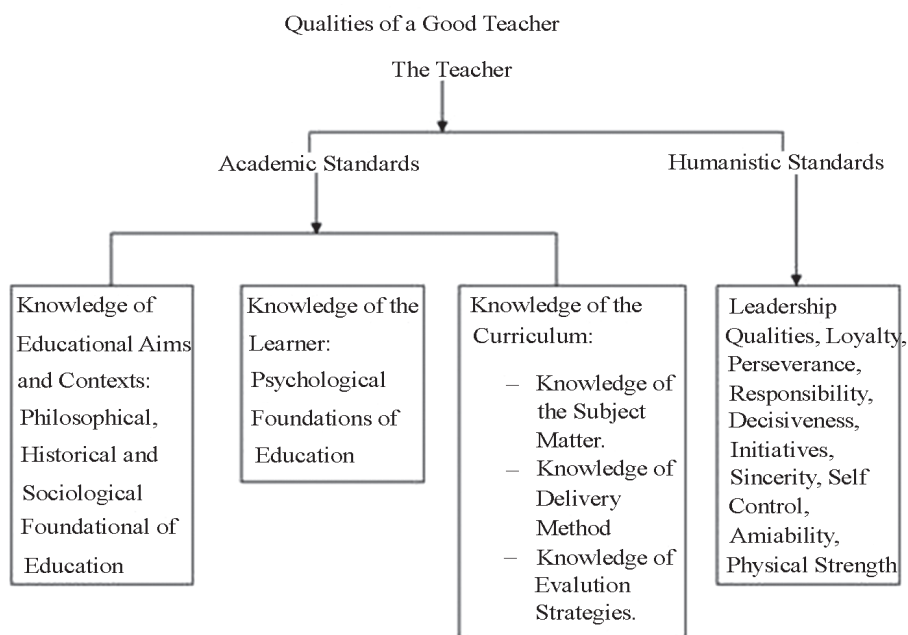
Qualities of a Good Teacher

The Teacher

Academic Standards

Humanistic Standards

| Knowledge of Educational Aims and Contexts: Philosophical, Historical and Sociological Foundational of Education | Knowledge of the Learner: Psychological Foundations of Education | Knowledge of the Curriculum:
 – Knowledge of the Subject Matter.
 – Knowledge of Delivery Method
 – Knowledge of Evalution Strategies. | Leadership Qualities, Loyalty, Perseverance, Responsibility, Decisiveness, Initiatives, Sincerity, Self Control, Amiability, Physical Strength |

Fig. Qualities of a God Teacher Vikoo (2003).

The Characteristics of a good teacher can be grouped under two broad standards Academics of Humanistic standards

Academic Standards – A teacher due to his training is grounded in his area of specialization. Vikoo (2003) opines that the knowledge required of a teacher can be condensed into three main types namely.

1. *Knowledge of educational aims and contexts:* The aims and objectives of education vary from societies based on the problems and needs of the society. The teacher needs to be grounded in the historical, philosophical, sociological and other issues the society is experiencing and how education can be used in solving them.

2. *Knowledge and characteristics of the learner:* A good teacher should understand how children learn and develop. He/she should be able to provide learning opportunities that supports their intellectual, social and personal development. Education revolves around the learner; a learner who has acquired a sound education should be able to contribute to the solutions of problems in society.

3. *Knowledge of curriculum:* The teacher here should understand and have the knowledge of the subject matter, delivery methods and knowledge of evaluation methods.

The Humanistic standards of a teacher deals with his/her personality traits, such as: his/her sense of responsibility, amiability, initiative, sincerity, self-control, loyalty, physical strength, leadership qualities and be good personality, decisiveness, likes fun and a sense of humour, punctual, co-operates with colleagues and be committed to self improvement amongst others. All these will help the teacher to succeed in the varied task he/she must perform.

Finally, success in the discharge of the duty of a teacher depends to a large extent on the degree to which teachers possess the necessary cognitive, affective & psychomotor skills. Therefore, the teacher should have the appropriate knowledge, attitude & physical skills to carry out whatever activities he/she is expected to engage in, to help learners acquire desired knowledge and skills to bring about changes.

What is Learning

Learning has been defined in various ways based on various theories explaining the process of learning. Learning involves changes in the behaviour patterns of an individual. Simply put, learning is the process of acquiring knowledge or skills and attitudes. This can be illustrated thus:
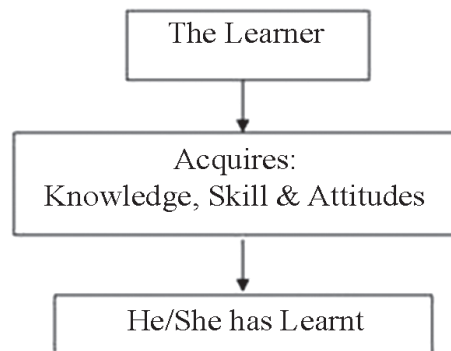
```
        ┌─────────────────────┐
        │     The Learner      │
        └─────────────────────┘
                  │
                  ▼
    ┌─────────────────────────────┐
    │          Acquires:          │
    │  Knowledge, Skill & Attitudes │
    └─────────────────────────────┘
                  │
                  ▼
    ┌─────────────────────────────┐
    │      He/She has Learnt      │
    └─────────────────────────────┘
```

Fig. Definition of Learning.

Some learning principles that can be used to facilitate teaching of learning in the classroom are:-

1. Students learn best by being actively involved in learning activities.
2. Positive or reward reinforcement is more likely to result in students' learning than negative reinforcement.

3. A situation which offers fresh and stimulating experiences is a kind of reward that enhances learning.
4. Meaningful material is easiest learnt and best retained
5. Learning is increased when provided in a rich and varied environment.
6. Detail must be placed into a structured pattern or it is forgotten.
7. Learning is enhanced by a wide variety of experiences which are organized around purposes accepted by the students.
8. Learning is transferred to the extent the learner sees possibilities for transfer and has opportunities to apply his knowledge.

It is important to understand the primary objective of teaching which is to bring about good education. Prospective teachers are encouraged to know the operation and approaches to learning in order to develop better teaching methodologies. In using these teaching methods, teachers should consider every learner's unique attribute.

Teaching calls for an active participation of the learner, thus for teaching & learning to be effective, it has to ensure a joint teacher-learner-class activity based on variety of methods which creates room for effective and efficient mastery of the subject matter on the part of the learner.

TEACHING METHODS

Simply put, teaching method is any teaching maneuver that can be used to facilitate students learning and satisfaction. Different teaching methods may elicit different types of changes in learning outcomes. Teaching methods are many and varied and could be used in different ways, considering among others the age of the learners, body configuration or physique of learners, (able or disabled learners). Academic ability/intelligence of the learners, number of learners and of course the type of curriculum discipline which recognizes the fact that certain teaching methods are much more suitable to some disciplines than others.

Vikoo (2003) is discussing types of teaching methods explained that teaching methods could be presented under three main categories:
- Cognitive development methods
- Affective development methods
- Psychomotor development methods

1. *Cognitive Development Methods:* Here, if the focus of the instructional objectives is to develop intellectual skills in learners, then the cognitive development methods of teaching are recommended. This method helps learners to comprehend, analyse, synthesize and evaluate information. *It helps learners develop good cognitive abilities. Though the cognitive development methods are essentially didactic. Some of the teaching methods in this category includes:*
   - Discussion Method
   - Questioning/Socratic Method
   - Team Teaching Method

- Talk Chalk/Recitation Method
- Field Trip/Escortion Method
- Team Teaching Method

2. *Affective Development Method:* This domain includes objectives which describe changes in interest, attitudes and values. It further deals with the development of appreciation and adequate adjustment. Education has a lot to give the learner in order to assist him/her develop in these areas, hence teachers are encouraged to include learning experiences that are worthwhile, teach in ways that arouse interest and develop proper attitude in learners. This mode of teaching are basically Philetic, here students feelings or opinion are aroused. Some teaching methods under this category includes:
   - Modelling Method
   - Simulation Method
   - Dramatic Method
   - Simulation Games
   - Role-Playing Method

3. *Psychomotor Development Methods:* These are activity based methods of teaching that aim at motor skills development in learners. This method requires that learners are able to illustrate, demonstrate, or perform certain skills using their manual dexterity. It is a heuristic method of teaching that involves enquiry and discovery methods of teaching. It is a more student activity based method.
   This method includes:
   - Enquiry Method
   - Discovery Method
   - Process Approach Method
   - Demonstration Method
   - Laboratory/Experimentation Method
   - Programmed Learning Method
   - Dalton Plan/Assignment Method
   - Project Method
   - Microteaching Method
   - Mastery Learning

Over the century, a great number of teaching methods have been developed, modified and even combined. Below is a list of some teaching methods that can be used to facilitate learning generally.

As already mentioned, there are several methods of teaching; the following methods will be discussed in this paper:

1. Discussion method
2. Questioning method
3. Role Playing Method
4. Stimulation Method
5. Demonstration Method
6. Enquiry/Discovery Method

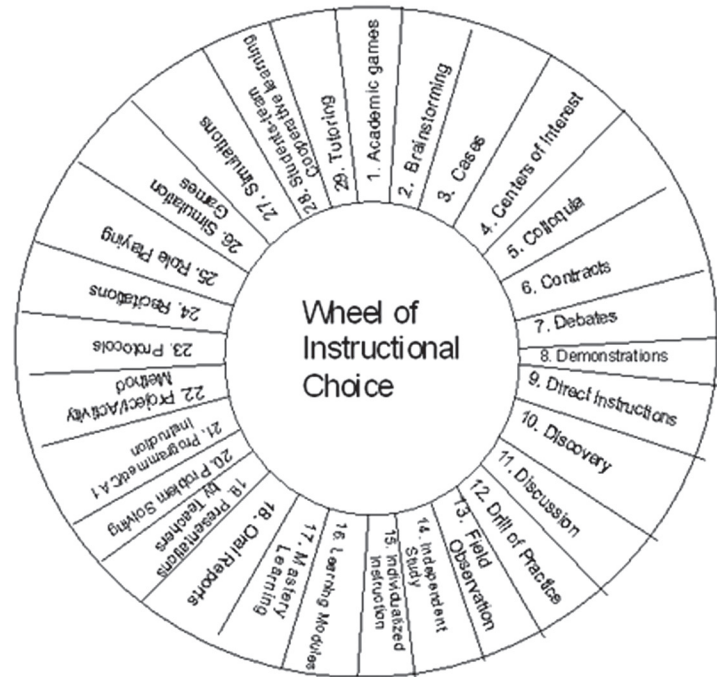The wheel of instructional choice showing various teaching methods.

Fig. Wheel of Instructional Choice showing various Teaching Methods.

Discussion Methods

Discussion is usually at a higher cognitive level and it develops critical thinking. Student's participation is necessary for a successful classroom discussion. It is a student centered teaching technique but requires careful planning by the teacher to guide discussion. Successful discussions are guided by specific teaching goals. It involves a process of free guided discussion and expression of views and ideas on a given topic, question or problem by the teacher. In the students attempt to solve the problem or answer the question, students pair up in smaller groups for about 5 minutes or more,, discuss the issue on ground and then they are brought back for a full group discussion. Various students are able to participate and are exposed to other student's ideas. In small group students can discuss a complex issue and when they are brought back to the larger groups, these students can discuss their reactions, share ideas and build on each other's suggestions. This method encourages student's participation, develops critical thinking, develops student's ability to communicate, and problem solving skills. It allows all to participate.

Trouble Shooting: Atimes, in the process of critical discussion, it turns out into emotional charged unproductive debates, here the teacher should get other students involved to identify the issue of conflict and encourage them to analyse the discussion with less emotional charge. Discussion method can be tedious to co-ordinate and not practical with a lot of students at once.

Finally, discussions are characterized by multiple interactions, with the teacher as the facilitator. Discussions are basically small groups in nature and these groups vary in size and composition. Participant interactions are encouraged to be arranged face-to-face.

QUESTIONING METHOD

Questioning method of teaching aids learners in connecting concepts, increasing awareness, encouraging creative and imaginative thought, making inferences, *etc.* Questioning generally helps learners to explore deeper level of thinking, knowing and understanding. Questioning, though it is more of a technique than a method of teaching, it is used during various methods of teaching. Questioning aids in sensitizing the inquisitive mind of the learner. This method is credited to Socrates, a Greek Philosopher.

Questioning methods may be used for the following purposes:

1. *To arouse interest & curiosity:* At the beginning of a lesson, questions can be used to secure interest, and focus the attention of the group on the subject.
2. *To stimulate discussion:* Question that are thought-provoking can get the group to start reactions.
3. *To channel thinking:* By skillful questioning, the teacher can steer the group to the objective he has established, keep them on the right track and guide their thinking. The teacher can also help the group to move from the known to the unknown by a series of well-prepared questions.
4. *To determine how well the group understand the material:* By the response given to a question, the teacher can determine if the group has absorbed what is being presented, and provides opportunity to correct any misconceptions or to elaborate on points.
5. *To get the attention of an individual:* To help a timid person to express his or her thoughts

There are five basic types of questions namely:

- *Factual:* These require straight forward answers based on obvious facts or awareness. Answers are either right or wrong-yes or no.
- *Convergent*: Answers to questions of this nature are usually within a finite range of acceptable accuracy. They allow for only one right response; they are questions about concrete facts.
- *Divergent:* These questions allow for many right responses. These questions give students the room to explore various avenues, creates alternative answers. Correct answers here could be based on logical projections or imagination. Questions here deal with opinions, hypotheses & evaluation and they predict different outcomes.
- *Evaluative:* Evaluative questions are open-ended & more difficult to answer, because some criteria must be established for making any judgement. Basically, evaluative questions require students to make judgements on something. Responses to these questions are limited to a number of choices.

- *Combination:* These are questions that blend and can be combined as a question example.
    i. What are the differences and similarities between the death of late General Sanni Abacha when compared to that of General Muritala Mohammed.

ROLE PLAYING

This method of teaching can be used for solving real life situational problems. The technique of role lay develops practical professional skills and functioning knowledge. It enables students in the classroom to act as stakeholders in an imagined scene.

In a play role, the teacher selects an event that illuminates the topic of study and students are assigned roles, which will be played out, the role play will be concluded, with a reflection stage that reinforces the concepts introduced by the role play.

This method gives students the opportunity to explore together their feelings, attitudes, values and problem solving strategies. Role play also creates a stimulating environment that brings reality to life and intensify learners understanding of the event being played. This method intensifies and accelerates learning, it can be described as a hands-on approach to learning & students learn through active involvement in role-play. The problem with role playing method amongst others is that directing a role playing is complex. Also, some students may be too self-conscious and may not be able to play the role for other students to observe.

GAMES/SIMULATION METHOD

This method entails a real life activity in a simple manner that communicates the idea to the learners. Example, If the "use of money" is the topic in class; the teacher gets two students to act a trader and a customer scene, where the customer buys the items from the trader with the money, in this scene, the use of money is depicted in real life situation. This kind of simulation is better than mere verbal description.

Omieibi-David (2001) conceptualizes simulations as an imitation of real life situations that requires participants to play a role that involves them in interaction with other people or with elements of the environment concerned.

The use of stimulation methods in classroom situations is devised to help students learn how things operate in reality. Students are encouraged to act out the same roles and make decisions likened to real life situations.

Therefore, simulation helps students to practice and understand adult roles and also develop the skills necessary for a successful adult life. Simulation and games are used at all levels of education and creates both intrinsic and extrinsic motivation in the learner. While simulation methods present the students realities of life in concrete and simple forms, they are innovative and a welcome change in the learning experiences as compared to the routine

classroom learning. Simulation problems shooting areas lies in the fact that it is time consuming, very expensive, especially in an attempt to purchase a reasonable number for class use. It also requires great classroom management.

DEMONSTRATION METHOD

A demonstration involves showing, doing or telling the students the point of emphasis. It is mostly used as a technique within a method of teaching and a times as a method of teaching itself. Here the role of the teacher is to illustrate how to do something or illustrate a principle first by explaining the nature of the act verbally, followed by demonstrating the act in a systematic manner and later the students repeats the act. Here students are involved in dong things that will influence their behaviour patterns, through demonstrations, students are exposed to physical materials that will illustrate some meaning to their cognitive framework. Direct experiences like this go a long way to enrich learning. Demonstration is useful mostly in imparting psychomotor skills and lessons that require practical knowledge. The gains of using demonstration method in teaching lies in the fact that it bridges the gap between theory and practice, enables learners to become good observers and generate their interest; students see immediate progress as a result of a correct effort and it enables the teacher to teach manipulative and operational skills. The problems encountered in this method amongst others include the fact that students loose interest and confidence when they fail to repeat accurately; creativity and originality by students are hindered as students try to do it exactly the same way as their teacher did it and students have a limited opportunity to be familiar with learning materials.

ENQUIRY/DISCOVERY METHOD

This is a teaching learning situation whereby students are given the opportunity to discover and find out things for themselves. Enquiry/discovery methods have been known to provide meaningful learning to students when compared to other methods. This method is rooted in the heuristic teaching activity and problem solving; these are basically the major ingredients of modern science. It is a learner centered method, whereby the learner discovers & explores some problem solving experiences with a view to draw conclusions from data gathered through the process of observing, predicting, measuring and formulating relevant questions.

Learning acquired through enquiry/discovery method is mostly accepted as more meaningful and authentic than learning imposed by external forces. This method can be used with students at any acadmic level though more effective with students at the secondary and tertiary levels.

Two types of discovery methods can be used by the teacher namely the structured method and the open discovery method.

Structured Method: Here the teacher gives a clear set of instructions that learners are to follow to discover a fact, idea or skill for themselves.

Open Discovery Method: The teacher in this method presents a problem, gives some questions and directions that requires learners to find answers to. Here, the teacher gives the learner the freedom to explore different perspectives, views, possibilities, and solutions to the problem.

There are no stereo type answers as the learners arrive at different solutions to a problem, especially in the case of the open discovery method. In both situations, they are expected to find the solution within a specific time frame.

The gains of enquiry/discovery methods includes:
- It demonstrates students proficiency
- It encourages curiosity
- It encourages students to develop coding system which helps them to make connection among objects and phenomena.
- Fosters intuitive thinking in the classroom
- Develops good communication skills as science requires distinct communication for accurate sharing of methods and findings and
- Finally, students become independent thinkers.

Below are some problems experienced in using the enquiry/discovery method of teaching.
- It is not cost effective
- It requires a lot of planning before it can be implemented
- It is time consuming
- Unsuccessful attempts at arriving at needed solution may have negative impact on students.

CRITERIA FOR SELECTING TEACHING METHODS

In selecting teaching method, the teacher's analytical ability comes to play considering the situation at hand. There are some factors that will guide the teacher's choice of method to use in teaching a particular lesson; such factors include:
- The subject matter
- Instructional objectives
- The learner
- The teacher
- The time
- Instructional materials
- The environment.

THE SUBJECT MATTER

The content of a subject determines what method to be used to achieve effectiveness in the teaching and learning process. Subjects could be science or arts oriented, and as such, they definitely require different teaching methods that suit such disciplines. Science subjects are better taught with the enquiry or discovery methods while the lecture method can be used in some art subjects depending in the content of the subject.

INSTRUCTIONAL OBJECTIVES

The instructional objectives a teacher intends to achieve at the end of a lesson, determines the choice of teaching method to use in teaching the subject. Example from the objectives of a lesson, the teacher will know if the lesson intends to acquire new skills or illicit an emotional or aesthetic reaction from the students; knowledge of these will go a long way in determining which teaching method to use.

THE LEARNER

The learner is the pivot of teaching a teacher will have to know the student's prior knowledge.

The age, ability and the number of learners needs to be considered in some teaching method suitable for students within a given age group; students with different physical and mental abilities/disabilities, interest, students at the primary, secondary or higher institutions. Example- a method used with the physically challenged cannot be used with the normal students.

THE TEACHER

The teacher is the person that has to initiate the particular teaching method or methods he/she intends to use in a given lesson. He/she should be familiar with such methods and be prepared in every way. The teacher should endeavour to vary the methods he/she uses in teaching and should not be known to using a particular method always.

TIME

The time allotted to a subject on the school time-table should be considered when determining the choice of teaching method. Methods like role-playing, simulations can be done within double periods. When there is little time to cover large scheme of work, then, the lecture method can be used, but the learners must be considered in every way.

INSTRUCTIONAL MATERIALS

These go a long way to determine what teaching methods to use in a given lesson *e.g.,* a teacher that wants to teach a practical class in biology needs an equipped biology laboratory to demonstrate effectively, but where there is none; will end up with just a lecture method which does not completely suit that topic.

THE CLASSROOM ENVIRONMENT

Classroom environment set a tone for learning and causes learners to behave in certain ways. It is important to consider the classroom environment in selecting an appropriate teaching method for a lesson. The space available

in a class, ventilation, illumination and other teaching devices in a classroom, etc all these affects the choice of teaching methods to be used.

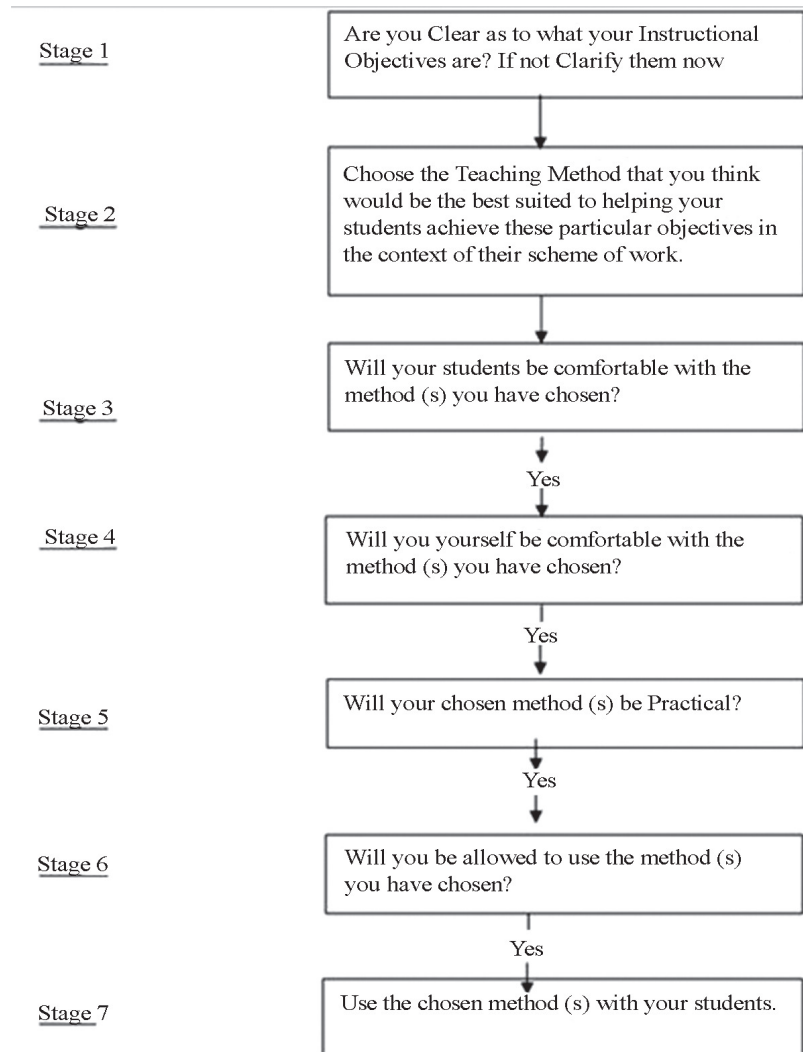A Programme Chart for Selecting Appropriate Teaching Method

Stage 1	Are you Clear as to what your Instructional Objectives are? If not Clarify them now
Stage 2	Choose the Teaching Method that you think would be the best suited to helping your students achieve these particular objectives in the context of their scheme of work.
Stage 3	Will your students be comfortable with the method (s) you have chosen?
	Yes
Stage 4	Will you yourself be comfortable with the method (s) you have chosen?
	Yes
Stage 5	Will your chosen method (s) be Practical?
	Yes
Stage 6	Will you be allowed to use the method (s) you have chosen?
	Yes
Stage 7	Use the chosen method (s) with your students.

Fig. A Chat for Selection of Appropriate Teaching Methods.

Curriculum Implementation & Its Implication for Teaching Methods

Curriculum is the planned and guided learning experiences and intended learning outcomes formulated through systematic reconstruction of knowledge and experiences for learners under the auspices of a school. (Tanner and Tanner (1975). Curriculum to Offorma (2005) is a structural series of learning experiences intended for the education of the learners under the guidance of the teacher. Nnachi (2009) conceptualizes curriculum as a programme of education made as a guide to the teacher and learner in respect of procedure, content an context of the course of study under the guidance of the school for effective

teaching and learning. In summary of all the definitions above, curriculum is the totality of the systematically planned experiences which the school offers to the learners.

The ability to put curriculum content and other instructional guidelines into practice inside the classroom can be referred to as curriculum implementation. Oforma (2005) stated that curriculum implementation is the transmission of the planned curriculum into the operational curriculum. On the other hand, Ivowi (2004) viewed curriculum implementation as the process of putting all that have been planned as a curriculum process into practice in the classroom through the combined efforts of the teacher, learner, school administrator as well as the interaction with the physical facilities, instructional materials, psychological and social environment.

Therefore, curriculum implementation is the sole concern of the teacher, and the interaction of learners and other education administrators geared towards achieving the objectives of education. Teachers carry out the task of providing learning experiences by providing instruction; these instructions can be achieved through the use of various teaching methods that are made available. Fundamentally, teaching is concerned with the attainment of maximum beneficiary learning for the learner. The teacher's major task among others is to ensure that learning is effective and efficient. Teaching methods known as patterns of interaction between the learners and the teachers are intended to lead to a change in the learner's behaviour.

There are a variety of teaching methods, and it is through the use of such teaching methods that teachers are able to implement the school curriculum. In situations where teachers fail to use appropriate teaching methods, a good curriculum plan could turn out to be damaged. The main purpose of curriculum implementation is to translate the ideas into a workable blueprint, and this can be achieved basically by using appropriate teaching methods in class. The secondary school curriculum as planned learning experiences provided to assist the learners in attaining the designated learning outcomes can be attained by the use of effective teaching methods. The teacher through his teaching methods makes direct use of the curriculum, thereby implementing it. The teacher uses the appropriate teaching methods and resources to achieve learning. Whenever a teacher is teaching a lesson through the means of various teaching methods, he is implementing the curriculum.

THE WAY FORWARD

The following suggestions are made for effective use of teaching methods in the teaching and learning process.

1. Teachers should know the nature of the subject matter to be taught and be conversant with it to enable him/her determine the most suitable teaching method/methods to use in a given lesson.
2. The instructional objectives a teacher intends to achieve by the end of the lesson determines to an extent the type of teaching methods. Teachers should try to match the instructional objectives to suit the teaching methods to be chosen for a lesson.

3. The teacher must be very familiar with the type of teaching methods he/she wants to use at any given time; and must ensure it is most appropriate for the success of the lesson.
4. The teacher must consider the age, interest, etc of the learner and ensures the right teaching methods and materials that will suit the learners are in place.
5. In choosing appropriate teaching methods, the teacher is encouraged to consider the time to be used for a lesson, as this will go a long way to determine also the type of teaching methods to use.
6. The teacher should put into consideration the population of the class, the environment and the size of the class. This will help to determine a most suitable teaching method to use for a lesson and make it worthwhile.

4

Shaping a New Vision of Higher Education

Equity of Access:
- Universal Declaration of Human Rights, admission to higher education should be based on the merit, capacity, efforts, perseverance and devotion, showed by those seeking access to it and can take place in a life-long scheme, at any time, with due recognition of previously acquired skills. As a consequence, no discrimination can be accepted in granting access to higher education on grounds of race, gender, language or religion, or economic, cultural or social distinctions, or physical disabilities.
- Equity of access to higher education should begin with the reinforcement and, if need be, the reordering of its links with all other levels of education, particularly with secondary education. Higher education institutions must be viewed as and must also work within themselves to be a part of and encourage, a seamless system starting with early childhood and primary education and continuing through life. Higher education institutions must work in active partnership with parents, schools, students, socio-economic groups and communities. Secondary education should not only prepare qualified candidates for access to higher education by developing the capacity to learn on a broad basis but also open the way to active life by providing training on a wide range of jobs. However, access to higher education should remain open to those successfully completing secondary school, or its equivalent, or presenting entry qualifications, as far as possible, at any age and without any discrimination.

- As a consequence, the rapid and wide-reaching demand for higher education requires, where appropriate, all policies concerning access to higher education to give priority in the future to the approach based on the merit of the individual, as defined in Article 3(a) above.
- Access to higher education for members of some special target groups, such as indigenous peoples, cultural and linguistic minorities, disadvantaged groups, peoples living under occupation and those who suffer from disabilities, must be actively facilitated, since these groups as collectivities and as individuals may have both experience and talent that can be of great value for the development of societies and nations. Special material help and educational solutions can help overcome the obstacles that these groups face, both in accessing and in continuing higher education.

Enhancing participation and promoting the role of women:
- Although significant progress has been achieved to enhance the access of women to higher education, various socio-economic, cultural and political obstacles continue in many places in the world to impede their full access and effective integration. To overcome them remains an urgent priority in the renewal process for ensuring an equitable and non-discriminatory system of higher education based on the principle of merit.
- Further efforts are required to eliminate all gender stereotyping in higher education, to consider gender aspects in different disciplines and to consolidate women's participation at all levels and in all disciplines, in which they are under-represented and, in particular, to enhance their active involvement in decision-making.
- Gender studies (women's studies) should be promoted as a field of knowledge, strategic for the transformation of higher education and society.
- Efforts should be made to eliminate political and social barriers whereby women are under-represented and in particular to enhance their active involvement at policy and decision-making levels within higher education and society.

Advancing knowledge through research in science, the arts and humanities and the dissemination of its results:
- The advancement of knowledge through research is an essential function of all systems of higher education, which should promote postgraduate studies. Innovation, interdisciplinarity and transdisciplinarity should be promoted and reinforced in programmes with long-term orientations on social and cultural aims and needs. An appropriate balance should be established between basic and target-oriented research.
- Institutions should ensure that all members of the academic community engaged in research are provided with appropriate training, resources and support. The intellectual and cultural rights on the results of research should be used to the benefit of humanity and should be protected so that they cannot be abused.

- Research must be enhanced in all disciplines, including the social and human sciences, education (including higher education), engineering, natural sciences, mathematics, informatics and the arts within the framework of national, regional and international research and development policies. Of special importance is the enhancement of research capacities in higher education research institutions, as mutual enhancement of quality takes place when higher education and research are conducted at a high level within the same institution. These institutions should find the material and financial support required, from both public and private sources.

Long-term orientation based on relevance:

- Relevance in higher education should be assessed in terms of the fit between what society expects of institutions and what they do. This requires ethical standards, political impartiality, critical capacities and, at the same time, a better articulation with the problems of society and the world of work, basing long-term orientations on societal aims and needs, including respect for cultures and environmental protection. The concern is to provide access to both broad general education and targeted, career-specific education, often interdisciplinary, focusing on skills and aptitudes, both of which equip individuals to live in a variety of changing settings and to be able to change occupations.
- Higher education should reinforce its role of service to society, especially its activities aimed at eliminating poverty, intolerance, violence, illiteracy, hunger, environmental degradation and disease, mainly through an interdisciplinary and transdisciplinary approach in the analysis of problems and issues.
- Higher education should enhance its contribution to the development of the whole education system, notably through improved teacher education, curriculum development and educational research.
- Ultimately, higher education should aim at the creation of a new society—non-violent and non-exploitative—consisting of highly cultivated, motivated and integrated individuals, inspired by love for humanity and guided by wisdom.

Strengthening cooperation with the world of work and analysing and anticipating societal needs:

- In economies characterized by changes and the emergence of new production paradigms based on knowledge and its application and on the handling of information, the links between higher education, the world of work and other parts of society should be strengthened and renewed.
- Links with the world of work can be strengthened, through the participation of its representatives in the governance of institutions, the increased use of domestic and international apprenticeship/work-study opportunities for students and teachers, the exchange of personnel between the world of work and higher education institutions and revised curricula more closely aligned with working practices.

- As a life-long source of professional training, updating and recycling, institutions of higher education should systematically take into account trends in the world of work and in the scientific, technological and economic sectors. In order to respond to the work requirements, higher education systems and the world of work should jointly develop and assess learning processes, bridging programmes and prior learning assessment and recognition programmes, which integrate theory and training on the job. Within the framework of their anticipatory function, higher education institutions could contribute to the creation of new jobs, although that is not their only function.

- Developing entrepreneurial skills and initiative should become major concerns of higher education, in order to facilitate employability of graduates who will increasingly be called upon to be not only job seekers but also and above all to become job creators. Higher education institutions should give the opportunity to students to fully develop their own abilities with a sense of social responsibility, educating them to become full participants in democratic society and promoters of changes that will foster equity and justice.

Diversification for enhanced equity of opportunity:

- Diversifying higher education models and recruitment methods and criteria is essential both to meet increasing international demand and to provide access to various delivery modes and to extend access to an ever-wider public, in a life-long perspective, based on flexible entry and exit points to and from the system of higher education.

- More diversified systems of higher education are characterized by new types of tertiary institutions: public, private and non-profit institutions, amongst others. Institutions should be able to offer a wide variety of education and training opportunities: traditional degrees, short courses, part-time study, flexible schedules, modularized courses, supported learning at a distance, *etc.*

Innovative educational approaches: critical thinking and creativity:

- In a world undergoing rapid changes, there is a perceived need for a new vision and paradigm of higher education, which should be student-oriented, calling in most countries for in-depth reforms and an open access policy so as to cater for ever more diversified categories of people and of its contents, methods, practices and means of delivery, based on new types of links and partnerships with the community and with the broadest sectors of society.

- Higher education institutions should educate students to become well informed and deeply motivated citizens, who can think critically, analyse problems of society, look for solutions to the problems of society, apply them and accept social responsibilities.

- To achieve these goals, it may be necessary to recast curricula, using new and appropriate methods, so as to go beyond cognitive mastery of

disciplines. New pedagogical and didactical approaches should be accessible and promoted in order to facilitate the acquisition of skills, competences and abilities for communication, creative and critical analysis, independent thinking and team work in multi-cultural contexts, where creativity also involves combining traditional or local knowledge and know-how with advanced science and technology. These recast curricula should take into account the gender dimension and the specific cultural, historic and economic context of each country. The teaching of human rights standards and education on the needs of communities in all parts of the world should be reflected in the curricula of all disciplines, particularly those preparing for entrepreneurship. Academic personnel should play a significant role in determining the curriculum.

- New methods of education will also imply new types of teaching-learning materials. These have to be coupled with new methods of testing that will promote not only powers of memory but also powers of comprehension, skills for practical work and creativity.

Higher education personnel and students as major actors:

- A vigorous policy of staff development is an essential element for higher education institutions. Clear policies should be established concerning higher education teachers, who nowadays need to focus on teaching students how to learn and how to take initiatives rather than being exclusively founts of knowledge. Adequate provision should be made for research and for updating and improving pedagogical skills, through appropriate staff development programmes, encouraging constant innovation in curriculum, teaching and learning methods and ensuring appropriate professional and financial status and for excellence in research and teaching, reflecting the corresponding provisions of the Recommendation concerning the Status of Higher-Education Teaching Personnel approved by the General Conference of UNESCO in November 1997. To this end, more importance should be attached to international experience. Furthermore, in view of the role of higher education for life-long learning, experience outside the institutions ought to be considered as a relevant qualification for higher educational staff.

- Clear policies should be established by all higher education institutions preparing teachers of early childhood education and for primary and secondary schools, providing stimulus for constant innovation in curriculum, best practices in teaching methods and familiarity with diverse learning styles. It is vital to have appropriately trained administrative and technical personnel.

- National and institutional decision-makers should place students and their needs at the centre of their concerns and should consider them as major partners and responsible stakeholders in the renewal of higher education. This should include student involvement in issues that affect that level of education, in evaluation, the renovation of teaching

methods and curricula and in the institutional framework in force, in policy-formulation and institutional management. As students have the right to organize and represent themselves, students' involvement in these issues should be guaranteed.

- Guidance and counselling services should be developed, in cooperation with student organizations, in order to assist students in the transition to higher education at whatever age and to take account of the needs of ever more diversified categories of learners. Apart from those entering higher education from schools or further education colleges, they should also take account of the needs of those leaving and returning in a life-long process. Such support is important in ensuring a good match between student and course, reducing drop-out. Students who do drop-out should have suitable opportunities to return to higher education if and when appropriate.

PRINCIPLES FOR A NEW COOPERATION POLICY

The UNESCO Policy Paper 'Change and Development in Higher Education' sets international cooperation a major objective: 'The most pressing need for international cooperation in higher education is to reverse the process of decline of institutions in the developing countries, particularly in the least developed.

The adverse conditions in which higher education has to function call, first of all, for appropriate measures and efforts by the respective states and institutions. They must learn to be more effective and efficient in strengthening their links with society so as to play a full part in the development efforts of their region or community.

It is not unusual to perceive the university-level establishment as part of the institutional machinery of the state instead of seeing it as an essential part of a local community and of society in general. It is essential to persuade the decision-makers and all of society that the latter is the case' (page 34). To put this idea into practice the following general outlines of a new cooperation policy can be proposed.

WORLD OF WORK AND HIGHER EDUCATION

For the construction of sustainable human development and a culture of peace, we must therefore advocate a logic of cooperation based on the interdependence of all societal components and on solidarity in the struggle against imbalances and the vicious circle of underdevelopment.

This new logic implies a quest for harmonization between the world of work and the other components of society and, accordingly, harmonization between the world of work and higher education in a spirit of partnership. There is one fixed basic principle: higher-education institutions must not set their long-term guidelines exclusively in the light of the labour market or of forward studies of labour requirements but of social needs. The world of work helps to create wealth

that can be reinvested to meet the other needs of society but, in a society which is becoming increasingly knowledge-based, it has an increasing need for staff with high technical qualifications but a humanist view of the pursuit of their activities and an ability to anticipate future needs and requirements, especially those connected with constructing a more just society.

For its part, higher education cannot loftily ignore the fact that the world of work and the whole of society are evolving ever more rapidly. If it is not to fail in its fundamental task, it must therefore make a point of establishing partnerships with the world of work in order to supply the needs of its training programmes in accordance with the rapid advance in knowledge, develop in those programmes the skills needed by society in general and the world of work in particular, create an entrepreneurial spirit and pave the way for professional and cultural mobility.

Such harmonization also implies that higher education must adapt its training structures and arrangements to the new needs or create new forms of teaching on the basis of criteria such as flexibility, employability, adaptation to a wide variety of contexts and topics, the principle of life-long training and the internationalization of training. The task is therefore to change from a paradigm centred on teaching and the transmission of knowledge to one centred on learning and the development of transferable skills in differing space and time contexts.

A wide range of approaches and schemes will therefore be necessary: modularization together with a precise definition of the initial skills demanded and the skills required on graduation, capitalization, allowance for life experience, networking of training courses, diversification of subjects with greater use of short professional courses, establishment of 'bridges' between training courses, use of common differentiated standards, accreditation and recognition of qualifications, distance learning, types of supervision based on decentralization or the use of IT, diversification of institutions and courses, work experience.

These changes entail several levels of cooperation:

1. Cooperation with the world of work (production, service and creative enterprises, including the SMEs and the community service arrangements which are generating an increasing number of jobs) by jointly defining relevant training policies, collaborating and exchanging resources for certain training modules, supplying expertise, taking part in studies of the labour market and changes in needs, evaluating alternative scenarios, seeking out and developing new technologies or transferring knowledge and studying the social and ecological impact of certain choices;

2. Internal cooperation between higher-education institutions at both the national and regional levels according to the following principles: quality, effectiveness and efficiency requirements are such that not every institution can organize all training programmes or maintain research laboratories whose resources are quantitatively and qualitatively sufficient

in all sectors; the organization of distance-learning schemes increasingly means that a regional outlook must be cultivated for cost reasons and in order to strengthen integration policies;

3. Cooperation at international level based both on solidarity and respect for differences in order to provide a relevant and equitable answer to the challenges of globalization and internationalization; this implies a policy of quality which, when applied, will take into account the specific features of the contexts ('think globally and act locally'); provision of data bases in all countries, including the least developed; post-graduate and post-doctorate courses under international programmes and in collaboration with centres of excellence, with the dual aim of acquiring qualifications which are both of an extremely high level and applicable to the situation in the country of origin; cooperation policies which allow the developing countries to get something back from the benefits derived by the most developed countries from the brain drain; international-cooperation actions designed to eradicate crucial problems such as hunger, disease, illiteracy, environmental destruction, violence and marginalization.

This harmonization between the world of work and higher education is a two-way process: not only must changes in the world of work in a changing society compel higher education to make its training more relevant and to support development through its research, but higher education in its turn must urge the world of work to reform itself so as to promote sustainable human development and a culture of peace.

Higher education must discharge its duties of observation, consciousness-raising and anticipation in this context, too, by standing back and looking at society in the round. Here too, higher education must not simply provide training but must also produce citizens who are aware of their own individual surroundings and of the society of which they are members.

This is the context in which regional and international cultural cooperation must be visualized in order not only to preserve and disseminate the different heritages but also to create a culture of peace, conceived as a world which has been liberated from all conflict and enjoys evenly-distributed socio-economic prosperity, enriched by cultural diversity and a common concern to create a democratic society.

FROM VISION TO ACTION OF EDUCATION

Qualitative Evaluation:

• Quality in higher education is a multidimensional concept, which should embrace all its functions and activities: teaching and academic programmes, research and scholarship, staffing, students, buildings, facilities, equipment, services to the community and the academic environment. Internal self-evaluation and external review, conducted openly by independent specialists, if possible with international expertise,

are vital for enhancing quality. Independent national bodies should be established and comparative standards of quality, recognized at international level, should be defined. Due attention should be paid to specific institutional, national and regional contexts in order to take into account diversity and to avoid uniformity. Stakeholders should be an integral part of the institutional evaluation process.

- Quality also requires that higher education should be characterized by its international dimension: exchange of knowledge, interactive networking, mobility of teachers and students and international research projects, while taking into account the national cultural values and circumstances.

- To attain and sustain national, regional or international quality, certain components are particularly relevant, notably careful selection of staff and continuous staff development, in particular through the promotion of appropriate programmes for academic staff development, including teaching/learning methodology and mobility between countries, between higher education institutions and between higher education institutions and the world of work, as well as student mobility within and between countries. The new information technologies are an important tool in this process, owing to their impact on the acquisition of knowledge and know-how.

THE POTENTIAL AND THE CHALLENGE OF TECHNOLOGY

The rapid breakthroughs in new information and communication technologies will further change the way knowledge is developed, acquired and delivered. It is also important to note that the new technologies offer opportunities to innovate on course content and teaching methods and to widen access to higher learning.

However, it should be borne in mind that new information technology does not reduce the need for teachers but changes their role in relation to the learning process and that the continuous dialogue that converts information into knowledge and understanding becomes fundamental. Higher educational institutions should lead in drawing on the advantages and potential of new information and communication technologies, ensuring quality and maintaining high standards for education practices and outcomes in a spirit of openness, equity and international cooperation by:

- Engaging in networks, technology transfer, capacity-building, developing teaching materials and sharing experience of their application in teaching, training and research, making knowledge accessible to all.

- Creating new learning environments, ranging from distance education facilities to complete virtual higher education institutions and systems, capable of bridging distances and developing high-quality systems of education, thus serving social and economic advancement and democratization as well as other relevant priorities of society, while

ensuring that these virtual education facilities, based on regional, continental or global networks, function in a way that respects cultural and social identities.

- Noting that, in making full use of information and communication technology (ICT) for educational purposes, particular attention should be paid to removing the grave inequalities which exist among and also within the countries of the world with regard to access to new information and communication technologies and to the production of the corresponding resources.

- Adapting ICT to national, regional and local needs and securing technical, educational, management and institutional systems to sustain it.

- Facilitating, through international cooperation, the identification of the objectives and interests of all countries, particularly the developing countries, equitable access and the strengthening of infrastructures in this field and the dissemination of such technology throughout the society.

- Closely following the evolution of the 'knowledge society' in order to ensure high quality and equitable regulations for access to prevail.

- Taking the new possibilities created by the use of ICTs into account, while realizing that it is, above all, institutions of higher education that are using ICTs in order to modernize their work and not ICTs transforming institutions of higher education from real to virtual institutions.

Strengthening higher education management and financing:
- The management and financing of higher education require the development of appropriate planning and policy-analysis capacities and strategies, based on partnerships established between higher education institutions and state and national planning and coordination bodies, so as to secure appropriately streamlined management and the cost-effective use of resources. Higher education institutions should adopt forward-looking management practices that respond to the needs of their environments. Managers in higher education must be responsive, competent and able to evaluate regularly, by internal and external mechanisms, the effectiveness of procedures and administrative rules.

- Higher education institutions must be given autonomy to manage their internal affairs, but with this autonomy must come clear and transparent accountability to the government, parliament, students and the wider society.

- The ultimate goal of management should be to enhance the institutional mission by ensuring high-quality teaching, training and research and services to the community. This objective requires governance that combines social vision, including understanding of global issues, with efficient managerial skills. Leadership in higher education is thus a

major social responsibility and can be significantly strengthened through dialogue with all stakeholders, especially teachers and students, in higher education. The participation of teaching faculty in the governing bodies of higher education institutions should be taken into account, within the framework of current institutional arrangements, bearing in mind the need to keep the size of these bodies within reasonable bounds.

• The promotion of North-South cooperation to ensure the necessary financing for strengthening higher education in the developing countries is essential.

FROM 'BRAIN DRAIN' TO 'BRAIN GAIN'

The 'brain drain' has yet to be stemmed, since it continues to deprive the developing countries and those in transition, of the high-level expertise necessary to accelerate their socio-economic progress. International cooperation schemes should be based on long-term partnerships between institutions in the South and the North and also promote South-South cooperation. Priority should be given to training programmes in the developing countries, in centres of excellence forming regional and international networks, with short periods of specialized and intensive study abroad.

Consideration should be given to creating an environment conducive to attracting and retaining skilled human capital, either through national policies or international arrangements to facilitate the return—permanent or temporary—of highly trained scholars and researchers to their countries of origin. At the same time, efforts must be directed towards a process of 'brain gain' through collaboration programmes that, by virtue of their international dimension, enhance the building and strengthening of institutions and facilitate full use of endogenous capacities.

Experience gained through the UNITWIN/UNESCO Chairs Programme and the principles enshrined in the regional conventions on the recognition of degrees and diplomas in higher education are of particular importance in this respect.

Partnership and Alliances

Partnership and alliances amongst stakeholders—national and institutional policy-makers, teaching and related staff, researchers and students and administrative and technical personnel in institutions of higher education, the world of work, community groups—is a powerful force in managing change. Also, non-governmental organizations are key actors in this process. Henceforth, partnership, based on common interest, mutual respect and credibility, should be a prime matrix for renewal in higher education.

We, the participants in the World Conference on Higher Education, adopt this Declaration and reaffirm the right of all people to education and the right of access to higher education based on individual merit and capacity. We pledge to act together within the frame of our individual and collective responsibilities,

by taking all necessary measures in order to realize the principles concerning higher education contained in the Universal Declaration of Human Rights and in the Convention against Discrimination in Education.

We solemnly reaffirm our commitment to peace. To that end, we are determined to accord high priority to education for peace and to participate in the celebration of the International Year for the Culture of Peace in the year 2000. We adopt, therefore, this World Declaration on Higher Education for the Twenty-First Century: Vision and Action. To achieve the goals set forth in this Declaration and, in particular, for immediate action, we agree on the following Framework for Priority Action for Change and Development of Higher Education.

FINANCING OF HIGHER EDUCATION AS A PUBLIC SERVICE

The funding of higher education requires both public and private resources. The role of the state remains essential in this regard.

- The diversification of funding sources reflects the support that society provides to higher education and must be further strengthened to ensure the development of higher education, increase its efficiency and maintain its quality and relevance. Public support for higher education and research remains essential to ensure a balanced achievement of educational and social missions.
- Society as a whole must support education at all levels, including higher education, given its role in promoting sustainable economic, social and cultural development. Mobilization for this purpose depends on public awareness and involvement of the public and private sectors of the economy, parliaments, the media, governmental and non-governmental organizations, students as well as institutions, families and all the social actors involved with higher education.

Sharing knowledge and know-how across borders and continents:

- The principle of solidarity and true partnership amongst higher education institutions worldwide is crucial for education and training in all fields that encourage an understanding of global issues, the role of democratic governance and skilled human resources in their resolution and the need for living together with different cultures and values. The practice of multilingualism, faculty and student exchange programmes and institutional linkage to promote intellectual and scientific cooperation should be an integral part of all higher education systems.
- The principles of international cooperation based on solidarity, recognition and mutual support, true partnership that equitably serves the interests of the partners and the value of sharing knowledge and know-how across borders should govern relationships among higher education institutions in both developed and developing countries and should benefit the least developed countries in particular. Consideration should be given to the

need for safeguarding higher education institutional capacities in regions suffering from conflict or natural disasters. Consequently, an international dimension should permeate the curriculum and the teaching and learning processes.

• Regional and international normative instruments for the recognition of studies should be ratified and implemented, including certification of the skills, competences and abilities of graduates, making it easier for students to change courses, in order to facilitate mobility within and between national systems.

5

Privatisation of Higher Education

The new trends of thinking and overall constraint in resources call for private initiative and community support. In the Indian mixed economy, while the contribution of private sector has been significant in general, its contribution to higher education has not been encouraging. While until now there is no formal private university in India, there are a large number of private colleges in the general and technical education spheres.

Private colleges that form about three-fourths of the total number of colleges, are of two types: privately managed but publicly funded colleges familiarly known as (government) "aided" colleges and privately managed and funded colleges, known as "unaided" colleges.

A substantial number of private colleges belong to the former category and they receive government aid to meet almost the whole recurrent expenditure. The private aided colleges have not contributed significantly to easing the financial burden of the government, as more than 95 per cent of the recurring expenditure and sometimes even the capital expenditure, is met by public exchequer. Hence strictly from the point of view of finances, such private colleges do not have any significant role.

Pure or "unaided" private colleges do provide financial relief to the government in providing higher education, but at huge and long-term economic and non-economic cost to the society. Such institutions have been really a recent phenomenon. They are the result of private enterprise and initiative. In the very recent period, growth of private engineering and medical colleges has been remarkable. They charge donations and capitation fees. While other colleges are, by definition, non-profit institutions, many of these institutions not merely

cover their costs, but also make profits, which are not necessarily reinvested in education. The government wants to encourage private initiatives in higher education but not commercialisation.

NEW APPROACHES AND TOPICS IN HIGHER EDUCATION

Genuinely interdisciplinary research spawns the new disciplines of tomorrow and is more likely to be relevant to industrial opportunities and the resolution of industrial or societal problems. One challenge is how to stimulate interdisciplinary research pro-actively when institutions are normally organised on discipline-based departments and when much external evaluation reinforces this, by itself reviewing disciplines and implicitly discouraging interdisciplinary connections The rigid disciplinary boundaries between the hard sciences and the social sciences and the humanities that limited the comprehension of the fundamental processes of nature and society are already breaking down in some fields.

There must be a stimulus to the creation of interdisciplinary programmes and resources must be ensured for collaborative research among different disciplines and involving groups around thematic projects A further issue is the extent to which higher education institutions perceive themselves as having the optimum range of disciplines for their likely future needs. An individual institution may seek solution to its problem through strategic alliances with other institutions or with companies, through amalgamation with other institutions, or by growing its new specialisms itself. Many experts see the need for renewal of teaching and learning approaches and contents. They emphasise that higher education institutions must be more responsive in meeting the needs of employers and adapting to the generation of new knowledge in the various academic disciplines It is important and urgent to carry out a series of case studies in the different regions on regional priorities, in which higher education institutions should play an important role.

The exercise prepared by the CRE for the Palermo European Regional Meeting with 20 institutional case studies from European higher education institutions is worthwhile looking into. In the case of Africa, case studies proposed in the Action Plan (1997) include: the type of leadership to be promoted, strategic management and planning, systemic interactions between primary, secondary, tertiary and continuing education, revision of programmes of education and training, the relative importance and feasibility of face-to-face and distance teaching programmes, strategies for ensuring improved participation of women in education and in decision making bodies, town and country planning, measures against the security problems of Africa (such as poverty, displaced populations, the trauma of war).

In connection with relevance, the Action Plan for Latin America proposes to elaborate projects on the problems of widening access to higher education, design of integrated educational systems and life-long education for all throughout life.

Appropriate emphasis needs to be placed on renewal of curriculum; new approaches to both classroom and distance education curriculum, which traditionally focused on academic disciplines in arts and sciences and training for elite professions, now put considerable emphasis on applied science and technology, business and management studies and professional training in such fields as engineering, accounting and computer science Frequently new programmes are begun within the framework of the international UNITWIN/ UNESCO Chairs and form students on different subjects, such as the resolution of conflicts, regional development and the social integration of marginalised groups, including refugees who constitute a grave problem in the African region.

These formal initiatives must be complemented by community sensitivity activities such as public conferences and the creation of relevant groups such as those of NGOs and diplomatic and cooperation staff.

To overcome the limitations of higher education institutions, in the European university case studies some strategic issues and tensions as well as directions for action are proposed:

- Limited development of new fields of multi-disciplinary study from the stimulation of synergy between existing foci (Basel: ecological studies), especially where these correspond to market opportunities. This is seen as a means of sustaining critical masses in key subject areas.
- The addition of new disciplines perceived as critical to the university's contribution to society -a form of horizontal diversification (Jagiellonian University of Cracow, University College of South Stockholm).
- Accessing wider learning networks, through strategic alliances with other universities with complementary disciplines (Catalonia) or extensive use of Internet arrangements (Copenhagen Business School).
- The possibility of institutional mergers over the next decade to facilitate the creation of critical mass, as a natural regional consequence of the foregoing. The Australian experience has already been mentioned above.
- Accessing the knowledge base of industry, especially where professional/ vocational training is a core element in institutional mission (Pau, Porto, Sheffield Hallam).

ADVANCEMENT OF KNOWLEDGE BY RESEARCH

To fulfil its mission to society, ideally every system of higher education should have the capacity to carry out research and have staff who are actively involved in research activities. At a minimum, this is desirable to support regular teaching activities and the staff development needs of academics, as well as to provide expertise in accessing the international body of research knowledge and assisting in technology transfer to local industry. At the same time, in many countries it is now recognised widely that not all higher education institutions need to be involved in research and not all academics need to be undertaking research

activities on a regular basis in order to provide high quality teaching, especially at more junior levels. The World Bank has advised developing and newly industrialised countries, in the interests of economic efficiency, to strictly limit the establishment of new research universities and the number of students enrolled in them and to provide cheaper and more cost effective alternatives, such as junior colleges, technological institutes and short cycle institutions, to cater for a large proportion of the student population. Because of pressures on resources, in some countries research funding has been reduced over the past decade, but in others research funding has increased appreciably and special efforts have been made to establish new research centres and build additional links between universities and industry.

A major policy dilemma for higher education systems and research universities is how scarce research resources should be distributed and what mechanisms should be employed to do this. A common trend is the allocation of research funds to institutions and individuals on a competitive basis depending on the research funds they have already attracted, publication output and the number of research higher degree completions. There is a policy debate about whether research and research infrastructure funds should be concentrated to a greater degree in order to develop a small group of stronger internationally recognised research universities, or whether the current method of competition will ensure a sufficient degree of concentration. Another policy dilemma relates to the balance between basic and applied research. While effective applied research needs to be supported by basic research, the actual mix of basic and applied within a higher education system varies greatly, depending on government and institutional priorities and the respective roles in research of higher education and industry within the country. In China, the policy of the State Education Commission is 'that scientific research should be oriented to the economy, that training people and developing science and technology should be combined and complement each other and that different types of institutions should conduct scientific and technical activities in different ways'. It seems that there is a growing feeling that the distinction between basic, strategic and applied research is breaking down in the higher education institution which is genuinely oriented towards economic regeneration and societal modernisation. How this synthesis is accelerated and planned for is a genuine agenda item for the next century?

There is an exponential growth in knowledge, with very little direct contribution from some regions, among them the African region, as a consequence of insufficient attention to and insufficient resources for research, as well as lack of a long-term vision in the planning and management of teaching and research activities. Institutions of higher education in Africa should make special efforts to develop scientific and technological programmes to help meet the demands of the accelerated development of new technologies, especially new information and communication technologies.

These programmes should be supported by intensive research activities, from which will emerge the critical mass of the expertise needed for the region's

development as it faces the pressures of globalisation. Existing potentials of information and communications technologies should be boosted to give rise to virtual universities, which could considerably improve access, while at the same time proving world-class educational resources. Research should be made to bear a closer relation to the needs of African societies, so that basic research can be more closely linked with applied and development-oriented research stressing genuine partnerships with public and private institutions and the civil society. This would be one way of ensuring the active involvement of higher institutions in societal development efforts.

Responsibilities to Other Educational Levels

One area where there is consensus that universities can make a major contribution that will have direct benefits in the longer term for higher education is direct involvement in the training of school teachers and staff development activities for teachers. The University of Campinas in Brazil is a good example of this, with a large responsibility in teacher training at the national level parallel to its concentration on research. Strengthening the quality of teaching in schools will lead in time to better prepared university students, who can become agents of their own education; promoting socio-educational research into such problems as early school drop-outs and students' repeating courses; and ensuring its contribution to the design of State policies in the field of education.

It is widely recognised that higher education has an important contribution to make in community service and in assisting other education sectors in society. However, in some contexts there is some measure of disappointment with performance, especially with that of more traditional universities. This is unfortunate, since close links with the community and the other education sectors can do a great deal for universities in building wide community and political support, achieving renewal of the curriculum and sometimes generating new forms of financial support. The last point is particularly important since in the current environment of financial constraint there is often a strong tendency for universities to decrease or abandon much of their more traditional community service.

GROWTH IN EXPENDITURE ON HIGHER EDUCATION

Higher education in India is in financial stress. However, it should be noted that huge investments have been made in higher education in independent India. Total expenditure on higher education has increased remarkably during the post-independence period. At the inception of planning in the country (1950-51), India was spending ₹ 172 million on higher education. Government expenditure alone was of the order of ₹ 42,035 million in 1996-97 and it has risen further during the subsequent period. This impressive growth is, however, considerably offset by increase in prices and increase in population, more particularly student numbers in higher education. Inflation has had an adverse effect on education.

Nevertheless, on the whole, the trends suggest that higher education had a good start during the 1950's (with real growth of 7.5 per cent per annum) and had its golden days during the 1960's, with the real expenditure increasing at an annual rate of growth of 11 per cent; but it suffered significantly during the 1970's, with the rate of growth coming down to a meagre 3.4 per cent as educational planners aimed at consolidation of higher education instead of its rapid expansion; and showed some tendencies to recover during the 1980s. Though the growth in expenditure on higher education has been erratic during the 1980's, it had increased on the whole at a rate of growth of 7.3 per cent per annum. The 1990s heralded an era of austerity and higher education suffered greatly.

SHARE OF HIGHER EDUCATION

The relative priority accorded to higher education can be measured in terms of the share of higher education in GNP. Starting from a very low figure of 0.19 per cent of GNP invested in higher education in 1950-51, the share of higher education increased five-fold by 1980-81; but it came down to nearly one per cent of GNP after three decades of development. But ever since, allocation of resources has been steadily coming down: it tended to decline to 0.4 per cent of GNP by mid 1990s.

India has adopted Five Year Plans as an important development strategy since 1950. The Five Year Plans set new directions for development—quantitative expansion, improvement in quality and relating to several other dimensions of education development—and represent the serious intention of the planners to further develop the system.

The share of higher education doubled in the total education outlay from 9 per cent in the first Five Year Plan to 18 per cent in the second Five Year Plan and increased to an all time peak of 25 per cent in the fourth Five Year Plan and ever since it has been consistently declining and was about 15 per cent in the seventh Five Year Plan. The share of higher education in the total education outlay in the eighth Five Year Plan was estimated to be 8 per cent.

In case of education, including higher education, plan expenditures are of relatively small size and huge amounts are incurred as 'non-plan expenditures', *i.e.*, for the maintenance of the gigantic system, recognised as the second largest system in the world. In the total expenditure on education, the share of higher education was less than one-fifth in 1950-51, it increased to about a quarter by 1955-56 and became stable around one-fourth, suggesting that the relative importance given to higher education in the total education system remained unchanged since the beginning of the second Five Year Plan up to the sixth Five Year Plan, though there had been marginal increases during this period. But the situation has changed considerably from the seventh Five Year Plan onwards. Devaluation and the accompanying price rise, has led to an enormous increase in prices of books and journals; and as a result, many universities have had to inflict very serious cuts on their library budgets.

SOURCES OF FUNDS

The various sources of finances for higher education in India are: (a) government sector— central government and state government; and (b) Non-governmental sector— students/parents (or families), *e.g.,* fees and other maintenance expenditure and the rest of the community at large, *e.g.,* donations and endowments. The relative shares of various sources in 'total' expenditure on higher education in India have changed considerably over the years. The share of the government has increased in financing higher education and correspondingly that of every other source, *viz.,* student fees, community contributions and other internal sources declined steeply, though in absolute money terms there has been a significant increase in the contribution of these sources as well. The share of government (central and state) increased from 49 per cent in 1950-51 to 76 per cent in 1986-87.

And the share of the non-governmental sector declined remarkably. Students' contributions in the form of fees used to form more than one-third of the total until the beginning of the 1960s; its relative share declined to less than half of what it was in 1950-51. The share of "other" sources (including voluntary donations, endowments, *etc.*) also declined, though the decline is not as sharp as the decline in the share of the fees. Non-governmental finances (fees and others) accounted for one-fourth of the total. Thus, higher education in India is characterised by massive public investment, though the investment is still regarded as much below optimum. Such a rapid growth in public financing of higher education in India has been necessary for the following reasons:

- Facilities for higher education available at the time of independence were insignificant. Independence had created an abnormal increase in the social demand for higher education and public expenditure has had to cope with the demand.
- Building up a new socio-economic system after the end of the colonial rule required large scale manpower with varied skills; so the government had to expand investment in higher education.
- The very development models emphasised high skilled labour force and building up of huge social infrastructure for excellence in science and technology and research and development.
- Government policies towards equality in education led to the growth in public investment in education, since it involves huge subsidies at all levels of education to a substantial number of students, belonging to weaker sections.
- The rapid growth of school education naturally pushed the demand for higher education.

Recently, efforts are being made to mobilise resources and it has been recommended that while the government should make a firm commitment of funding higher education, colleges and universities should also make efforts to raise their own resources.

MEASURES FOR FINANCIAL SELF-RELIANCE

Nowadays with declining or stagnant budgets for education, specifically for higher education, institutions of higher education increasingly feel the need to become financially self-reliant by generating resources not only through increase in fees, but also through other measures, such as augmentation of resources from corporate sector in the form of donations and other similar contributions, by forging effective relationships with industry. The government has already promised incentives both to the institutions and to the individual donors. The institutions that generate such resources are promised matching grants by the government, besides stating that such resources would not be taken into account in giving bulk/maintenance grants. The donors are offered fiscal incentives in income tax savings (tax deduction at the rate of 125 per cent of the contributions to professional institutions and 100 per cent to other institutions of education).

It is, however, recognised that none of these measures for mobilisation of additional resources should aim at reducing the demand for higher education.

NEW CHALLENGES OF GLOBAL SCENARIO

India recognises that the new global scenario poses unprecedented challenges for the higher education system. The University Grants Commission has appropriately stated that a whole range of skills will be demanded from the graduates of humanities, social sciences, natural sciences and commerce, as well as from the various professional disciplines such as agriculture, law, management, medicine or engineering. India can no longer continue the model of general education as it has been persisting in for the large bulk of the student population. Rather, it requires a major investment to make human resource productive by coupling the older general disciplines of humanities, social sciences, natural sciences and commerce to their applications in the new economy and having adequate field based experience to enhance knowledge with skills and develop appropriate attitudes.

Responding to these emerging needs, the UGC stated: "The university has a crucial role to play in promoting social change. It must make an impact on the community if it is to retain its legitimacy and gain public support". It seeks to do so by a new emphasis on community based programmes and work on social issues. Concepts of access, equity, relevance and quality can be operationalised only if the system is both effective and efficient. Hence, the management of higher education and the total networking of the system for effective management, has become an important issue. The shift can occur only through a systemic approach to change as also the development of its human resource and networking the system through information and communication technology.

The decline in public funding in the last two plan periods has resulted in serious effects on standards due to increasing costs on non-salary items and emoluments of staff, on the one hand and declining resources, on the other. Effective measures will have to be adopted to mobilize resources for higher education. There is also a need to relate the fee structure to the student's capacity

to pay for the cost, so that, students at lower economic levels can be given highly subsidised and fully subsidised education. The Ninth Plan policy imperatives will focus on (a) access and equity; (b) relevance and quality of education; (c) universities and social change; (d) the delivery systems, the institutional and organisational structures and management; and (e) funding which constitutes the necessary resource underpinning for development.

Emphasis has to be laid on curriculum change; interdisciplinary courses gradually replacing discipline oriented learning, especially at the master's degree level; greater emphasis on field based learning experiences for students both in undergraduate and postgraduate programmes; more career oriented courses and response to local needs for human resource in specific work-related opportunities.

The university is required to be seen not only as a seat of learning and new knowledge through its research and extension functions but also as a focal point for the dissemination of information to the community through continuing education, extension education and through field outreach activities. It will have a major role to play in directly impacting on the community for social development and change. It should be facilitated in this task which is described by the UGC as the third dimension of education.

As universities abandon their isolationist existence and increasingly interact with other segments of society, there is a need for them to adopt a more professional management. This includes opting for a new type of leadership capable of interfacing with user and other groups in society and at the same time, capable of providing academic and administrative leadership within a decentralised system of administration and making increased use of information technology. The above implies that there will be greater interaction with the user community of both employers and the public to create relevant programmes, to develop greater autonomy in a decentralised structure and to develop a professional management system which has autonomy as well as accountability and maximising the use of information technology for both effective and efficient management.

As a very small proportion of the relevant age group (around 6 per cent) is enrolled in higher education in India, compared to the developed countries (about 40 per cent) with which the country is going to engage itself in the international market, efforts will need to be directed towards raising the enrolment in higher education sector and meeting the increasing costs of such enrolment. Access means costs but access cannot be overlooked when the base is narrow, not in absolute numbers but in the percentage of the educated in the country's structure. We have to acknowledge the need to prepare a human resource capable of accepting the challenges of the new millennium.

We have also to realise that social changes and transformation can only be brought about by people and not through technology alone which itself is a product of human endeavour. Hence, human resource development, at all levels, needs to be given priority and made a part of the nation's overall strategy.

International Cooperation

Universities in India have been a primary conduit for the advancement and transmission of knowledge through traditional functions such as research, innovation, teaching, human resource development and continuing education. International cooperation is gaining importance as yet another function. With the increased development of transport and communication, the global village is witnessing a growing emphasis on international cooperation and action to find satisfactory solutions to problems that have global dimensions, and, higher education is one of them. India has been in the forefront to adopt the new 'information society' technologies such as distance education and the internet to forestall the further widening of the gap between itself and the advanced countries. International cooperation in education is seen in this context of partnership — rather than aid — where countries assist each other by sharing their successful experiences, technologies, material and financial resources and learning to appreciate each other's cultural heritage. International cooperation has also been an important focus area in promoting the ideals and objectives of higher education. The Indian National Commission for Cooperation with UNESCO (INC), set up in 1949, is an apex advisory, executive, liaison, information and coordinating body at the national level. INC has been playing an active role in UNESCO's work, particularly in the formulation and execution of its programme in collaboration with the UNESCO Secretariat as well as the National Commissions of Asia and the Pacific Region.

India contributes to the activities of UNESCO and its Regional Offices through participation in numerous workshops, symposia and conferences, by assisting in the organisation of national, regional and inter-regional activities in India in areas of competence of UNESCO, arranging participation of Indian experts in UNESCO's activities, formulating projects under the Participation Programme of UNESCO and administration of UNESCO Coupons Scheme. India is a member of the Executive Board of UNESCO. Public information activities relating to UNESCO are supported in the form of publication of Hindi and Tamil editions of the Courier, a UNESCO periodical.

So far, nine UNESCO Chairs have been set up in India in diverse areas such as cultural development, eco-technology, science education, peace, human rights and democracy, energy, small industries and teacher education. Proposals for setting up UNESCO Chairs in social economics, biotechnology, social anthropology, medicinal plants and cultural identities are under consideration.

The UNITWIN/UNESCO Chairs Programme was launched by UNESCO in 1991 as an international action plan and movement for academic solidarity to strengthen inter-university cooperation, with particular emphasis on support to higher education in the developing countries. The programme aims at establishing and reinforcing strong and durable links amongst higher education and scientific institutions worldwide.

The programme has the following goals:
- To give fresh impetus and a global dimension to twinning and other linking arrangements between higher education institutions in the industrialised and developing countries;
- To reinforce existing sub-regional and inter-regional cooperation networks of higher education and research institutions and to establish new networks, whenever there is a perceived need;
- To develop centres of excellence for specialised studies and advanced research, with international support;
- To alleviate the consequences of the brain drain.

The programme focuses on graduate studies and research and places particular emphasis on developing strategies and mechanisms for the rapid and efficient transfer of knowledge and for its application to specific national and local conditions and needs.

The INC operates the UNESCO International Coupon Programme which assists individuals and institutions working in the fields of education, science, culture and communication to import their bonafide requirement of educational publications, scientific equipment, educational films, *etc.,* from abroad without undergoing the foreign exchange and import control formalities.

The Department of Education in the Ministry of Human Resource Development has also built relations with other international organisations such as the Commonwealth Secretariat, Commonwealth of Learning, SAARC, UN Organisations and NAM and Shastri Indo-Canadian Institute, *etc.* The External Academic Unit of the Department handles policy matters to promote India's external academic relations with more than 97 countries with whom India has bilateral Cultural Exchange Programmes (CEPs) and other collaborative arrangements and monitoring of the educational component of the bilateral and collaborative programmes with other countries. The INC has been closely associated with the work of the Delors Commission on Education for the 21st Century.

The Report of the Commission, *Learning: The Treasure Within*, has been reprinted by the INC for wider dissemination. A national debate is envisaged on the recommendations of the Report. A two-member delegation of the Department also attended the Conference on Education for the 21st Century in the Asia-Pacific Region, held at Melbourne from 30 March to 3 April, 1998.

The Bilateral Exchange Programmes connected with the university sector, between India and other countries, are implemented by the UGC on behalf of the Government of India. In 1996-97, such programmes had been initiated with 70 countries. Development of bilateral linkages in specific areas between identified departments of universities and institutions of higher education have been given greater emphasis.

The UGC provides foreign language teachers to universities having a proper infrastructure for teaching foreign languages under the Collaborative Exchange Programmes. In 1996-97, 32 foreign teachers in German, French, Chinese,

Portuguese, Spanish, Hungarian, Mongolian, Iranian, Russian, Polish, Rumanian, Pushto and Korean were assigned to various universities in India. Several scholarships and fellowships have been instituted in Indian universities with the support of the German and French governments. The UGC also implements the scheme of SAARC Chairs/Fellowships/Scholarships.

An Academic Link Interchange Scheme is being implemented in collaboration with the British Council for the development of linkages between institutions in higher education in India and the UK, in specific areas such as joint research, joint publication, curriculum development and so on. Under the Commonwealth Academic Staff Fellowships/Scholarships programme, the UGC coordinates with the Association of Commonwealth Universities (ACU) in UK and makes nominations for the award of Commonwealth fellowships and scholarships to enable promising faculty members in universities and colleges in India to do research work at the universities/institutions in the UK.

Proposals from 13 Universities for undertaking the Canadian Studies programme have been approved by the UGC. Financial support is being provided to these universities, at various levels, for undertaking studies relating to the historical, social, economic and political aspects of Canada. Travel grants are provided by the UGC for teachers who have offers of fellowships/stipends for foreign countries for collection of source material for their research work.

Vision and Tasks Ahead

Towards a New Synthesis: India realizes, like other nations of the world, that humanity stands today at the head of a new age of a large synthesis of knowledge and that the East and the West have to collaborate in bringing about concerted action for universal upliftment and lasting peace and unity.

In this new age, great cultural achievements of the past have to be recovered and enriched in the context of the contemporary advancement so that humanity can successfully meet the evolutionary and revolutionary challenges and bring about a new type of humanity and society marked by integrated powers of physical, emotional, dynamic, intellectual, ethical, aesthetic and spiritual potentialities.

Frontiers of knowledge are, therefore, bound to expand unimaginably and new researches will oblige humanities, sciences, technologies and fine arts to arrive at new equations and new combinations.

Operation Knowledge: India has already decided to launch "Operation Knowledge" as a part of the Information Technology Action Plan. This will mean not only continuous expansion and improvement of the facilities of modern equipment but also a gigantic task to redesign teaching-learning materials in every discipline appropriate to the special demands of the new technologies and media of transmission and new teacher-pupil relations.

Determining New Objectives: A most difficult task ahead is to conceive certain new objectives of higher education. It will not be enough to promote specialized knowledge and skills of professional excellence; a deeper and subtler aim will

be to develop abilities to think globally and to resolve emerging tensions between rationalistic, ethical, aesthetic and spiritual elements of personality. The objective of a complete education for a complete human being will need to be underlined as of highest importance.

Need for Vast Changes: All these factors will impel higher education to undergo vast changes in respect of objectives, contents and methods. It will have to bear momentous responsibilities for generating new vistas of knowledge and wisdom, bolder forms of courage and heroism, unprecedented arts of harmony and beauty and unimaginable skills suited to developing technologies and crafts. It will also be required to set more exacting standards of excellence and perfection.

Coming of Information Age: The world is entering into an Information Age and developments in communication, information and technology will open up new and cost-effective approaches for providing the reach of higher education to the youth as well as to those who need continuing education for meeting the demands of explosion of information, fast-changing nature of occupations and life-long education.

Sovereignty of Young People: We also feel called upon to encourage and support the forces and developments relating to the learning society and to the theme of the sovereignty of learners, particularly young people.

Designing New Contents: Another major task will be to change the contents of higher education. Appropriate courses have to be designed so as to achieve a proper blending of wide general knowledge and such specialization, which would have inbuilt facilities to renew relevant knowledge and skills at increasingly shorter intervals and even on a continuous basis. Increasing freedom of choice in selecting subjects of studies has to be ensured and interdisciplinary studies will have to be so devised that they will foster understanding and appreciation of national history in the context of the goal of multi-cultural understanding and of creating in the world a harmonious human family, appropriate to the ancient Indian ideal of "Vasudhaiva Kutumbakam".

Student-Centred Education and Dynamic Methods: Methods of higher education also have to be appropriate to the needs of learning to learn, learning to do, learning to be and learning to become. Student-centred education and employment of dynamic methods of education will require from teachers new attitudes and new skills. Methods of teaching through lectures will have to subordinated to the methods that will lay stress on self-study, personal consultation between teachers and pupils and dynamic sessions of seminars and workshops. Methods of distance education will have to be employed on a vast scale.

Teachers – New Dimensions of their Role: Special emphasis on value-oriented education will impart a new dimension to the role of the teacher. For value-orientation cannot be imparted without teachers' own value-orientation. Again, the objective of integral development of personality cannot be fulfilled without teachers developing their own integral personality.

It is increasingly recognized that if the defences of peace are to be built in the minds of men and women and if the qualities of cooperation, mutuality and harmony are to be fostered in humanity, the role of the teacher will include the task of changing the tendencies of egoism and domination that are the ultimate causes of division and war. It is particularly for this reason that a new programme of teaches' training has to be envisaged and this programme will not only cater to the continuous development of professional skills but also continuous development of teachers' ethical and spiritual abilities. Appropriate to the new and difficult demands on teachers, we have to constantly raise the status of teachers in the country.

Major Changes in System of Governance: Our present system of governance of higher education is undergoing increasing strain and sooner rather than later, major changes will have to be effected not only to ensure greater autonomy and accountability but also to facilitate rapid changes in the very framework, directions and goals.

Greater Investment: Financial strain in the educational sector imposes several difficult tasks not only relating to fee structure and new partnership of education with industry and various income and profit generating sectors but also to the cost-effective designs of structures and methodologies of education that can cater to the needs of massive programmes of education as also to those of intensive education that aim at individual perfection. The advances in communication technology, specially the satellite based teleconferencing, have made it possible to use distance education for training skills in virtual classrooms. It is expected that technology, rightly designed for developing deeper and higher dimensions of personality, will at once bring down the costs and increase the efficiency of the educational system.

'I firmly believe in the efficacy of education as a panacea for our social evils.'

—*Dr. B. R. Ambedkar*

India's Realistic Optimism: India looks upon the future with realistic optimism, despite difficult challenges and worldwide crises through which humanity is passing today. We feel that major efforts are required to cross over the present transitional period, during which negative forces will try to outweigh the positive forces. But considering the vast ethical and spiritual potentialities that lie really untapped, we can trust that humanity will overcome the crisis and emerge stronger to create a new world of harmony and unity. But in fulfilling this hope, education will have to play a crucial role.

Considering also that future advances in research will affect the theme of higher knowledge centrally, the country is getting ready to strengthen the system of higher education and to adopt strategies that will provide new dimensions to the delivery system that will help change society and prepare young people to shoulder the heavy responsibilities of a difficult but fascinating future.

Wider Access: India recognizes that access to higher education will have to be so broad-based that the system of open universities has to continue to grow

and it will not only have to be extended vastly but also to be so designed that it can foster among students constant motivation to learn and to develop not only academic abilities but also practical skills and talents that are being demanded by the modern world.

National Testing Service: A major task ahead is to bring about radical changes in the system of examination. Methods of testing have to be so devised that not only will tests be rigorous but they will be so flexible and of varied nature so as to be appropriate to the demands of promoting various curricular and non-curricular abilities, physical fitness, artistic taste and value-orientation. In this context, National Testing Service needs to be established, the tests of which can be availed on voluntary basis by those who may need certification or admission for employment, irrespective of whether they hold prescribed degree or diploma. The new testing system should facilitate delinking of degrees from jobs and curricular reforms bringing in emphasis on multi-disciplinary courses. Such changes will also be a recognition of the sovereignty of the learner and of making education reality-oriented and learner-centred.

Towards a Learning Society: As we move towards a learning society, every human activity will require contributions from experts and this will place the entire sector of higher education in sharp focus. Although the priorities, which are being assigned today to the task of Education for All, will continue to be preponderant, the country will have to prepare itself to invest more and more on higher education and, simultaneously, measures will have to be taken to refine, diversify and upgrade higher education and research programmes.

CPD Benefits

CPD-benefits to patients:
- CPD increases the levels of protection to the patient by providing the framework for the maintenance of competence.
- CPD enhances the delivery of specialist services by enabling the acquisition of specialist skills.
- CPD improves the efficiency and effectiveness of health care delivery by maximizing the professional human resource.

CPD- Benefits to Employers

Investment in management development contributes directly to long term success, giving the organisation a vital competitive edge:
- CPD enhances employee competence and flexibility.
- CPD leads to improvements in efficiency, productivity and quality of work.
- CPD increase employee contribution to business performances through enhancement of quality and clinical standards.
- CPD lead to increased customer/client satisfaction. It produces employees who will continue to develop the knowledge, skills and expertise required responding to ever-increasing organisational and technological changes.
- CPD facilitates Health service accreditation.

CPD- Benefits to Employees:
- CPD provides a structured framework enabling the individual to make informed decisions about his/her own future.
- CPD encourages a higher standard of personal performance.
- The individuals career prospects are enhanced through increased competence.
- CPD offers increased job satisfaction through control of career direction and personal development.
- CPD offers an opportunity for personal career planning and development for promotion.
- Increased professional recognition and proof of commitment to learning and self development enhances the individuals professional status.
- CPD offers an opportunity to move ahead- and stay ahead; it is the means by which each individual maintains his/her own competitive edge.

The framework requires a commitment to undertake a minimum of 35 hours of CPD activity each year. The range of activities could include- research, post-qualification studies, short courses, distance learning, management development, conferences and seminars, web based learning, work-place based in-service learning, staff exchanges, counselling courses, formal publication in journals, language, communication and computer training, formal academic qualifications and reading programmes.

There is a proposal to initiate MRITPTI (Medical Radiation and Imaging Technology Professionals Training Institute) which will arrange short term training programmes in the above range of activities for Radiological sciences professionals to improve their competency, not only this but also for Physicians and Nurses and Hospital administrators in association with National professional society and associations in the country.

Now the question comes who is responsible for providing such continuing professional development (CPD) activities? Although primary responsibility should lie with the individual person, but the following must pursue such activities and if possible take the help of existing infrastructure in the country whereby professionals are invited to their hospitals, institutes and medical colleges to conduct short term programmes for their staff as continuing education activity of the institution for which budget must be allocated.

Providers of CPD could be:
1. Higher education institutions.
2. Professional societies and associations.
3. Companies that market and supply equipment.
4. The Employer and the workplace.

Strategies for Training through Distance Learning: Distance education systems have emerged the world over to meet the growing demand for education, including vocational and professional education, to provide opportunities at a comparative low cost and meet the continuing education needs of professionals.

The methodology of distance teaching-learning often involves multi-media approach to design, develop and implement independent learning programmes through self instructional materials, both in print and electronic media forms. Distance study allows or facilitates the learner to have control over their learning. With the advancement of Web based learning, many study modules could be downloaded from important web-sites and even students can write their exam on the net. The various media used for distance education delivery include among others, printed material, audio and video programmes, T.V programmes, tutoring and counselling, field visits, laboratory practical on the equipment, extended contact programmes and teleconferencing.

CHALLENGES AND ISSUES IN 21ST CENTURY

Today radiological sciences related professionals are in every nook and corner of this country, in rural as well as urban areas. Many professionals have done their basic qualification years back and have no way to increase their knowledge and gain newer experiences in the development of radiological sciences. Many do not get opportunity to even attend a professional conference in their lifetime. Employers exploit skilled work from untrained personnel. Many employers do not have any resource where they can send their employees to train and better equip.

Professionals have no way to improve their educational qualification and skills to upgrade themselves. Even though in a vast country like India all these difficulties exist, yet there is a way out if distance education and web based education is provided to interested radiological sciences personnel.

Educational bodies like *NCERT* and *PSSCIVE* must come forward in support of this strategy to reach out to the whole countries radiological community. *Universities must begin degree courses in association with hospitals and diagnostic centres with adequate facilities and workload.*

In conclusion it is worth noting that distance education and web based learning has tremendous potential for providing education and training programmes to different categories of radiological sciences professional all over the country even if they are working in remotest village and have access to Internet.

Continuing Professional Development (CPD) must become part of professionals activity wherein they complete the minimum set hours and improves on their Curriculum Vitae, which should help them for promotions and new jobs.

Even International bodies like *IOMP, ISRRT, RSNA* and *WHO* can play a great role in facilitating the achievement of national and institutional targets. The *Ministry of Human resource and Development (HRD) and the Ministry of Health and Family welfare and Indira Gandhi National Open University and Professional society and associations* must come forward and implement this strategy to fulfil the continuing educational needs of skilled radiological sciences community in our country.

IS ZERO-BASE BUDGETING FEASIBLE IN GOVERNMENT

THE UNION Finance Minister, in his budget speech last year, hinted at the introduction of zero-base-budgeting in Government. The Andhra Pradesh Governor's address to the Legislature recently refers to zero-base-budgeting prominently. A wag once quipped, "Governments in India have always been practising zero-base budgeting (ZBB)—for implementing many of the schemes announced, the resources available are zero! What we need is not a zero but a 100-base budget which would give total support to a scheme once it is in the budget." Jokes apart, the present article proposes to: Outline the basic logic of ZBB; explain the current motivation to try it; give the arguments for and against its introduction; and propose a realistic way forward.

Whenever any decision has to be taken in Government, the question that is asked is not, "Is it good or bad, right or wrong?", but "Has it been done before?" Governments are to a great extent precedent- bound. Studies of budget-making processes in many countries have shown that the single most important influence on the current year's budget is the previous year's budget.

This no doubt ensures a certain degree of continuity, consistency and predictability. But it may also blinker the government from perceiving the need for change or better alternatives. Balancing continuity and change is important in any budget-making. The widespread perception, however, is that government budgets are oriented excessively towards continuity and against any change other than cosmetic or marginal.

This perception could have arisen from one or more of the following facts:
  (i) Circumstances have changed since the currently funded activities were started and priorities now need to be reordered.
  (ii) Evaluation of some activities has shown their ineffectiveness and unsustainability.
  (iii) Better methods/strategies have since become available for achieving the objectives of currently funded activities.

ZBB is thus expected to be an antidote to the widely perceived status quoism in the government budgeting ethos.

In essence, ZBB consists of the following steps:
  • At present, an item entering a Government budget is as secure as an employee entering government service. Under ZBB, no item has an automatic, assured place in the budget. Every item has to be justified afresh even if it was included in last year's budget. That is to say, we start from a "zero base" or clean slate of items to be included in the budget every year. At present, previous year's items are automatically carried forward and then new items are included to the extent possible.
  • For every policy goal, several alternative strategies/programmes ("decision packages") are evolved and the best is chosen and included in the budget.
  • Policy goals are prioritised and resources are moved from low to high priority areas.

- In order to gauge each department's internal priorities, every year each department is asked to give three budget proposals:
  - One based on the same resource level as last year but with a different internal redistribution if considered necessary.
  - One based on the assumption that 10 per cent more resources would be available than last year.
  - One based on the assumption that 10 per cent less resources would be available than last year.
- Evaluation reports on currently funded items should accompany budget proposals.

Thus, by taking a fresh, open-minded hard look at the policies, programmes and the pattern of internal allocation of each department every year, ZBB seeks to align what is spent with what is most desirable and eliminate obsolescent, wasteful expenditure. ZBB had its heyday along with performance budgeting, planning-programming-budgeting and later, MBO. In most countries where it was tried, it had failed to take roots and either got ritualised or was given up quietly. Like most attention-grabbing management concepts, ZBB contains the germ of a basically sound idea. Overworking it and converting it into a cumbersome methodology may, however, create some problems.

We may first list out some of the advantages of using ZBB in government:
- ZBB compels the identification of well-entrenched, obsolete, wasteful and ineffective expenditure and shifts resources to high priority areas. Resource effectiveness and productivity are thus enhanced.
- ZBB provides a much-needed opportunity and systemic legitimacy to highlight populist, unsustainable activities and better alternatives to them.
- ZBB facilitates continuous alignment of resource deployment strategy with a fast-changing environment.
- In the event of an unexpected resource crunch, ZBB may serve as a rational method of rationing out scarce resources to the highest priority areas.
- Over a period, ZBB, hopefully, would improve the fiscal position of the government by improving returns on the one hand and eliminating waste on the other.
- ZBB would, hopefully, improve the financial credibility of Government and soften resistance to revenue-raising measures.

Possible problems connected with the implementation of ZBB in Government are:
- Every funded activity benefits some who would resist its being curtailed or abandoned, especially if jobs are likely to be lost. (The APVAN project of Mr. Chandrababu Naidu was bitterly opposed by all Staff Associations in spite of his assurance that no one would be retrenched.)
- Departments may reluctantly agree to an across-the-board cut on all departmental budgets. But they would oppose any cut in their budgets if the savings are going to be passed on to other departments.

- Allowing an existing activity to be curtailed or abandoned amounts to indirectly admitting that it was either wrongly chosen or badly implemented. Injured egos apart, this may result in audit objections or even an enquiry! New arguments will, therefore, be invented to justify all on-going activities.
- Abandoning or downsizing an activity half way through may result in the past expenditure and the created assets infructuous.
- In Government, budgets are often prepared based on insufficient data. It is doubtful whether the administration can produce in time every year the kind of qualitative evaluation of on-going activities and fruitful alternative decision packages that ZBB demands. Ultimately, therefore, haphazardly and hurriedly put together proposals may get into the budget just to show that ZBB is being practised.
- A zero-base review may be used by politicians to smuggle their pet schemes in place of good schemes initiated earlier by other governments.
- Too frequently reviews and the possibility of everything being changed resulting from ZBB, especially in matters of economic and industrial policy, may create a feeling of uncertainty among entrepreneurs. In an unpredictable, fast- changing business environment, entrepreneurs expect from government not perfection but a certain measure of stability in policies and continuity which they can build into their strategies. An overemphasis on ZBB or its inefficient implementation may dilute entrepreneurial optimism and the feel- good factor. (It may be recalled that Mr. V. P. Singh, as Finance Minister, wanted to announce a long-term fiscal and financial policy and broad budget parameters and stick to them so as to facilitate business planning.)
- The budget is primarily an accounting document indicating the sources and application of funds. Overloading it and overlaying it with other ideas like ZBB which belong to the substantive realm of management may make the budgeting exercise too complicated and time-consuming. (After a consultant explained the MBO methodology in detail, a manager asked, "If I do MBO, when do I do my job?" The same thing may happen with ZBB!)

When so much can be said on both sides, what does one do?

The following approach is suggested:

- A zero-base attitude is sound and indicates a receptive mind and a desire to improve. We should, therefore, retain the essence of the concept without creating a taxing, time-consuming methodology which a typical Government bureaucracy cannot master and execute.
- A zero-base review could be done flexibly in different ways. Instead of attempting an annual review of every scheme and a rearrangement of the entire budget at one go (which exceeds the present administrative capability), the following alternatives could be tried out:

- Initiate a thorough annual review of all schemes. Corrective action, however, would be completed at different points of time depending on the effort involved and not necessarily within the same financial year for all schemes.
- Review one or two major resource-guzzling activities every year and complete action within the same year.
- Activities and programmes could be reviewed at short intervals, strategies at medium intervals and goals and policies at longer intervals.

- A thorough evaluation of on-going activities is the basis of any productive review. Without quick, reliable evaluation mechanisms, ZBB will be a blind ritual and may even worsen things. (The Programme Evaluation Organisation of the Planning Commission used to be a high-profile body. Today, one does not even know whether it exists!)

- It is not enough if ZBB results in high priority activities replacing low priority ones. The former, after inclusion in the budget, must be given total support. If, in the expectation that even these may become a casualty in the next ZBB review, these are haltingly funded, then we will simply be changing the budget every year without changing the economy!

- The present practice of including proposals in the budget without a detailed appraisal and the Finance Ministry, under the guise of expenditure control, starts sitting in judgement over them only when release of funds is sought, must be replaced by a proper, pre-budget-inclusion appraisal. This will minimise axing under a ZBB review later.

- Floating a Green Budget based on ZBB to elicit the reaction of the public, the professionals and political leaders before finalising the actual official budget is an idea worth trying out. However rational the review and the budgeting processes may be, in an open, democratic society it takes time for the predominant public opinion to crystallise and the initial resistance to change the weaken. (When his APVAN project met with resistance in an election year, Mr. Naidu tactically withdrew, but soon after getting re-elected he is pushing it through.)

- Trying any new idea in Government has the risk of making the Government look foolish if it fails. On one side, the Government, therefore continues to claim success and on the other the Opposition tries to make political capital out of it. Officers may also be afraid of being made scapegoats of. The way out is to openly announce that a new idea (such as ZBB) is being tried out as a Pilot Project in a few departments. If the pilot project succeeds, it can be universalised and if it fails, it can be modified based on experience or given up without loss of face or creating a controversy. It is better that ZBB is first tried out as a Pilot Project in order for government to gain experience and a feel of what it involves.

A serious ZBB exercise is likely to lead to tough decisions like downsizing, reducing subsidies, increasing prices, outsourcing, privatisation and disinvestment. Such decisions call for strong leadership, total commitment and a politically stable tenure. Andhra Pradesh seems to enjoy all these advantages right now and we may expect its Chief Minister to achieve some measure of success in introducing some form of ZBB. As regards the Union Government, one is not all that optimistic, to put it mildly.

6

The Role of Computer Simulations in Teaching Learning Process

Over the last few years, there has been a great expansion in the computer-assisted methods of teaching and learning. The implementation of such methods into our physics course and laboratories has brought about very effective results. The reasons for our choice to incorporate these powerful computation tools into our courses and laboratories include its assistance to our students in acquiring a better strategy for learning physics, as a demonstration and study of physics concepts and phenomena, and to check results measured from experimental work. We have formulated our own methods of using computer simulations to study physics phenomena based on Adobe Flash CS3 software. Our set of computer simulations allows the students to grasp a deeper understanding of physics phenomena.

We present the set of computer simulations and describe the increase in the interest of students using them for a better success in understanding physical concepts. Also, as example we describe the computer simulation elaborated for the study of the thermal activation energy of intrinsic conduction for a semiconductor. By conducting a statistical survey of the number of functioning computer simulations implemented in our course and laboratories, we notice a rise in the participation of students using them. This suggests that we should encourage the production of more computer simulations. We apply a long term focused teaching-learning strategy in order to improve our physics teaching-learning process. This creates the possibility for our courses and laboratories to be carried out at a higher level, as computer simulations have a great effect on

the educational process. An interactive education based on computers advances the effectiveness and efficiency of educational processes. Therefore, students are allowed to further their knowledge and feel better prepared for integration into society.

In the recent years, from the educational viewpoint has been admitted that the classical methods of teachinglearning connected with some computer-assisted methods are good solutions for improving the educational process. The implementation of powerful technologies used in computer based learning leads to the increasing and development of this educational method. At international and national levels, considerable efforts have been made for the implementation of adequate software in the educational process. Concerning the continue improvement of our physics course and laboratories, a very important task is to describe various physical phenomena and bring them alive with help of computer simulations.

The technical issue includes computational requirements, modern and powerful software and hardware. We have incorporated these powerful computational tools in the educational process for assisting students to achieve a better understanding of physics concepts and phenomena, and to check the results obtained from experimental work. We have developed a strategy for teaching students how to operate and realise an interactive use of adequate software for exploring, learning and applying physics laws. Our set of computer simulations is elaborated using Adobe Flash CS3 software. For a high level of performance we have optimized continually the applications. We notice a continue improvement of students understanding and an increasing of interest concerning the work at the physics laboratories. Students have become more motivated and this has been the reason for the production of more computer simulations. We provide a study of the role of computer simulations in the computer-assisted educational process. We performed a statistical survey of the number of computer simulations implemented in our course and laboratories through the recent years. This study enlightened a rise in the participation of students that used the computer simulations. Also, for illustrating our work we present the computer application elaborated for the study of the thermal activation energy of intrinsic conduction for a semiconductor.

IMPLEMENTATION OF COMPUTER SIMULATIONS IN THE TEACHING-LEARNING PROCESS

The development of computational technologies has determined an increasing of the implementation of new computational programmes in engineering education. The computer assisted education provides a framework for the integration of new and powerful computational tools and especially of the computer simulations of physics phenomena. Our long-term experience in the field of physics has demonstrated the usefulness of processing data using the computer simulations. We do not intend to make a complete replacement of the traditional methods of teaching and learning physics, but we want to perform a good understanding of physics laws and phenomena.

In this light, we have provided our physics laboratories with a set of computer simulations that allow the students to develop skills of measurement and analysis. Also, the computer simulations are not affected by the errors generated by the measurement process and the sensibility of apparatus, and can be used as checking tools for the laboratory work. for the results obtained from experimental work We have created a set of interactive physics simulations using computer applications to illustrate some key phenomena and laws of physics concerning oscillations, waves, thermodynamics and optical phenomena. These computer simulations are used in our physics laboratory since 2006 and most of them are elaborated in Adobe Flash CS3. We own a suite of twelve different simulations of our laboratory works regarding various physics phenomena, detailing many aspects of physics studied in the course that we offer. It was very important to decide which physics laboratories need computer simulation activities, and amongst these, which hold more priority.

We have collaborated with our students in order to establish which laboratory works are more suitable for computer simulations, taking in account their arguments and options. After sorting the experiments into the order of priority, we have elaborated the computer simulations so that they have to yield the same results as those of experimental results. A comparison between the practical experiment and the simulation can be made by the students, as the software is able to run during or after the experiment. We chose the animation and programming environment of Adobe Flash CS3 for the elaboration of simulations motivated by its flexibility and advanced graphical facilities. Many applications, animations and web pages are created and processed in this professional software. The operations, the functions and the user friendly style allow users who are developing Flash applications access to extraordinary possibilities.

This differentiates Flash as a robust and exciting environment for developing applications. The applications use data that has been collected from physical experiments in order to allow the simulation to describe the behaviour and indications of the laboratory equipment as accurately as possible. Necessary physical formulas are applied to obtain the results. Using the experimental data acquired from certain sites within a given period of time, an interpolation of 1st degree could be implemented in these applications. As a result, the user can analyse simulation values within the same time span as that of the experiment.

Therefore, the user can choose a value, without being constricted to a limited number of values or even by only the experimental values. We ensure that the applications have a menu in Romanian and English, so that the user may choose just as to preference or necessity. Each application allows the students to verify experimental data, calculate formulas and construct and present graphs. As an example, we present the application elaborated for the determination of the thermal activation energy of intrinsic conduction for a semiconductor. We present the screen-shots of the applications interface. The computer interface image for the lab objectives, the apparatus and equipment, and the measurements and procedure. The aim of the computer simulation is the determination of the

thermal activation energy of intrinsic conduction for a semiconductor. For the determination of the thermal activation energy of intrinsic conduction for a semiconductor the dependence between the resistance and temperature of a thermistor is used.

The components of the experimental equipment are:
- A thermistor with the terminals coupled to an electronic ohmmeter;
- An electronic ohmmeter by means of which the resistance is measured;
- Heat source, that is a 40-W bulb;
- Temperature probe, mounted next to the thermistor and connected to it by thermal contact.

The information from the temperature probe is sent to an electronic thermostat programmable in the range 0-100 C equipped with a graded scale. For usual practice, the range 0-60 C is recommended. To open the application, the students have to press the switch on the electronic thermostat and to choose the values of temperature for which the values of resistance will be indicated by the electronic ohmmeter. After they have entered the first value of the temperature, which is indicated to be greater than the temperature of surroundings, they have to increase the values of the temperature and to read the corresponding values of the resistance.

Otherwise, a warning indicated by a yellow box flashing next to the value of temperature which corresponds to the equilibrium state of the value of the resistance has to be read. After the values that observe the possible value ranges are entered, the button Upgrade will be pressed as it displays the obtained values of $10^3/T$, R and lnR, upgrading at the same time the graphic which gives the dependence between lnR and $10^3/T$. The computer interface image for the laboratory objectives, measurements and procedure and the components of the experimental equipment. This screenshot allows the students to become familiar with the theory and experimental method.

DISCUSSION

In the last decade, more students and physicists are involved in the use of computer simulations for providing a better understanding of concepts and physics phenomena. In our work we present a set of 12 computer simulations and point out the increase in the interest of students using these computer applications for a better success in processing the experimental data with aid of efficient and accurate computational tools. Most of our computer simulations for the physics laboratory are elaborated in Adobe Flash CS3 programme. As an illustrative example we describe the computer simulation prepared for the study of the thermal activation energy of intrinsic conduction for a semiconductor. In addition, we give a statistical study of the number of functioning computer simulations implemented in our course and laboratories.

The rise in the participation of students that are interested in computer simulations of physics phenomena make us to produce more computer simulations. Because the process of collecting experimental data is affected by errors we offer to the students the possibility of using virtual tools like computer simulations.

The computer simulations are not affected by experimental errors and can be used as checking tools for the results obtained from experimental work. We are confident, and the large participation of our students support this, that computer simulations have improved the teaching-learning process. Further, the computer simulations allow students to become more familiar with the virtual labs and a comparative mode of learning, and how to experiment and use software applications. In the future, we want to implement the set of physics simulations in the distance learning via the Internet (e-learning). Applying an interactive education based on the use of computers simulations we improve our courses and laboratories, which are carried out at a higher level, and we advance the effectiveness and efficiency of educational processes. Therefore, students are allowed to further their knowledge and feel better prepared for integration into society.

THE STATE OF EDUCATION AND REFORM

To many observers, the report A Nation At Risk: The Imperative For Educational Reform was a watershed moment in the U.S., debate on education reform. Prior to 1983, reform movements and debate about the performance of the education system were a steady drum beat in the U.S., socio-political consciousness with peaks of concern and activity after WWII; the Civil Rights Movement; and the Soviet launch of Sputnik. The report was commissioned by then-Secretary of Education T. H. Bell to address "the widespread public perception that something is seriously remiss in our educational system." Blunt and damning in its language, the report states, "If an unfriendly foreign power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war."

A sampling of specific observations includes:
- "International comparisons of student achievement, completed a decade ago, reveal that on 19 academic tests American students were never first or second and, in comparison with other industrialized nations, were last seven times.
- About 13 per cent of all 17-year-olds in the United States can be considered functionally illiterate. Functional illiteracy among minority youth may run as high as 40 per cent.
- There was a steady decline in science achievement scores of U.S., 17-year-olds as measured by national assessments of science in 1969, 1973, and 1977.
- Between 1975 and 1980, remedial mathematics courses in public 4-year colleges increased by 72 per cent and now constitute one-quarter of all mathematics courses taught in those institutions."

In the wake of A Nation at Risk, we have witnessed a flurry of reform movements, a profound increase in political activity on education reform at the national level in addition to state and local efforts, and an intensification of debate at all levels. What follows is a few of the many education reform activities since 1983.

SCHOOL CHOICE

What many refer to as the "School Choice Movement" has gained momentum since the late 1980s. School voucher programmes, first proposed by Milton Friedman in 1955, began in earnest at the local level in 1990 in Milwaukee and the federal level in 2004 with the creation of a programme in Washington, D.C. The first charter schools were founded in Minnesota in 1991 and now educate more than one million students in 3,600 schools in 40 states. While firm statistics are difficult to obtain, an estimated 1 million students in the 2005–2006 school year were educated in home schools up from approximately 15,000 in the early 1980s.

NATIONAL

Government and legal activities in education reform have occurred on a wide variety of fronts. The "Even Start" programme was approved by the U.S., Congress in 1988. This programme combined both improved early childhood education with adult family literacy in an attempt to end the generational cycle of illiteracy in the U.S., In 1989, the Kentucky Supreme Court declared the entire state education system unconstitutional on the basis that the state was not providing minimally adequate education to which public school students were constitutionally guaranteed. As of 2000, twelve other states including New Hampshire, Wyoming, Alabama and New Jersey faced and lost similar "adequacy-based" lawsuits. In 1994, the U.S., Congress enacted "Goals 2000: Educate America Act", a bill intended to improve teaching and learning by creating a national framework for education reform, encourage high levels of academic achievement and "promote the development and adoption of a voluntary national system of skill standards and certifications".

Also in 1994, Proposition 187, passed in California in a general election referendum, banned undocumented immigrants from public education. In 1996, President Clinton in his State of the Union address, called for an end to the practice of "social promotion", a practice in which students are allowed to progress to the next grade level regardless of actual academic achievement. And in 2001, the U.S., Congress passed the "No Child Left Behind" Act which, among other mandates, transformed voluntary "Goals 2000" national education standards to compulsory ones and made federal funding conditional on school performance. This "accountability" feature in NCLB reflected a growing trend through the 1990s at the states-level of instituting or expanding accountability systems.

STATE AND LOCAL

Across the country, numerous small-scale programmes, teaching movements and pilot programmes have been altering the education landscape. Overall, state-level reform efforts can be characterized as focusing on education outcomes. As a result, nearly all states have raised their academic standards and instituted

new assessment programmes. As of 2004, twenty states added exit examinations to their high school graduation requirements up from 10 in 2001. A perennial plank in the National Educators Association's platform has been reducing class size at all grade levels. Beginning in 1985, Tennessee's Department of Education launched the four-year, Student/Teacher Achievement Ratio programme to study the effects of classroom size on student learning at the kindergarten through 3rd grade. A follow-up study was conducted on the cohort in the 10th-grade. Wisconsin began the Student Achievement Guarantee in Education programme in the 1996- 1997 school year, a programme aimed at maintaining student-teacher ratios at 15-1 or below for kindergarten through 3rd grade. This selection of reform efforts is by no means comprehensive. Reform developments in pedagogy, technology, teacher education and qualification, school and classroom architecture, special education, higher education and more are clearly missing. Even so, this brief presentation demonstrates the intensity of education reform since 1983. After so much work, where are we now?

NATIONAL EDUCATION TRENDS

The National Center for Education Statistics, in conjunction with the Institute of Education Sciences and within the auspices of the Department of Education, is the primary entity for collecting and analyzing education data for the federal government. NCES maintains two parallel programmes for measuring national progress in education: the National Assessment for Educational Progress Long-Term Trends programme and the "main" NAEP assessments programme. The LTT programme has employed the same assessment instruments and methodologies since inception, allowing for the direct comparison of results from year-to-year. The main NAEP programme is subject to revisions as new priorities, content and methodologies emerge. Because the two programmes differ significantly, it is not possible to directly compare results between programmes.

The points along the trend lines are national averages of scale scores for ages roughly corresponding to 4th, 8th and 12th grade. You may have noted that the trends express little change between the start and end points and minimal variation across the periods with three exceptions: mathematics scores for ages nine and thirteen show twenty-two and fifteen point gains respectively from 1973 to 2004; reading scores improved by nine points from 1971 to 2004. Mathematics, science and reading represent "core" subjects in the NCES assessment strategy. However, NCES does conduct periodic assessments of other subjects including U.S., history, geography, art and music. The Condition of Education Report 2003 and contain results from the first studies conducted in 1994 in U.S., history and geography and the most recent results from 2001. The methodology of these assessments is closer to the main NAEP than the LTT. The full bar in each column represent 100 per cent of each sample. Like the LTT graphs, you may have observed modest changes between the two sets of assessments. That in all grades, approximately one-third of all students were

below basic standards in these subject areas with the exception of 12th grade U.S., history achievement in which over one-half were below basic standards.

As discussed earlier, the main NAEP assessments evolve over time. Because the assessment methodologies remained relatively consistent from 1990 to present in mathematics and from 1996 to present in science, year-to-year comparisons can be made with a significant degree of reliability and validity. The primary features are achievement levels by grade expressed as percentages of each sample. However, these express achievement levels as groupings, *i.e.*, at or above Basic, *etc.,* a style of presentation seen in most of the recent NAEP literature. Mathematics progress for the 4th grade shows significant improvement with a twenty per cent decrease in below Basic achievement from 1990 to 2005.

The data also suggests acceleration in the improvements made at the 4th grade level from 2000 to 2005. Smaller but noteworthy gains are exhibited in the 8th and 12th grade samples. Note the correspondence in trends between the main NAEP mathematics data and the LTT graphs. However, take notice of the fact that below Basic achievement in 2005 still ranges from twenty per cent to thirty-five per cent. In contrast, science achievement reveals little or no improvement from 1996 to 2005 and below Basic achievement ranges remain in the thirty to forty-five per cent range. There is also correspondence between the main NAEP Science and the LTT Science trends although a comparison of three assessment intervals to two assessment intervals is far from conclusive. An interesting pattern, or perhaps coincidence, emerges from a comparison of all three sets of data: 12th grade/age 17 academic improvements are the least significant between the three groups. Is this pattern real or a statistical anomaly? If the pattern is real, what might be the cause? A quick review of data from Kentucky and Colorado suggests that this pattern might be born out at the state level, too. This observation merits further study. Switching gears, let us consider the premise that there was a net increase in the quantity of education reform since the publication of the A Nation at Risk report in 1983. To be clear, TCFIR is not yet aware of any study supporting this premise empirically.

Rather, this premise is based on an impression formed in our own research of the literature. Let us also acknowledge that the phrase "education reform" suffers from a lack of a specific and generally agreed upon definition which further weakens the premise. However, it can be said with certainty that the statement "No education reform has taken place since 1983" is false. Let us consider a second premise: The education reforms that have been put into service since 1983 have been executed in good faith, backed by sound research and an expectation of success.

Finally, let us consider the third premise: The assessment instruments and research programmes evaluating both educational achievement and the effects of education reform have external and internal validity. The third premise is supported by at least one study. Let us consider an addition premise: There is no one "right" reform of education, no "magic bullet", nor can all reforms be "New Math". The effectiveness of reforms should be expected to fall along a

range from relatively ineffective to relatively effective regardless of the good faith intent of the designers of reforms. In fact, the effectiveness of the population of reforms would probably fall within a normal distribution if a metric for effectiveness could be created. But, given premise two, we might presume a negatively skewed distribution so that the mean effect of all reform efforts nationwide would result in an increase in the mean academic achievement. Simply stated, assuming that most reforms are at least mildly effective we should see some general improvement in academic achievement. Given these premises–and even allowing that the pace of education reform was unaffected by A Nation At Risk–do the graphs and reflect the kind of academic achievement gains we would expect to see based on the sheer scale of efforts nationwide to reform education? Are we seeing an adequate return on our education investment? And if we are not, then why not?

KENTUCKY AND THE KERA REFORM EFFORT

Can we see evidence of a positive effect of education reform on achievement at a smaller scale? In 1989, the Kentucky Supreme Court ruled in the case of Rose v. Council for Better Education that the state's education system was unconstitutional. The suit contended that the education system failed the test of "efficiency" and "minimally adequate education" for all of the state's students. The Court ordered the state bring the education system into constitutional compliance within one year, forcing one of the most sweeping overhauls of a state education system in U.S., history. The Supreme Court took the unusual step of enumerating the characteristics of an efficient school system in eight of the pages within the decision. The Kentucky Education Reform Act of 1990 "recreated the entire education system and included not only finance and governance changes, but also programme changes". KERA established new education standards and the Kentucky Instructional Results Information System assessment. The statewide education budget was increased by 32% from 1990 to 1999.

Other effects and mandates of KERA included:
- Creation of the first online university in the nation.
- Decentralized decision making with major decisions shifting to the school level. The objective was to improve parent involvement and parent-teacher cooperation in issues related to instruction, curriculum and even personnel.
- The creation of a primary school programme to replace the kindergarten through 3rd grade system that included multi-age, multi-ability classrooms.
- Major changes to teacher training and qualification requirements including the creation of a mentoring programme for all novice teachers.

KERA has drawn both strong praise and strong criticism. In the mid-1990's, the Ford Foundation and Harvard University awarded Kentucky the Innovations in Government Award, Kentucky will receive 2006 Frank Newman Award for

State Innovation from Education Commission of the States. The Department of Education has cited Kentucky in several NAEP reports for significant improvements in its mathematics and science education scores.

Inspired by the precedent set by the Rose v. Council for Better Education decision, twelve other states have faced similar lawsuits and a number of states and municipalities including Arkansas and New York City have looked to Kentucky as a potential model of education reform. On the other hand, critics have sited continuing inequities in funding due to formulas that fail to adequately fund schools with relatively small reduced- or free-lunch student populations. A study in 2004 "suggested that Kentucky schools need $740 million to $1.2 billion more a year, on top of their current $4.1 billion allocation, to adequately fund the promises of KERA" while parties from the Rose v. Council for Better Education suit have threatening new legal action based on these same funding concerns.

Some education reform observers suggest that Kentucky now leads the nation in the rate of increase in non-public school enrollments, indicating that parents are giving up on KERA reforms. Another resource suggests that the Kentucky Department of Education was warned by American College Test, Inc. of problems with the reliability of KIRIS but suppressed the information until pressed by state lawmakers. Other questions have been raised about the reliability and validity of KIRIS especially in comparison to results from NAEP. In both cases, the implication is that KIRIS is overstating education achievement in the state. There are criticisms about Kentucky HB 178, a bill which redefined students awarded GEDs as successful graduates of the education system. Observers claim that the bill is in conflict with the stated goals of both KERA and NCLB and represents a manipulation of the statistics on the Kentucky Department of Education's actual performance. One report states, "Lawmakers are so concerned about the department's reports that they ordered an audit of Kentucky's dropout data in August 2003." While NAEP data indicates a clear trend of improvement for Kentucky, the results can be characterized as bringing Kentucky within the range of the national scale score averages. The rate of gains over fifteen years in academic achievement place Kentucky in the top one-third of states in mathematics and science but in the middle of the pack in reading. Perhaps more importantly, recent data shows a significant slowing in academic gains. As a "model" programme, the Kentucky example raises important questions about the effectiveness of current education reform strategies.

INTERNATIONAL COMPARISONS

We examined the effects of U.S., reforms represented in the national data and, on a smaller scale, the results of one of the most extensive state-level reforms in U.S., history: the KERA programme in Kentucky. Let us turn our attention to international comparisons of academic achievement. In the 20th century, the U.S., achieved an unparalleled global economic and political dominance due, in part, to high academic achievement relative to other nations and leadership in science, engineering and technology.

With the advent of globalization and profound investments on the part of other nations such as Ireland, India, China, Singapore, Taiwan and Japan in the improvement of their education systems, the relative advantages in education that the U.S., once enjoyed have narrowed. Concerns in the U.S., over relative education quality are not new as the Sputnik-era reforms demonstrate. However, the problem of relative U.S., educational achievement has become especially acute as both the Indian and Chinese economies, representing over 2.5 billion people combined, grew in 2005 at a rate 7.6% and 9.9% respectively and both countries begin to supplant U.S., dominance in technology and manufacturing. In light of these global changes, the Department of Education has participated in a number of programmes to assess the relative quality of the U.S., education system. One such programme, the Trends in International Mathematics and Science Study is conducted by the International Association for the Evaluation of Educational Achievement. The third and most recent study was conducted in 2003 and is summarized below:

Mathematics:
- At the 4th grade level, the U.S., was 12th out of 25 countries with a score of 518 compared to the average score of 495 and the high score of 594 from Singapore. The U.S., score was unchanged from 1995. This, however, represents a reduction in relative standing.
- At the 8th grade level, the U.S., was 15th out of 45 countries with a score of 504 compared to the average score of 466 and the high score of 595 from Singapore. The U.S., score improved by 12 points from 1995 and represented an improvement in relative standing.

Science:
- At the 4th grade level, the U.S., was 6th out of 25 countries with a score of 536 compared to the average score of 489 and the high score of 565 from Singapore. The U.S., score dropped 6 points from 1995 and represented a lower relative standing.
- At the 8th grade level, the U.S., was 9th out of 45 countries with a score of 527 compared to the average score of 473 and the high score of 578 from Singapore. The U.S., score improved by 15 points from 1995 and represented an increase in relative standing.

Reading literacy has been studied in a separate effort. The Progress in International Reading Literacy Study was conducted by IEA in 2001 as the first in a five-year cycle of trend studies on reading literacy. The last comparable study was conducted in 1991 by IEA. PIRLS was administered in 35 countries to 9 year olds. PIRLS is designed to measure reading ability related to enjoyment and reading to acquire and use information, specifically the ways in readers construct meaning from text. The scale was set for 1000 with an average score of 500 and a standard deviation of 100.

A summary of results are as follows:
- The U.S., ranked 9th in combined literacy with a score of 542 compared to the high score of 561 by Sweden.
- The U.S., ranked 4th in the literary subscale with a score of 550 compared to the high score of 559 by Sweden.

- The U.S., ranked 13th in the information subscale with a score of 533 compared to the high score of 559 by Sweden.
- U.S., Black and Hispanic combined literacy scores of 502 and 517 respectively were significantly below the U.S., average of 542.
- U.S., schools with a student body consisting of 75% or more free- or reduced-price lunch recipients had a combined literacy score of 485 compared to the U.S., average score of 542.

As with the national data from NCES, the IEA assessments present a mixed picture of educational reform progress in the U.S., Most importantly, especially in light of the imperative of maintaining a strong position for the U.S., in the global economy, the U.S., does not lead in any of the three indicators of relative academic achievement. The literacy data also highlights the problems the U.S., has in addressing gaps in student education across ethnic groups. As one of the most ethnically diverse countries in the world, the failure to achieve parity in education among all ethnic groups represents at best a waste of "human capital" and a pivotal problem that the U.S., must overcome.

This year, the National Academies published Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future, a report commissioned by the Energy Subcommittee of the Senate Energy and Natural Resources Committee in May, 2005 for the purpose of assessing the current state of U.S., science and technology and making federal policy recommendations. The U.S., education system was one of several domains investigated by the National Academies.

Among the report's findings were:
- "In 2003 the Organisation for Economic Co-operation and Development's Programme for International Student Assessment measured the performance of 15-year-olds in 49 industrialized countries. It found that US students scored in the middle or in the bottom half of the group in three important ways: our students placed 16th in reading, 19th in science literacy, and 24th in mathematics. In 1996, US 12th graders performed below the international average of 21 countries on a test of general knowledge in mathematics and science."
- "Fewer than one-third of U.S., 4th grade and 8th grade students performed at or above a level called "proficient" in mathematics; "proficiency" was considered the ability to exhibit competence with challenging subject matter. Alarmingly, about one-third of the 4th graders and one-fifth of the 8th graders lacked the competence to perform even basic mathematical computations."

The PISA results are consistent with the IEA studies, consistent with the main and Longterm Trend NAEP assessments and consistent as well with individual state-level achievement data. We believe that it is highly significant that international, national and state-level assessments –using different assessment methodologies– converge on roughly the same appraisal of U.S., academic achievement. The National Academies report provides a body of interesting facts on higher education that depict another dimension of the state of the U.S., education system.

These facts need to be quoted in whole:

- "In South Korea, 38% of all undergraduates receive their degrees in natural science or engineering. In France, the figure is 47%, in China, 50%, and in Singapore 67%. In the United States, the corresponding figure is 15%.
- Some 34% per cent of doctoral degrees in natural sciences and 56% of engineering PhDs in the United States are awarded to foreign-born students.
- In the U.S., science and technology workforce in 2000, 38% of PhDs were foreign-born.
- Estimates of the number of engineers, computer scientists, and information technology students who obtain 2- 3-, or 4-year degrees vary. One estimate is that in 2004, China graduated about 350,000 engineers, computer scientists, and information technologists with 4-year degrees, while the United States graduated about 140,000. China also graduated about 290,000 with 3-year degrees in these same fields, while the US graduated about 85,000 with 2- or 3-year degrees. Over the past 3 years alone, both China and India have doubled their production of 3- and 4-year degrees in these fields, while the United States production of engineers is stagnant and the rate of production of computer scientists and information technologists doubled.
- About one-third of US students intending to major in engineering switch majors before graduating.
- There were almost twice as many US physics bachelor's degrees awarded as in 1956, the last graduating class before Sputnik than in 2004.
- More S&P 500 CEOs obtained their undergraduate degrees in engineering than in any other field."

The output of the U.S., primary and secondary education system becomes the input to higher education and the workforce. As such, other factors not easily measured by national or state assessments in particular subject areas emerge as trends in higher education and the workplace. One area requiring additional research is how well academic standards and practices actually prepare students for the workplace and post-secondary education. Karl Zinsmeister states, "Employers, too, are distraught. Noting that 44 per cent of the job-seekers who showed up at his office couldn't read at the ninth-grade level, Prudential Insurance executive Robert Winters mourned that 'they are 17 years old and virtually unemployable for life.'" Zinsmeister, 80 per cent of job applicants fail a 5th grade mathematics and 7th grade English competency exam used by Motorola for factory employment. At the post-secondary level, 72.5 per cent of four-year institutions and 99.4 per cent of "at least two but less than four year" institutions provide remedial education services. In addition, recent reports on high school graduation rates suggest that state and national data is flawed and overstated. And, given the facts provided by Rising Above the Gathering Storm,

one must ask what is happening in primary and secondary education to divert graduates from scientific and technical higher education and career choices?

The NCES The Condition of Education 2006 reports that:

- "The number of bachelor's degrees awarded increased by 33 per cent between 1989-90 and 2003-04, while the number of associate's degrees increased by 46 per cent.
- The sole decline among the top five most popular degree fields between 1989-90 and 2003-04 was in engineering and engineering technologies."

What is the number one major in the U.S.,? The Job Outlook 2005 survey, the answer is accounting. The issue, then, is not whether U.S., student are seeking higher education. The "leakage" in the pipeline through higher education away from technical disciples has profound implications for the future of the U.S., economy as do the questions about high school graduation rates and basic academic skill levels at the other end of the workplace spectrum.

The National Academies report states that an estimated one-half of U.S., economic growth since World War II has been the result of technological innovation. Based on the rate of natural science and engineering degrees earned in other countries compared to the U.S.,, the probability of innovation-driven economic growth being centered outside the U.S., is high. The relative strength of the U.S., education system raises troubling questions about the future.

NOTES ON THE STATE OF EDUCATION AND REFORM

For more than two decades, reform of the U.S., education has been a "hot topic" and the focus of great effort at all levels and yet the results as measured by state, national and international assessments are mediocre. NCLB promises to raise academic achievement to nearuniversal standards of "proficiency" but the long-term trends suggest that the goal may be beyond reach within the current paradigms of education even while the short-term trends suggest that improvements are occurring. The sidebar "Then and Now" presents two quotes, one from A Nation At Risk and the other from Rising Above a Gathering Storm; the similarities are disturbing given their separation by more than two decades.

Is it unfair to say that, like Alice in the Red Queen's court, we are running as fast as we can just to stand still? For those who might ask whether we have a problem with our education system, the answer is an unequivocal, "Yes!" The "School Choice" movement is just one example that demonstrates frustration on the part of parents with public education by creating alternatives to a system some say is broken beyond repair, while lawsuits such as Rose v. Council for Better Education attack the system from within. In the realm of the social sciences, public perception is often recognized as a force which creates "facts" regardless of the data.

The data on the education system says "maybe" but strong, vocal and active social factions are actively working to re-form education outside or on the margins of the system.

This alone creates an imperative to reform education. But the "averageness" of the U.S., education system in international comparisons draws us away from the domain of perception back to objective fact. The U. S. economy has benefited from the disparities between our educational, scientific and technological accomplishments and those of other nations through the 20th century. Other nations, looking to our example, are fast on our heels. If the future trends of the U.S., education system resemble the trends from the LTT data projected forward by thirty years, the U.S., will most surely slip behind. Maintenance of the status quo in academic performance equates to failure on the international stage. From anthropology, we learn that inter-cultural contact, and the resulting diffusion of ideas, technology, *etc.,* is a major driver of cultural change. In this way, U.S., successes have diffused to the world and now we must compete with our own ideas uniquely transformed and reinvented by dozens of countries. The situation is not all bad. Strides have been made in the educations system. Recognition of the importance of early childhood education and programmes such as Head Start has improved the readiness of many children to be educated.

The focus placed on removing institutional and social inequities in the education system have reduced performance gaps between genders and ethnics groups, although those gaps remain. For most of U.S., history, primary control of the education system existed at the state and local level, resulting in a diversity of standards, curricula and infrastructures that created challenges in addressing even the most basic issues of education reform. While there are many criticisms of "standards-based education" and greater federal control of education, the U.S., for the first time has the potential to see the effect of education reforms by reducing this diversity to something more manageable while elevating accountability and measurement of academic performance to new levels of importance. For better or worse, NCLB has put the U.S., on the path of a grand experiment in education. The scale of this experiment will undoubtedly leave its mark in the record of education trends. The need for education reform will not end even if NCLB is a stunning success.

Many observers assert that the world is moving towards a "knowledge-based economy" although that term is as ill-defined as "education reform". What is clear is that technology is transforming every aspect of the world and will continue to do so. Human knowledge continues to grow at a geometric, if not exponential, pace. If "knowledge" is the currency of both the present and future economy, the quality of the output of our education system can only increase in importance. Moreover, the ability to self-educate as well as transform data and information into productive knowledge may be a kind of "academic skill" more critical to both individual and national success than those particular skills and knowledge represented by current national standards. There remain innumerable questions about why our education system is as it is. The U.S., has faced any number of challenges and produced remarkable results in relatively short periods of time as examples such at the economic response to World War II and the Apollo Project demonstrate.

Given the talents we as a nation have demonstrated, why do thirty years of education performance data reveal such limited improvements? The KERA case study sheds light on the problems with translating a new vision into a working reality but the real answers are yet to be found or perhaps merely assembled into a story that makes sense. Whatever the reasons, the need to ensure that the U. S. education system is serving the needs of the nation in all its manifest diversity is clear. The remainder of this whitepaper will discuss ideas for reforming education beyond, or perhaps within, the new standards-based education paradigm. You may find, as we at TCFIR have, that the story of CAT/L is not about a new idea but the discovery that some answers to the problem of education reform are right there in front of us.

COMPUTER AIDED TEACHING AND LEARNING

Education is important. The quality of the U.S., education system directly affects the nation's economy through the quality of the workforce available to employers, the demographics of the consumer market, the productive capability of the economy, the pace of innovation, and the relative standing of the U.S., globally. The quality of education determines the life opportunities available to individuals and their ability to exercise their right to "life, liberty and the pursuit of happiness." And the quality of education influences the cultural and social fabric of every nation, even influencing such seemingly unrelated phenomenon like birth rates, marriage demographics, trends in religion and urbanization patterns. While NCLB represents a major overhaul of our nation's education system, the need to ensure that the education system is doing what it must do demands that we not wait to see whether the states can meet the NCLB targets. New ideas in education are as important and relevant now as they have ever been. CAT/L is a proposal for a framework and an organizing set of principles to guide educational research and development. The idea for CAT/L coalesced around the observation that, despite large sums of money, bright ideas and energetic execution, gains in academic achievement are not what one would hope. We presented evidence from state, national and international sources to support this observation.

The data presented does show that some progress is being made. However, judgment of the success or failure of the education system is something that truly cannot be empirical; it rests with each person's dreams of the future and with the ideals of the nation. Whether the data from the previous part represents success, failure or some mixed state is up to you. TCFIR has taken on education reform because, regardless of the judgment one might pass on the education system, we see many opportunities for improvement. Since the publication of A Nation at Risk in 1983, information technologies have transformed or influenced almost every dimension of our world, including education. But like the main body of reform efforts, information technology has manifested little strong positive effect on academic outcomes.

We cannot point to any trend or set of data and say, "Here it is. Here is where information technology has improved education." Yes, parents and teachers exchange e-mails. Yes, multimedia in the classroom has moved far beyond the film strips and reel-to-reel projectors of days past. Yes, report cards and school assessments are available via the Web. Yes, computer science is part of the education curricula of most high schools. Yes, the Internet has placed within reach of everyone with a computer such vast quantities of information that it is almost unusable.

And, yes, there have been innumerable developments in learning and teaching technology, from the LOGO programming language to computer-based learning programmes and Blackboard to online classes. But despite these developments, information technology has not yet penetrated the core problem of helping students to learn better and teachers to teach better. What is the main effect of information technology? Information technology is an enabler and facilitator of human capability, like a lever that allows a person to move loads far heavier than muscle power alone. Information technology manipulates data but data only becomes information and knowledge in the human context and by processes of the human mind.

One example of the magnification of human capability can be found in an explanation of the long period of economic growth through the 1990s: information technology enabled dramatic increases in worker productivity as businesses found ways of exploiting the capability of personal computers and networks.

In other vein, mathematical simulations of climate processes could be produced with pencil and paper, as human Computors once did in calculating books of navigation tables, but computers make it possible to view the results in hours or days rather than centuries and in charts, graphs and visual simulations far more useful than tables of raw data. Information technology in the context of education has already enabled many things not previously possible. For example, the principle of accountability within NCLB is made practicable by information technology because data can be shared, aggregated and analysed in ways not possible twenty years ago. But information technology must do more for education.

Bounding the entire CAT/L framework is a question: how can information technology and Internet-enabled technology in particular, improve education? This is not a new question but it is a question that remains unanswered. Within the framework is an observation: hundreds of technologies, insights from research, methodologies and processes already exist that address parts of the problem of improving education. Binding the framework together is a premise: these existing pieces of technology, research, methodologies and processes can be integrated by organizing principles and additional research and development to create something new, unique and powerful in education reform. This is one meaning of the name "CAT/L". Technology, then, is the foundation of CAT/L and an Archimedes Lever by which to move the world of learning.

The remainder of the CAT/L framework can be described in a series of principles:

- The education process must become learner-centered.
- Assessment - diagnostic, formative and summative - must be improved and deeply integrated into the learning and teaching process.
- National and state academic standards must be met or exceeded.
- Ethnic academic achievement"gaps" must be addressed and eliminated.
- Learning must become more active.
- The formation of life-long learning behaviours must be facilitated.
- Education reform must be guided by empiricism.
- Well-designed, technology-enabled education reform will be self-improving, selfreforming and self-documenting.
- Teaching and learning content must be of the highest possible quality, current and relevant.
- Proven pedagogical methodologies and the best research from all fields with a bearing on learning and teaching must be integrated into education.
- The needs of all stakeholders must be served.
- Reform must also address the need to improve the formation and achievement of vocational goals by students.
- Where minimum standards exist, the goal must be near-universal mastery rather than a standard distribution of achievement.

These principles, written as imperatives, sound like inflexible goals but they are in fact standards by which to assess the various activities within the CAT/L framework. Each principle is drawn from research but also reflects a consensus opinion within TCFIR. In addition, these principles represent hypotheses and, as such, are subject to falsification by scientific method and by consensus of the larger scientific and educational community. In total, the goal implied by the principles of CAT/L is ambitious and perhaps even unattainable. But there are too many examples of great successes arising from impossible-sounding ideas to be deterred from attempting an ambitious proposal.

Even partial success has the potential to significantly advance education. For example, what is the benefit to education and to the U.S., if technology and methodologies could be produced that resulted in near-universal mastery of minimum standards? What would be the outcome of identifying to a high degree of "certainty" those pedagogical methods that produce the best results? At present, one can only guess at an answer to either question. That is why CAT/L is called a framework based on questions and principles. Clearly, the job of education is complicated and difficult if for no other reason than the fact that we are only just beginning to understand the human mind. The problem of reforming education is even more complicated and difficult because, in addition to not clearly understanding the object on which the processes of education operate, there is the system of education made up of people in roles and social structures that perform and manage education and the consequences of getting it wrong.

To paraphrase Donald Rumsfeld, we do not know what we do not know. Therefore, CAT/L is also a journey of discovery. As briefly discussed in the preface, education is connected to all dimensions of society and the individual. Therefore, the methods and perspectives used to develop CAT/L will come from any and all disciplines. We submit that education reform must be interdisciplinary to be both effective and practicable. However, interdisciplinary research and development, in and of itself, will present a great challenge because the sum of human knowledge is large and by necessity has become fractured into specialties and sub-specialities. How an epistemologist might relate to computer programmer and a political scientist on a problem of education is a serious question and a significant challenge. But if information technology is to be crafted into a form that promotes the acquisition of human knowledge and implemented within a large bureaucracy, such a meeting of minds will have to happen and be productive.

THE PRINCIPLES OF THE CAT/L FRAMEWORK IN BRIEF

Assessment against national academic standards is a major principle of NCLB and recent state-level reform efforts. Assessment methods are generally categorized just as to three types: diagnostic, formative and summative. The summative method of assessment is the most common type and includes quizzes, exams, writing assignments, reports, *etc.* but also include the various NAEP instruments and high school exit exams. The distinguishing characteristic of summative assessment is that it is typically used after a period of learning and represents a judgment about the learning that has taken place. In practice, each judgment is represented by a grade with each grade over a period of time, *i.e.*, a semester, trimester, school year or career aggregated into a summation of each student's relative mastery of the body of learning. Within the current education paradigm, summative assessment is usually the end of the learning process for a unit or body of material; the teacher moves to the next unit in the lesson plan and students remain at whatever level of achievement they have demonstrated in the assessment.

In contrast, formative assessment may employ similar instruments as the summative method but is used during the instructional process to provide feedback to both the teacher and learner. Information from formative assessment guides further learning and teaching activities and, in an ideal education environment, provides a basis for guiding all students to a uniform mastery of each unit of learning. Diagnostic assessment has a less concrete definition than the summative and formative types. In this whitepaper, diagnostic assessment has two meanings: first, a method of assessment used prior to a unit or body of learning to determine what preexisting knowledge and skills students have, and two, assessment used to determine traits of each student that influence learning. In the first meaning, "diagnostic assessment" includes both summative and formative assessment methods as each method, in a dynamic context, provides information useful to subsequent teaching and learning. A subtype of assessment

important to CAT/L is certainty assessment. Certainty assessment adds a dimension of data in summative and formative assessment methods by including student self-assessment of the certainty with which they have answered a question. Certainty assessment is currently employed by the company Knowledge Factor in their proprietary industrial learning systems and in the United Kingdom by researchers and universities in a variety of settings.

In formative assessment, certainty ratings allow both the learners and teachers to understand qualitatively how well discrete units of knowledge and skill are apprehended. In combination with formative assessment processes overall, certainty assessment facilitates precise adjustments to pedagogy, focused remediation of material not mastered and an empirical base to guide the pace and direction of a lesson plan. In addition, certainty-informed diagnostic, formative and summative assessment provides detailed information about "delta" in the student that may be used to formulate a new "grading system" if one is deemed necessary. The importance of improving and deeply integrating assessment into the teaching and learning process cannot be overstated. Simply stated, one cannot understand, control or improve what one cannot measure.

Improved assessment methods bring empiricism into the classroom and provide a precision, efficiency and productivity to the education system that has previously been missing. In a psycho-social context, improved assessment methods facilitate learnercentered practices by promoting a partnership between teacher and learner; reduce or eliminate the need for "high stakes" assessment like high school exit exams because a student's progress through the body of education standards will be well known; potentially reduced stresses associated with assessment, *i.e.*, "test anxiety", by a) increasing student preparedness for summative exams and b) habituating students to assessment as a means of learning; and possibly reduce or eliminate social stigmas attached to grades and academic achievement as the meaning of assessment is different in this approach. Finally, because detailed information along multiple dimensions will be developed by an improved assessment system, other practical uses for this information will be discovered. One potential use is helping students with the process of identifying and accomplishing academic goals related to vocation.

National and State Academic Standards Must be met or Exceeded

Any reform effort that ignores or seeks to bypass the current paradigm of standardsbased education is doomed to failure because NCLB is the law of the land. A common criticism of education standards coupled with accountability practices is the potential to narrow the scope of education to only that which produces the best assessment results. Regardless of this and other criticisms, standards are a reality that must be embraced. The principles of CAT/L– especially improved assessment, learner-centered practices and appropriate uses of technology–are, as a body, intended to produce reform that helps the U. S. education system meet the targets set by NCLB. But CAT/L in its full prospective manifestation has the potential to move academic achievement beyond national

standards and address latent needs for adaptive life-long-learning, workplace achievement, critical thinking, metacognitive skills useful in a "knowledge-based" economy and relative national economic competitiveness.

Ethnic Academic Achievement "Gaps" must be Addressed and Eliminated

The persistent quality of the disparity in academic and socio-economic achievement between ethnic groups in the U. S. despite numerous, targeted reform efforts suggests that there is a "structural" problem with the education system. Learner-centered practices show promise in addressing the ethnic achievement gap but multiple lines of new research and development may also be required. In addition, the technological base of CAT/L leads to a problem in addressing the ethnic achievement gap: the prevalence of computers and high-speed Internet connections are lower in non-White ethnic groups and in low socio-economic status schools and districts. Regardless of the challenges, demographic shifts in the U. S. population make addressing the ethnic achievement gap more important than ever.

Learning Must Become more Active

There are numerous justifications for this principle but one will suffice to communicate the point.

If we the accept the premises that:
- Conditions are changing rapidly in technology, the workplace, within the economy, *etc.,*
- The pace of change is unlikely to abate,
- Current concepts such as the "knowledge-based economy" and "knowledge worker" are valid and tokens of actual processes in action,
- A major adaptive trait of individuals in these conditions is the ability to self-educate, then "active learning" is a concept that has great value both in the posteducation setting and in the education setting as "simulation" of the environment that students will face upon entering the knowledge-driven workplace.

In this practical justification, active learning is equated with self-education although the two are not synonyms: active learning most aptly applies to structured or guided learning settings while self-learning is a superset of active learning but descriptive of any self-directed learning in any learning context. In this perspective, active learning can be offered as an ideal of the learner "self-educating" even within the context of the classroom. Active learning, however, requires some knowledge of both learning and thinking on the part of the learner, areas addressed in the cognitive and metacognitive domain of the Learner-Centered Psychological Principles. Consider for a moment your own experience within the education system and then answer these questions. Were you ever taught strategies for thinking or problem solving? Were you ever given explicit methods for effective study or research? Were you ever presented with opportunities to connect pieces of the knowledge or skills you acquired to other

pieces or explore applications of your knowledge in a variety of contexts? Most likely, your answer is "no" to all three questions and yet these active learning skills are fundamental to all effective learning and to the application of academic experience to life.

The Formation of Life-long Learning Behaviours must be Facilitated

Life-long learning is a generative and creative process driven by curiosity and exemplifying the power of intentionality in learning. In the context of our change-driven world, lifelong learning is adaptive. The principle of life-long learning shares the same set of justifications as active learning. A large body of research exists on life-long learning but anecdotal evidence alone from discussions with educators suggests that life-long learning behaviour is a relatively rare trait. This principle is included in the CAT/L framework as a guide to additional research to identify those factors in the current education system that discourage the acquisition of life-long learning behaviours and discover those factors which promote life-long learning.

Education Reform must be Guided by Empiricism

Improving and integrating assessment into the education process is but one part of promoting empiricism in education. The Learner-Centered Model and LCP represent two other dimensions of empirical education reform. Simply stated, empiricism in education reform means replacing all ineffective parts of the education system with new parts validated by research as effective.

To do this, interdisciplinary research is demanded because the system of education, its parts and its connectedness to the larger social system contain manifold dimensions that influence the outcome of the current education system and any reformed system one might envision. No one scientific discipline contains a perspective which encompasses all dimensions of the system of education. Empiricism is a core value of the CAT/L framework.

Well-designed, Technology-enabled Education Reform will be Self-improving, Self-reforming and self-Documenting

"Education reform" is a never-ending process driven, in part, by culture change. Just as the principles of active learning and life-long learning have value to the individual in a dynamic society, so to can an education system benefit from technology that facilitates adaptation to the needs of the society it serves. Improved assessment systems provide information that both teacher and learner can use to "reform" the learning process on the micro-scale. Aggregated assessment data tied to students, student populations, learning content, lesson plans, curricula, schools, districts, states and the national education system can produce new and continuously updated data to assess and reform the system at the mezzo- and macro-scale. Internet-enabled communities and communication can promote collaboration and further reform development. Technology can facilitate the shift from episodic reform to continuous, organic reform much in the same way that "continuous quality improvement" has influenced industry.

Teaching and Learning Content must be of the Highest Possible Quality, Current and Relevant

The Internet is a strange phenomenon, both over-hyped and under-exploited. However, it can be said without hyperbole that within the Internet is more information about everything than any one person can apprehend. Separating canon from apocrypha is another matter. Harnessing the Internet as a dynamic source of educational content is a principle focus of CAT/L.

The intersection between the topics of educational content and the Internet is vast, therefore only a few points will be developed here. Education content across the entire U.S., education system suffers from the same heterogeneity as funding, infrastructure, student and teacher demographics, *etc.* Well-funded school systems have better content than "poor" systems. Internet content has the potential to replace or supplement traditional content thereby equalizing content quality across the nation. Content quality is further improved by access to new material as it is developed and to alternative content that can facilitate learner-centered practices. Integration of improved assessment practices with Internet-enable technologies results in the potential to assess, learn and teach simultaneously and even non-invasively. Internet-enabled teaching technologies have the potential to streamline administrative tasks such as lesson planning by providing teachers with access to existing, successful lesson plans and support materials developed by Internet communities. TCFIR is currently preparing a report on educational content from the perspective of the CAT/L framework.

Proven Pedagogical Methodologies and the best Research from all Fields with a Bearing on Learning and Teaching must be Integrated into Education

This principle is related to the principle of empirical education reform but is presented separately because it speaks specifically to empiricism applied to the dynamics of teaching and learning. Even a relatively brief survey of education literature reveals a great diversity in the theories and practices of education and yet the core model if U.S., education has remained relatively unchanged for several decades.

There is a disjunction between educational theory and research, and the execution of education within the current system; traditions persist despite superior alternatives and numerous reform efforts. A new survey of the body of educational theory and research–in combination with a review of related, interdisciplinary material–is being undertaken by TCFIR with the goal of presenting this work to scholars for critical analysis.

It is expected that certain patterns and insights will emerge to guide a subsequent process of research and development with the ultimate goal of identifying additional "best practices". The needs of all stakeholders must be served. This principle is an extraordinary challenge but one that is necessary if reform is to succeed. TCFIR is developing a paper which will elaborate on this principle.

**Reform must also Address the need to Improve the Formation
and Achievement of Vocational Goals by Students**

Extraordinary pressure is placed on today's students to make good decisions about education and vocation. While a high school diploma once served as the base for a spectrum of career choices that could produce a middle-class lifestyle, a four-year college degree has become the new de facto standard. Seventeen years of education represents an enormous investment just to meet a minimum standard of qualification to enter the workforce beyond minimum wage. The consequences of making a bad decision are considerable. While meeting the targets of NCLB should improve the academic skills that are the base of any vocational choice, NCLB mandates no reform that would improve the assistance that students might receive in identifying their interests and aptitudes and translating these insights into clear vocational goals. Trends, such one-third of engineering students changing their majors before graduating, support the need to address this issue. In combination, the principles of CAT/L should address many important dimensions of vocational selection. The enriched feedback of improved assessment methods may provide new kinds of information to students, parents, teachers and guidance councilors. Learner-centered education and active learning practices should promote engagement and the intimacy of contact with all subjects thereby improving learners' understanding of their choices. However, additional research and development will be conducted by TCFIR to explore this issue.

**Where Minimum Standards exist, the Goal must be near-Universal
Mastery rather than a Standard Distribution of Achievement**

The meaning of this principle rests with an understanding of "minimum". Minimum academic standards imply a body of knowledge and skills that everyone must have to function and participate in society. One can debate the meaning of an ill-defined phrase like "function and participate in" as it might relate to individual fulfillment or national need and the responsibility society has, through the education system, to serve this need. However, the intent of such a statement is clear: education must serve students so that they are at least minimally prepared for life. This is the implication of "no child left behind". Earlier, we argued that the expectancy of a standard distribution of academic achievement in any population of students represented a tacit acceptance of failure but this is only true based on the relationship between the mean of the distribution relative to a minimum standard, and in the context of a mass-education paradigm where there is little done to address the needs of students on the left side of the distribution. Human variation ensures that no population of students can be made uniform in their academic accomplishments. Reforming education so that all students have certain basic academic abilities, while also enabling students to reach the highest level of their native abilities beyond those minimum standards, is possible in the context of a system which emphasizes the development of students over student populations.

7

Developing a Teaching Style
and Learning

The first step in preparing to teach a particular course is to decide on a particular style of teaching that is compatible with and appropriate for your students and the goals of your course. It is likely that you will use a combination of the three teaching styles, depending on the circumstances of your course. While developing their own teaching style, science teachers must answer a fundamental question: Is the primary goal of my course for each student to gain specific information, or for each student to master how to organize and apply new information independently to new situations? The primary goal may not be the same for each student in a course, especially when the students come from diverse backgrounds. In courses that are the foundation for more advanced learning in a subject area, how should the Bottom of Form

content be organized and presented? Because science curricula tend to be vertically structured, students' content knowledge is critical for advancement in a field and for understanding the next level of information. In science courses for nonscience majors, how should the content be organized and presented? In any given course, we should ask what should be the balance between specific information, application of that information, and conceptual understanding of basic principles? If the course is truly to be a course for lawyers, citizens, teachers, and other nonscientists, it should provide some of the essence of what science is and the nature of the scientific enterprise.

Most science courses, particularly introductory courses, emphasize discipline-centered teaching. Generations of students have been exposed to science as a

subject in which the correct formulas and answers must be memorized, and the material is divided into many different and seemingly unrelated pieces. Problems with this approach have been exacerbated by the explosion of scientific information. Faculty members, wishing to cover the latest results and ideas but reluctant to discard classical material, rush to cover more and more information in the same amount of time.

Collaborative Syllabus Design

Often, multiple sections of an introductory course are taught by different faculty members. Some faculty members find it useful to meet with their colleagues to design a syllabus that optimizes the order and structure in which to present the course material.

For example, if you are teaching atomic theory, is it best to start with basic terms and then to build up to a model, or to start with a model and disassemble it piece by piece? The first step in collaborative syllabus design is to meet with fellow faculty members who teach the same course to identify basic concepts. Then, separately, each teacher does an analysis of the critical variables related to each concept. Finally, the colleagues reassemble to compare their lists, identify similarities and differences, and discuss the implications of their lists for instruction.

Those who have studied the learning of science have concluded that students learn best if they are engaged in active learning, if they are forced to deal with observations and concepts before terms and facts, and if they have the sense that they are part of a community of learners in a classroom environment that is very supportive of their learning.

Instructor-centered and student-centered teaching are more effective than is discipline-centered teaching for students to learn in this way. When the focus is on meaning rather than solely on facts, students develop their conceptual abilities. They assimilate information by incorporating new concepts or by using information to differentiate among already existing concepts. This is not necessarily at the expense of their development of algorithmic abilities, because conceptual understanding gives a context for the application of problem solving methods. A student-centered style is more likely to motivate students by engaging their interest. Several factors can influence your choice of teaching style:

- Student needs (future course and career requirements, preparation for participatory citizenship, and preparation for careers in science, engineering, technology, or education),
- Student background,
- Familiarity with various teaching methods,
- Course enrollment (size, students with special needs, the logistics of managing small group activities),
- Student learning styles,
- Teaching load (number of contact hours, office hours, time for preparation and grading),

- Other responsibilities (research, committee work, administrative duties),
- Support structures (equipment cost, teaching and demonstration assistants),
- Facilities (laboratory equipment and computers, classroom and laboratory space, and demonstration equipment), and
- Parallel sections that require some uniformity of coverage and examination.

In some circumstances, teachers must use methods that emphasize the imparting and acquiring of basic information and skills. Time constraints, class size, or course goals may lead to an emphasis on factual knowledge at the expense of developing a conceptual framework. Students are usually encouraged to accept facts from some authority (*e.g.,* the instructor or the text) without questioning. If all their learning is rote learning, however, students seldom associate the new facts with concepts or models already part of their pictures of the world (A Private Universe, 1989).

What can be done about the many options, goals, and competing pressures? Current practice is not to prescribe one teaching style as best for a given course or type of student. Various methods for engaging students are applied successfully in a wide range of institutional settings.

Using the Internet for Open Learning

In a way, the Internet is open learning. People can use it at times of their own choice, in their own ways, at their own pace and from anywhere that access to it is available to them. That said, this does not mean that it is automatically a vehicle for productive and effective learning. Indeed, it is very easy to become side-tracked by all sorts of fascinating things, and to stray well away from any intended learning outcome. The suggestions which follow are not intended as starting points for setting out to *deliver* open learning through the Internet (this is indeed possible, but could take a whole book to explore properly), but rather to help open learners to *use* the Internet to obtain material to use in connection with their studies, such as in assignments they are preparing. The following suggestions may help you to help your open learners both to enjoy the Internet *and* to learn well from it.

1. *Play with the Internet yourself:* You need to pick up your own experience of how it feels to tap into such a vast and varied database, before you can design ways of delivering it to your open learners with some meaningful learning experiences.

2. *Decide whether you want your open learners to use the Internet or an Intranet:* An Intranet is where a networked set of computers talk to each other while using Internet conventions, but where the content is not open to the rest of the universe. If you are working in an organization which already has such a network, and if your open learners can make use of this network effectively, there will be some purposes that will be better served by the Intranet. You can also have *controlled* access to the Internet via an Intranet, such as by using hot-links to predetermined external sites.

3. *Use the Internet to research something yourself:* You may well, of course, have already done this often, but if not, give it a try before you think of setting your open learners 'search and retrieve' tasks with Internet. Set yourself a fixed time, perhaps half an hour or even less. Choose a topic that you are going to search for, preferably something a little offbeat. See for yourself how best to use the search engines and compare the efficiency of different engines. Find out for yourself how to deal with 4,593 references to your chosen topic, and how to improve your searching strategy to whittle them down to the ten that you want to use!

4. Don't just use the Internet as a filing cabinet for your teaching resources! While it is useful in its own way if your open learners can have access to your own notes and teaching-learning resources, this is not really *using* the Internet. Too many materials designed for use in other forms are already cluttering up the Internet. If all you tend your open learners to do is to download your notes and printed own copies, sending them e-mailed attachments would do the same job much more efficiently.

5. *Think carefully about your intended learning outcomes:* You may indeed wish to use the Internet as a means whereby your open learners address the existing intended outcomes associated with their subject material. However, it is also worth considering whether you may wish to add further learning outcomes to do with the processes of searching, selecting, retrieving and analysing subject material. If so, you may also need to think about whether, and how, these additional learning outcomes may be assessed.

6. *Give your open learners specific things to do using the Internet:* Make these tasks, where it is relevant, involve up-to-the-minute data or news, rather than where the 'answers' are already encapsulated in easily accessible books or learning resources.

7. *Consider giving your open learners menu of tasks and activities:* They will feel more ownership if they have a significant degree of choice in their Internet tasks. Where you have a group of open learners working on the same syllabus, it can be worth letting them choose different tasks, and then communicating their main findings to each other (and to you) using a computer conference or by e-mail.

8. *Let your open learners know that the process is at least as important as the outcome:* The key skills that they can develop using the Internet include designing an effective search and making decisions about the quality and authenticity of the evidence they find. It is worth designing tasks where you already know of at least some of the evidence you expect them to locate, and remaining open to the fact that they will each uncover at least as much again as you already know about.

9. *Consider designing own interactive pages:* You may want to restrict these to an Intranet, at least at first. You can then use dialogue boxes to cause your open learners to answer questions, enter data, and so on. Putting such pages up for all to see on the Internet may mean that you get a lot of unsolicited replies!

10. *Consider getting your open learners to design and enter some pages:* This may be best done restricted to an Intranet, at least until your learners have picked up sufficient skills to develop pages that are worth putting up for all to see. The act of designing their own Internet material is one of the most productive ways to help your open learners to develop their critical skills at evaluating materials already on the Internet.

Computer Application in Educational Institutions

Application Software

Application software is any tool that functions and is operated by means of a computer, with the purpose of supporting or improving the software user's work. In other words, it is the subclass of computer software that employs the capabilities of a computer directly and thoroughly to a task that the user wishes to perform.

This should be contrasted with system software (infrastructure) or middleware (computer services/processes integrators), which is involved in integrating a computer's various capabilities, but typically does not directly apply them in the performance of tasks that benefit the user. In this context the term application refers to both the *application software* and its implementation. A simple, if imperfect analogy in the world of hardware would be the relationship of an electric light bulb (an application) to an electric power generation plant (a system). The power plant merely generates electricity, not itself of any real use until harnessed to an application like the electric light that performs a service that benefits the user.

Typical examples of 'software applications' are word processors, spreadsheets, media players and database applications. Multiple applications bundled together as a package are sometimes referred to as an application suite. Microsoft Office, OpenOffice.org, and iWork, which bundle together a word processor, a spreadsheet, and several other discrete applications, are typical examples. The separate applications in a suite usually have a user interface that has some commonality making it easier for the user to learn and use each application.

And often they may have some capability to interact with each other in ways beneficial to the user. For example, a spreadsheet may be embedded in a word processor document even though it has been created in a separate spreadsheet application.

User-written software tailors systems to meet the user's specific needs. User-written software include spreadsheet templates, word processor macros, scientific simulations, graphics and animation scripts. Even email filters are a kind of user software. Users create this software themselves and often overlook how important it is. In some types of embedded systems, the application software and the operating system software may be indistinguishable to the user, as in the case of software used to control a VCR, DVD player or microwave oven. It is important to note that this definition may exclude some applications that may exist on some computers in large organizations.

Terminology

The exact delineation between system software such as operating systems and application software is not precise, however, and is occasionally subject to controversy. For example, one of the key questions in the United States v. Microsoft antitrust trial was whether Microsoft's Internet Explorer web browser was part of its Windows operating system or a separable piece of application software. As another example, the GNU/Linux naming controversy is, in part, due to disagreement about the relationship between the Linux kernel and the operating systems built over this kernel. In computer science, an application is a computer programme designed to help people perform a certain type of work. An application thus differs from an operating system (which runs a computer), a utility (which performs maintenance or general-purpose chores), and a programming language (with which computer programmes are created). Depending on the work for which it was designed, an application can manipulate text, numbers, graphics, or a combination of these elements. Some application packages offer considerable computing power by focusing on a single task, such as word processing; others, called integrated software, offer somewhat less power but include several applications.

Application Software Classification

There are many subtypes of application software:
- *Enterprise software* addresses the needs of organization processes and data flow, often in a large distributed environment. (Examples include Financial, Customer Relationship Management, and Supply Chain Management). Note that Departmental Software is a sub-type of Enterprise Software with a focus on smaller organizations or groups within a large organization. (Examples include Travel Expense Management, and IT Helpdesk)
- *Enterprise infrastructure software* provides common capabilities needed to support Enterprise Software systems. (Examples include Databases, Email servers, and Network and Security Management)
- *Information worker software* addresses the needs of individuals to create and manage information, often for individual projects within a department, in contrast to enterprise management. Examples include time management, resource management, documentation tools, analytical, and collaborative. Word processors, spreadsheets, email and blog clients, personal information system, and individual media editors may aid in multiple information worker tasks.
- *Content access software* is software used primarily to access content without editing, but may include software that allows for content editing. Such software addresses the needs of individuals and groups to consume digital entertainment and published digital content. (Examples include Media Players, Web Browsers, Help browsers, and Games)

- *Educational software* is related to content access software, but has distinct requirements for delivering evaluations (tests) and tracking progress through material. It is also related to collaboration software in that many Educational Software systems include collaborative capabilities.
- *Simulation software* are computer software for simulation of physical or abstract systems for either research, training or entertainment purposes.
- *Media development software* addresses the needs of individuals who generate print and electronic media for others to consume, most often in a commercial or educational setting. This includes Graphic Art software, Desktop Publishing software, Multimedia Development software, HTML editors, Digital Animation editors, Digital Audio and Video composition, and many others.
- *Product engineering software* is used in developing hardware and software products. This includes computer aided design (CAD), computer aided engineering (CAE), computer language editing and compiling tools, Integrated Development Environments, and Application Programmer Interfaces.

Computer Applications

Doctoral programmes are centered around computer graphics and experimental approaches to the design of fractals. Applications have been developed for the design of patterns in carpet and textile industry. Applications have also been developed in discrete dynamical systems. Currently the department is investigating Fractal Theory in improving performance of Fractal Antennas and for noise mitigation in communication systems.

The Department also works in Computer Networking and Wireless Communication with the objective to improve the Quality of Service (QoS) by reducing congestion in high-speed communication. Currently work is in progress in developing new techniques for fast communication after a disaster has occurred. The department has produced five research papers in the last two years: three in international journals and two in national journals. To keep itself abreast of latest developments in computer applications, the Department makes extensive efforts to develop partnerships with industry. We have partnered with IBM to offer an intensive training programme for teachers on 'IT Infrastructure Management' and DB2. We also have collaboration with Infosys under their Infosys Connect Programme to offer intensive training for our students.

The Teaching Learning Process at the MCA level uses the latest electronic teaching aids and is characterized by a tight coupling between lectures, tutorial and laboratory work. The former contributes to interactive classroom learning where the student is able to discuss with the teacher and peer students. The latter enables planned learning and optimization of student teacher time to maximize learning.

Types of Educational Institutions

Computer-Integrated Surgical Systems and Technology Engineering Research Center: Developing novel computing methods, interfacial technologies, and computer-integrated surgical systems to revolutionize surgical procedures in the 21st century.

The impact of Computer-Integrated Surgical Systems and Technology (cisst) on medical care procedures within the next 20 years will be as significant as the impact of Computer-Integrated Manufacturing (CIM) Systems and Technology has been on manufacturing over the past 20 years. A novel partnership between human surgeons and machines, made possible by advances in computing and engineering technology, will overcome many of the limitations of traditional surgery. By extending human surgeons' ability to plan and carry out surgical interventions more accurately and less invasively, Computer Integrated Surgery (CIS) systems will address a vital national need to greatly reduce costs, improve clinical outcomes, and improve the efficiency of health care delivery. Further, the combination of consistent execution, patient and task models, and logging of intraoperative and outcome data made possible by CIS systems will produce the same sort of process learning advantages for surgery that have been realized in semiconductor CIM systems.

Computer for Instruction, Computer Aided Instruction (CAI)

Main

The use of computers in education started in the 1960s. With the advent of convenient microcomputers in the 1970s, computer use in schools has become widespread from primary education through the university level and even in some preschool programmes. Instructional computers are basically used in one of two ways: either they provide a straightforward presentation of data or they fill a tutorial role in which the student is tested on comprehension. If the computer has a tutorial programme, the student is asked a question by the computer; the student types in an answer and then gets an immediate response to the answer. If the answer is correct, the student is routed to more challenging problems; if the answer is incorrect, various computer messages will indicate the flaw in procedure, and the programme will bypass more complicated questions until the student shows mastery in that area.

There are many advantages to using computers in educational instruction. They provide one-to-one interaction with a student, as well as an instantaneous response to the answers elicited, and allow students to proceed at their own pace. Computers are particularly useful in subjects that require drill, freeing teacher time from some classroom tasks so that a teacher can devote more time to individual students. A computer programme can be used diagnostically, and, once a student's problem has been identified, it can then focus on the problem area. Finally, because of the privacy and individual attention afforded by a

computer, some students are relieved of the embarrassment of giving an incorrect answer publicly or of going more slowly through lessons than other classmates. There are drawbacks to the implementation of computers in instruction, however. They are generally costly systems to purchase, maintain, and update. There are also fears, whether justified or not, that the use of computers in education decreases the amount of human interaction.

One of the more difficult aspects of instructional computers is the availability and development of software, or computer programmes. Courseware can be bought as a fully developed package from a Software company, but the programme provided this way may not suit the particular needs of the individual class or curriculum. A courseware template may be purchased, which provides a general format for tests and drill instruction, with the individual particulars to be inserted by the individual school system or teacher. The disadvantage to this system is that instruction tends to be boring and repetitive, with tests and questions following the same pattern for every course. Software can be developed in-house, that is, a school, course, or teacher could provide the courseware exactly tailored to its own needs, but this is expensive, time-consuming, and may require more programming expertise than is available.

Computer-Aided Instruction

Computer-Aided Instruction (CAI), diverse and rapidly expanding spectrum of computer technologies that assist the teaching and learning process. CAI is also known as computer-assisted instruction. Examples of CAI applications include guided drill and practice exercises, computer visualization of complex objects, and computer-facilitated communication between students and teachers.

The estimated number of computers in American schools has risen from 1 for every 125 students in 1981 to 1 for every 4 students in elementary and secondary school in 2006. In some schools, pupils are given their own laptop personal computers for homework and instruction. Western European, Canadian, Australian, South Korean, and Japanese schools are likewise highly computerized. Access to computers has also grown in schools in India and China. International groups have joined in efforts to provide computers to students in developing countries in Africa and elsewhere.

Types of CAI

Information that helps teach or encourages interaction can be presented on computers in the form of text or in multimedia formats, which include photographs, videos, animation, speech, and music. The guided drill is a computer programme that poses questions to students, returns feedback, and selects additional questions based on the students' responses. Recent guided drill systems incorporate the principles of education in addition to subject matter knowledge into the computer programme.

Computers also can help students visualize objects that are difficult or impossible to view. For example, computers can be used to display human anatomy, molecular

structures, or complex geometrical objects. Exploration and manipulation of simulated environments can be accomplished with CAI—ranging from virtual laboratory experiments that may be too difficult, expensive, or dangerous to perform in a school environment to complex virtual worlds like those used in airplane flight simulators.

CAI tools, such as word processors, spreadsheets, and databases, collect, organize, analyze, and transmit information. They also facilitate communication among students, between students and instructors, and beyond the classroom to distant students, instructors, and experts. CAI systems can be categorized based on who controls the progression of the lesson. Early systems were linear presentations of information and guided drill, and control was directed by the author of the software.

In modern systems, and especially with visualization systems and simulated environments, control often rests with the student or with the instructor. This permits information to be reviewed or examined out of sequence. Related material also may be explored. In some group instructional activities, the lesson can progress according to the dynamics of the group.

Advantages and Disadvantages

CAI can dramatically increase a student's access to information. The programme can adapt to the abilities and preferences of the individual student and increase the amount of personalized instruction a student receives. Many students benefit from the immediate responsiveness of computer interactions and appreciate the self-paced and private learning environment. Moreover, computer-learning experiences often engage the interest of students, motivating them to learn and increasing independence and personal responsibility for education.

Although it is difficult to assess the effectiveness of any educational system, numerous studies have reported that CAI is successful in raising examination scores, improving student attitudes, and lowering the amount of time required to master certain material. While study results vary greatly, there is substantial evidence that CAI can enhance learning at all educational levels.

In some applications, especially those involving abstract reasoning and problem-solving processes, CAI has not been very effective. Critics claim that poorly designed CAI systems can dehumanize or regiment the educational experience and thereby diminish student interest and motivation.

Other disadvantages of CAI stem from the difficulty and expense of implementing and maintaining the necessary computer systems. Some student failures can be traced to inadequate teacher training in CAI systems. Student training in the computer technology may be required as well, and this process can distract from the core educational process. Although much effort has been directed at developing CAI systems that are easy to use and incorporate expert knowledge of teaching and learning, such systems are still far from achieving their full potential.

History of Computer-Aided Instruction

In the mid-1950s and early 1960s a collaboration between educators at Stanford University in California and International Business Machines Corporation (IBM) introduced CAI into select elementary schools. Initially, CAI programmes were a linear presentation of information with drill and practice sessions. These early CAI systems were limited by the expense and the difficulty of obtaining, maintaining, and using the computers that were available at that time.

Programmed Logic for Automatic Teaching Operations (PLATO) system, another early CAI system initiated at the University of Illinois in the early 1960s and developed by Control Data Corporation, was used for higher learning. It consisted of a mainframe computer that supported up to 1000 terminals for use by individual students.

By 1985 over 100 PLATO systems were operating in the United States. From 1978 to 1985 users logged 40 million hours on PLATO systems.

PLATO also introduced a communication system between students that was a forerunner of modern electronic mail (messages electronically passed from computer to computer).

The Time-shared Interactive Computer-Controlled Information Television (TICCIT) system was a CAI project developed by Mitre Corporation and Brigham Young University in Utah. Based on personal computer and television technology, TICCIT was used in the early 1970s to teach freshman-level mathematics and English courses.

With the advent of cheaper and more powerful personal computers in the 1980s, use of CAI increased dramatically. In 1980 only 5 percent of elementary schools and 20 percent of secondary schools in the United States had computers for assisting instruction. Three years later, both numbers had roughly quadrupled, and by the end of the decade nearly all schools in the United States, and in most industrialized countries, were equipped with teaching computers. A crucial development for CAI has been the vast expansion of the Internet and the World Wide Web, consortiums of interlinked computers. By connecting millions of computers worldwide, these networks enable students to access huge stores of information, which greatly enhances their research capabilities.

Personalising Learning and Teaching

Put simply, personalising learning and teaching means taking a highly structured and responsive approach to each child's and young person's learning, in order that all are able to progress, achieve and participate. It means strengthening the link between learning and teaching by engaging pupils – and their parents – as partners in learning. Some of the best schools and the best teachers are already demonstrating what these aspirations mean in practice. However, for them to be achieved for all children and young people, in all schools, all of the time, there will need to be changes both to the way the education system operates and to the practice of many teachers.

Personalisation so Important

Personalisation is a matter of moral purpose and social justice: pupils from the most disadvantaged groups are the least likely to achieve well and participate in higher levels of education or training. Personalisation also reflects wider changes in society, which are likely to continue at an increasing rate. Together, these present the education system with its most acute challenges. They mean that expectations of what all children and young people could and should achieve must be raised, along with schools' capacity to ensure that outcomes for pupils match those expectations.

Persistent Attainment Gaps

We recognise the achievements of pupils, teachers, schools and government in raising overall standards over the last ten years (as measured by national assessments at the end of Key Stages 1, 2 and 3 and by public examinations such as GCSE). However, the country cannot accept a situation in which over 20% of children leave primary school without a solid foundation in literacy and numeracy or one in which over 10% of 16 to 18 year olds are not in education, employment or training.

It seems clear to us that the education system will not achieve the next 'step change' in raising standards simply by doing more of the same: a new approach is required. Increasingly rich data now allow national and local government, as well as schools and individual teachers, to acknowledge that there are still too many children and young people who do not achieve or who fail to make good progress through primary and secondary school. The over-representation of particular groups of pupils amongst the lowest attainers results in attainment 'gaps'.

While some gaps have narrowed, for example, for black and minority ethnic pupils, others have proved to be extremely persistent nationally. This is despite overall improvement in the attainment of all groups of pupils. For example, the difference in the proportion of boys and girls achieving the expected levels in English at the end of primary school has remained fairly static since 1999 and the gap in average attainment at Key Stage 2 between pupils eligible and not eligible for free school meals has not decreased significantly.

In international comparisons, while England ranks relatively highly for overall achievement, a considerable tail of underachievement is evident, most notably in reading.

The gaps persist in part simply because they are difficult to rectify: the factors that contribute to them are complex and inter-related. These include individual attitudes, beliefs and expectations of pupils, parents and teachers. Closely linked to these are deep-seated social challenges, such as urban regeneration, economic development and migration. However, the gaps also persist because, for too many pupils, school does not engage them or equip them with the skills they need.

The Challenges Ahead

Although there are detectable trends in English society, relatively few aspects of the future can be predicted with accuracy and confidence. Meeting the challenges – both those outlined here and those yet to come – will place demands on all parts of the education system. Personalising learning offers structured ways to respond to these demands. For personalisation successfully to meet the learning needs of all children and young people so that they make good progress, it must face up to and reduce the persistent and unacceptable gaps in average attainment between different groups of pupils. A sharp focus is needed on the essential knowledge, skills, understanding and attitudes which children and young people require in order to thrive in a changing world.

Functional literacy and numeracy are vital: it has become almost impossible to succeed without them. If pupils' oral and literacy skills are not secure when they leave primary school, they will find it very difficult to access the secondary curriculum. Without decisive intervention, they are likely to lose confidence in their abilities and their motivation to learn will decline. As boys tend to place a lower value on language and literacy than do girls, and to have a lower opinion of their ability in this area, low literacy levels are likely to have a greater impact on subsequent attainment for boys than for girls.

The number of factors contribute to the capability of children and young people to engage in learning and to make the most of their educational opportunities.

These include being able to make good choices and decisions; an understanding of the impact of their actions – 'if I do *this*, predictably and consistently *that* will happen' – and how to influence events; and the ability (and desire) to concentrate, apply themselves to a task and persevere.

The recently published report from the Institute of Public Policy Research (ippr), *Freedom's Orphans*, analyses the increasing importance of these 'non-cognitive' factors in determining outcomes, from educational attainment to employment prospects, and in securing greater social cohesion.

The report also highlights evidence that some children are less likely to have access to experiences that help them to develop these skills and attitudes. Consequently, while activities to promote such development are of value to all children and young people, they are of particular value to certain groups in closing the attainment gap.

These skills and attitudes are as important in further and higher education as in the workplace. However, the National Curriculum gives them relatively little weight and they are measured, recorded and reported inadequately by national tests and most public examinations. As a result, they are in danger of being neglected by teachers and undervalued by pupils and their parents at a time when they matter more than ever.

The best schools are already succeeding in narrowing the gaps. They are achieving very different outcomes for their pupils compared with other schools with similar pupil profiles. A strategy for closing the gap through personalising

learning will therefore draw heavily on solutions adopted in schools where pupils 'buck the trend'. Such solutions may also be drawn from the experience of different types of schools, including special schools, which have considerable expertise in helping children with additional needs make good progress.

However, schools cannot be held solely responsible for 'closing the gap'. Schools in communities damaged by generations of underachievement, unemployment and social fragmentation rightly expect other agencies to help them tackle systemic barriers to raising the aspirations of children, parents and teachers. Local implementation of the Every Child Matters agenda offers the opportunity to improve continuity and progression in learning for children at risk of falling behind.

The Response so Far

All schools recognise these challenges. Some have identified the potential of personalising learning to offer a framework for their response, and have set about the task with energy and enthusiasm. Others are sceptical that personalising learning provides a path to improvement. Many fall between these extremes. Those schools that have responded most effectively to the challenges and opportunities of personalising learning recognise that they do not have all the answers. However, they do provide evidence of the kinds of deep changes that are likely to be necessary in tackling those challenges and opportunities.

The education system is already changing in response to the challenges of the 21st century. This will and must continue, testing ways in which the challenges of a still uncertain future can be tackled. To support this, not only will the education system need to build on the foundations for personalizing learning that are already in place, in schools and reflected in government policy; in addition, it must find new ways of meeting the needs of all children and young people. Decisions made by schools, national and local government and agencies in the short term could and should have a powerful and lasting effect on the character and quality of schooling in 2020.

Twelve Principles of Effective Teaching and Learning

These twelve principles are intended as guidelines to faculty and administrators interested in the improvement of teaching and learning. The list is derived, in part, from a study co-sponsored by the American Association for Higher Education and the Education Commission of the States (AAHE Bulletin, March 1987). That study reported seven principles of good practice and six powerful forces in higher education which has been extracted from fifty years of research on teaching and learning in higher education. Teachers' knowledge of the subject matter is essential to the implementation of important teaching tasks. Teachers who know their subject matter thoroughly can be more effective and efficient at organizing the subject matter, connecting the subject with the students' previous knowledge, finding useful analogies and examples, presenting current thinking on the subject, and establishing appropriate emphases.

Active involvement of the learner enhances learning. Learning is an active process which requires that the learner work with and apply new material to past knowledge and to everyday life. Some of the methods that encourage active learning in the classroom are: discussion, practice sessions, structured exercises, team projects, and research projects. In the words of William James:

Teaching without an accompanying experience is like filling a lamp with water. Something has been poured in, but the result is not illuminating.

Interaction between teachers and students is the most important factor in student motivation and involvement: Interaction between students and faculty, particularly informal interaction, is one of the most important factors in student motivation for learning. The opportunity to know a few faculty well often enhances students' intellectual commitment and provides valuable rolemodeling.

Students benefit from Taking Responsibility for their Learning

Students are more motivated when they take control of their own learning. This is the belief which has stimulated active interest in self-directed learning.

There are many Roads to Learning

Students learn in different ways and vary in their abilities to perform certain tasks. Understanding that each student has unique strengths and weaknesses related to the ways in which they approach learning is an important component of effective education. Providing a variety of learning activities for a class enables individual students to choose the activity which is the most effective for them at the moment.

Expect more and you will Achieve more

Simply stated, if an educator conveys to students that he or she believes in their ability to succeed learning is enhanced.

Learning is Enhanced in an Atmosphere of Cooperation

Learning is enhanced when it is perceived as a collaborative and cooperative effort between students. The opportunity to share ideas without threat of ridicule and the freedom to respond to the ideas of others increases complexity of thinking and deepens understanding.

Material must be Meaningful

If new material is presented in a pattern or framework that the learner can perceive, it is more readily learned and retained. New material will be more easily learned if the learner is helped to see its relationship to what s/he already knows. Material which is seen by the learner as relevant to his or her own problems and experiences will be more readily learned.

Both Teaching and Learning are Enhanced by Descriptive Feedback

Without feedback neither learner nor teacher can improve because they will not know what they need to know or to what extent they are fulfilling their

goals. The learners' behaviour will more quickly reach the objectives if they are informed (or given feedback) frequently about the correctness of their responses. Correct responses should be immediately reinforced to increase the "permanence" of learning. A positive reinforcer is anything that will increase the probability that the desired behaviour will be repeated. A smile or comment to let the learner know he or she has successfully completed the task is especially good because awareness of successful completion is, in itself, the most effective of all reinforces.

Feedback about progress is helpful because learning is facilitated when the learner is aware that he or she is progressing towards the goals.

Critical Feedback is only useful if the Learner has Alternatives to Pursue

There is no use giving teachers or students feedback about their performances unless they can do something about it, that is, unless they have some alternative course of action or behaviour.

Time Plus Energy Equals Learning

Lectures or seminars that are cancelled will not help the learner. Conversely, teachers who arrive at their lecture or small group setting a little before the scheduled time and stay around for a few minutes afterwards provide opportunities for valuable interaction between students and teachers. Office hours also help students to arrange time to talk with teachers. Students must learn how to organize their time so that they can find time to study. And the curriculum must be organized to allow students time to study.

Experience usually Improves Teaching

Experience is associated with increasing teacher effectiveness for some teachers, probably for those teachers who obtain feedback about their teaching and who are flexible enough to modify their methods in response to the feedback.

The Assessment of Open Learners

All forms of assessment, in open learning and in education and training in general, can be said to disadvantage some learners. For example, unseen written exams favour candidates who happen to be sured at preparing for and sitting such exams, and so on. The following suggestions aim to help you to allow all of your open learners the opportunity to show their potential at its best in at least some of the assessment formats they encounter.

1. *Remind yourself of why learners are being assessed:* Is it to measure their performance overall? Is it to certify their achievement in particular areas of competence? Are the learning outcomes associated with their open learning being assessed alongside other outcomes that they covered in class-based situations? The reasons for assessing your learners should inform the choices of the forms in which they are assessed.

2. *Look again at each intended learning outcome:* Ask yourself 'what is the most appropriate way to measure achievement of this?' Check that what is being assessed is not just the ability of learners to *write* about something that they have understood, nor just their ability to *make decisions* about a particular cross-section of what they have learnt. To be valid, the overall assessment should aim as far as possible to measure how well your learners have achieved each of the intended outcomes.

3. *Try to triangulate assessment:* Especially with important learning outcomes, look for more than one way of measuring them. This can help to find those open learners who may have achieved the outcome concerned, but whose assessment technique may let them down in one form of assessment, but who demonstrate their achievement much more successfully with another form. Maybe in such circumstances, it should be the best performance which is included in the overall assessment.

4. *Don't measure the same skills over and over again:* For example, marked essays and reports tend to favour candidates who are skilled at performing well in these formats, and who write purposeful introductions, coherent 'middles' and robust conclusions. While these skills are useful, it is not desirable to reward them time and time again. Use such assessment formats sparingly, and measure these skills well, but not repeatedly.

5. *Look at the advantages of short-form assignments:* For example, getting open learners to write an essay plan instead of an essay, or a short-form report instead of a full one, can cause them to do almost as much thinking as they would have done for a full essay or report. The essay plans or short-form reports are much less of a burden to assess, and can be assessed at least as objectively as would have been the case with the longer alternatives.

6. *Involve open learners in applying assessment criteria:* Give your learners opportunities to 'mark' past examples of essays, assignments, reports, and so on. This can alert them to successful practice and things to avoid! More importantly, getting learners to use assessment criteria lets them in on the assessment culture in which they are working, and helps them see what will be looked for in their own work in due course.

7. *Consider coupling self-assessment with tutor-marked or computer-marked assignments:* Most assessment forms play their part in driving learning, but this is a way to make at least some assessments enhance learning too. For example, asking open learners to complete a self-assessment proform along with assignments sent in for tutor-marking helps to ensure that learners derive additional learning payoff, both from their reflections on their work before marking and from feedback from tutors *about* their self-assessment. While it can be argued that some assessments are intended to be summative, and that feedback is not the real agenda in such cases, it is still possible to build some self-assessment into such assignments.

8. *Look for alternative ways in which open learners can demonstrate the success of their learning:* These are numerous alternatives to written essays or reports. These include posters, portfolios of evidence, and presentation given by learners to groups of their peers (which is possible, for example, when open learning pathways are being used in college-based courses). Each different alternative allows some learners the opportunity to show their achievements in ways that may be more comfortable (and more successful) than they would have been in, say, formal exams or traditionally assessed coursework.

9. *Consider the part that can be played by electronic communication:* Tutor-marked assignments can be sent electronically, and increasing proportion of open learners find working on computers preferable to picking up pen and paper. Feedback can be returned to them by e-mail too, including marking up their work with feedback comments and sending it back to them. This can work equally well as a means of assessing learners at a distance, or students studying role learning elements in college-based courses. In either case, time some costs (for example paper, postage, and admini-stration) can be saved by using technology, where such technology is already available to learners.

10. *Consider peer-assessment possibilities:* Even if peer-assessment does not count significantly in the context of the overall assessment framework, the amount of feedback that open learners can give each other (face-to-face or using electronic communication) is well worth the time spent setting up peer-assessment opportunities. Looking at someone else's attempt at an assignment can often teach open learners even more about their own attempt than they may have gained from direct feedback from a tutor.

Methods of Teaching and Learning

The variety of teaching and learning methods which is used within a course is an important ingredient in creating a course with interest to students. A course with a large proportion of its teaching taking place in lectures will need to have a high level of intrinsic interest to students to keep them engaged. Over the past few years, a wide range of different teaching and learning methods have been introduced and tested, often with the aim of developing skills which more didactic methods are poorly adapted to do.

There is a substantial literature on these methods and on how best to use them. It is not possible here to provide great detail on every possible teaching and learning method, so instead we have focused on some of the issues which could be considered by course teams when choosing the components of their course. A useful document to refer to is the Guidelines for Promoting Effective Learning, produced by the Centre for Research on Learning and Instruction and also available in the TLA Centre.

Lectures

Fifty-minute lectures remain the core teaching method for most undergraduate courses. Their role is best suited to providing an overview of the subject matter and stimulating interest in it, rather than disseminating facts. Lecturing to large classes is a skill which not all staff have acquired and some are not comfortable in this role, and so, where possible, a course organiser is advised to try to spread the lecturing load so as to favour those staff with best skill at it, although freedom of action in this respect is often limited!

All students appreciate good quality lectures, and the key ingredients are:
- Clear objectives;
- Clear overhead acetates or slides;
- A paced delivery;
- Appropriate handouts which provide students with complex diagrams or difficult or critical text.

This should not be viewed as spoon feeding. It is part of the process of ensuring that students take away the important elements from a lecture, irrespective of how well the lecture was delivered on the day. Good handouts also help to avoid the communication difficulties which can arise in any lecture where large numbers of students are present.

As class enrolments have risen and lecture theatres are used continuously, ease of access by students to the lecturer at the end of a lecture has been reduced. Providing agreed times and places, as soon as possible thereafter, when they can get questions answered is becoming an important issue. A more radical approach to the problems of the large 'performance' lecture is to consider the extent to which some lectures could be removed entirely and replaced by structured exercises. To some degree, those students who do not attend lectures follow this path anyway!

Tutorials and Seminars

After the lecture, this is probably the next most widely used teaching method. The distinction between what is a tutorial and what is a seminar is woolly - to some it depends upon size whereas to others the seminar has a different structure and different objectives. This last point - objectives - is certainly the most important issue, and it is probably here that most confusion exists in students' minds, and sometimes in tutors' minds too. Clarity of objectives is more important for tutorials than for lectures, in that there is general agreement and expectations for lectures whereas there is certainly greater divergence for tutorials. Much tutorial work is carried out by part-time staff, especially for courses in the first two years, and they too need to be clear about what they are trying to achieve with their students. When asking students about tutorials, the paradoxical finding that they complain about them but ask for more/more frequent tutorials is perhaps closely related to their perception of their need for small group support but lack of clarity about what they should be getting out of what is provided.

Making explicit what students should get out of tutorials can be quite a taxing exercise for the course organiser. A new addition to the tutorial format is that of electronic tutorials via e-mail, sometimes managed in a WWW forum such as HyperNews. Although rather few courses outside those which are traditionally computer-oriented have experimented with these methods, they hold out promise for those courses where students are difficult to bring together or to enable exchanges between face-to-face sessions. The active nature of the tutorial/seminar makes it the main source for students to acquire some of the 'personal transferable skills', *e.g.,* in presentation and group work.

Laboratory and Practical Classes

For science subjects, laboratory work is an essential ingredient of the course and some component of this is generally preserved, even though the amount may fall. In addition to the experience of lab work, students often derive a lot of their contact with staff in the lab setting, and compensation for this may be needed if lab time is significantly reduced. High quality lab work is expensive to provide, and it is important that we are sure that students do indeed gain all that they might from it, especially as the number of students present may have increased, more part-time demonstrators are used, and the frills have been trimmed to cut costs. The balance between fewer but better labs and more but simpler is not always easy to find, but is an important consideration.

Other Teaching Methods

Other methods that may be considered are numerous, including:
- Workbooks, diaries, and lab notebooks;
- Computer-based methods;
- Fieldwork;
- Learning in hospital wards and clinics;
- Independent learning tasks;
- Essays, dissertations and projects;
- Library searches;
- Portfolios;
- Posters;
- Videos.

Judicious use of them gives students the chance to use a variety of learning techniques so that each gets one or more which suits them best. If you find a possible method but are unsure how best to introduce it to your course, search out someone who has used it and pick their brains. You will probably find that TLA Centre can point you to such people, even if they may not be in the University of Edinburgh.

Students with Disabilities

The University has growing numbers of students with disabilities who may present particular challenges to courses with large numbers of students. For

example, a profoundly deaf student may be able to follow a lecture with the help of a sign language interpreter, but will not be able to take notes at the same time. A blind student may need special help with practical sessions. It is not possible to give detailed general advice on making the variety of teaching and learning methods described in this manual accessible to disabled students. However, the kind of support which they are likely to find helpful - *e.g.,* provision of good handouts - often benefit all students. Students with disabilities are students first and foremost, and in many cases a little thought and ingenuity on the part of lecturing staff is all that is required in order to allow them full benefit from their classes.

Computer Supported Learning

Just as it will be the course organiser's responsibility, in consultation with colleagues contributing to the course, to co-ordinate the availability of resources in the Library all other aspects of resource-based learning will require forward planning with which the course organiser will have to be involved. Various learning technologies are increasingly being used in support of the learning process, presenting new challenges and opportunities for staff and students. A major resource being used more frequently is the World Wide Web. An example of its use in presenting information about course content is given in Case Study 1 at the end of this stage. Wholesale importation of computer-based learning activities across the curriculum is unlikely to be a wise or desirable move for any course. CBL enthusiasts have been predicting significant gains in quality and efficiency of the teaching and learning process for many years, but the realities have, as yet, been less clear cut. On the other hand, computer-based approaches in education have been subjected to more demanding criteria of evaluation than the more traditional approaches have ever had to face. One of the real benefits of the recent interest in new learning technologies has been the reassessment of our more familiar approaches, which has in itself been useful. There are undoubtedly areas of the curriculum, however, in which the appropriate and targeted use of learning technologies will be of considerable importance, affording students the opportunity to engage with materials and resources which would otherwise be impossible.

In particular, the confluence of computer and communication technologies suggest exciting possibilities for the use of computer-mediated communication, in the form of electronic mail or computer conferencing systems, in support of tutorial and group work.

While students are facing increasing financial pressures, with the implication that many are functionally in part-time education, the asynchronous communications with teachers and peers which CMC potentially offers can ease conflict between employment and study. Many subjects, from Fine Art to Neuroanatomy, will benefit from the possibility of networked access to high quality images which may be in short supply, if not completely inaccessible, in the printed form. Computer simulations of practical exercises can allow us to address some

of the problems inherent in teaching large classes, provide access to experimental domains which would not otherwise be possible for reasons of cost or personal safety, and circumvent many of the ethical difficulties associated with some areas of research. Many organisations and agencies exist which can provide help to the teacher or course organiser wishing to become involved with the use of IT in the curriculum.

Using e-mail to Support Open Learning

Electronic communication is addictive! To most people who have already climbed the learning curve of finding out how to use e-mail, the apprehension they may have experienced on their first encounters fades into insignificance. E-mail can be an important medium in open learning. The following suggestions may help you to maximize some of the benefits it can offer to you and to your learners.

1. *Make sure that learners get started with e-mail:* Write careful, step-by-step briefing instructions for you learners. The computer literate people may hardly do more than glance at these before getting into the swing of using e-mail. However, for those people who lack confidence or experience with computers, these instructions can be vital and comforting until they become familiar with the medium.

2. *Decide what you really want to do with e-mail:* There are numerous purposes that e-mail can serve, and you need to ensure that the purpose is always clear to your learners. If they know *what* it is being used for, and *why* e-mail has been chosen for this, they are much likely to get more out of it.

3. *Make the most of e-mail:* Although you may just want be use e-mail for routine communication with (and between) learners, there are many more uses that the medium can lend itself to. Think about the possible uses of sending attached files, such as documents, assignments, digitally-stored images, sounds and video recordings. All of these can be edited or marked, and returned to learners, in the same ways as simple messages.

4. *Make most messages really brief and to the point:* Few people take much notice of long e-mail messages. If something takes more than one screen, most readers either dump them or file them. Also encourage your learners to make good use of the medium, and to send several short messages rather than to try cramming lots of points into a single missive.

5. *Take particular care with your e-mail message titles:* It can take ages to search for a particular e-mail if it is not clear what each message is about. The computer software can sort messages by date and by sender, but it is more difficult to track down topics. Two or three well chosen keywords make the most useful titles.

6. *When you send a long e-mail, explain why and what to do with it:* For example, from time to time you may want to send learners something

that you do not expect them to treat as a normal e-mail message, but perhaps to print out and study in depth. It makes all the difference if they know what they are expected to do with longer messages.

7. *Think about using e-mail to give feedback on assessed work:* It can be much quicker to compose e-mail replies to individual learners than to annotate their written work. It is also quite easy to give feedback on work submitted electronically, such as by adding *your* comments and notes in upper case to distinguish them from the original work, or (if your system permits this) by using a different colour or an alternative font for your feedback.

8. *Make the most of the lack of time constraints:* One of the most significant advantages of e-mail as a vehicle for feedback is that learners can view the feedback when they have time to make sense of it. They can store it until such time becomes available. They can also look at it as often as they wish to, and you can keep copies of exactly what you said to each individual learner.

9. *Be available!* When learners are accustomed to e-mail, they expect quick replies to their queries. If you are going to be away from your access to the system for more than a day or two at a time, it is worth letting all your learners know when you will be back online.

10. *Make the most of the speed:* Giving feedback by e-mail to learners at a distance obviously reduces delays. The sooner learners get feedback on their work, the more likely it is that their own thinking is still fresh in their minds, and the feedback is therefore better understood.

11. *Encourage learners to reply about your feedback:* This lets you know that it has been received but, more importantly, gives them the chance to let you know how they *feel* about the feedback you have given to them, or the mark or grade that you have awarded them.

12. *Use e-mail to keep a dispersed or distant group of learners together:* Sending out circular notes not only helps individuals to feel part of a community of learners, but also reminds them about important matters such as assessment deadlines, or problems that have arisen with course materials or updates to interesting materials that have been discovered on the Internet.

13. *Remember those learners whose access to e-mail is difficult or impossible:* One of the disadvantages of using e-mail as a means of communication on open learning programmes is, that if some learners have problems with access, they can become .... disadvantaged. You may need to find ways of compensating through other means for those things they miss out on.

Using Computer Conferencing for Open Learning

There are several parallel names for this, including computer-mediated communication (CMC), computer-supported cooperative learning and, more

simply, online learning. Whatever we call them, computer conferences can be of great value in open learning schemes, especially where the learners are geographically dispersed, but working on similar timescales. Many of the suggestions made about e-mail continue to apply, but in this section I would like to alert you to some of the additional factors to consider with computer conferences. The following suggestions may help you to maximize the benefits that your learners can derive from computer conferencing.

1. *Note the differences between computer conferencing and other forms of electronic communication:* The distinguishing feature of computer conferencing is that many people can see the same contents from different places and at any time. The contents 'grow' as further notes and replies are added by participants. Most systems automatically alert participants to 'new messages' that have been added since they last viewed the conference, and allow these messages to be read first if desired.

2. *Regard computer conferences as virtual classrooms, seminar rooms and libraries:* Computer conferences can be each of these. They can provide a virtual classroom, where the whole student group can 'meet'. They can be used to provide a virtual seminar room, closed to all but a small learning group of around six students. They can function as virtual libraries, where resource banks and materials are kept. They can also function as student-only gossip areas. Each of these ways of using computer conferences can emulate electronically the related best practice in face-to-face learning environments.

3. *Get involved in computer conferencing situations yourself first:* If you have access to e-mail or the Internet, one of the best ways to pave the way towards putting computer conferencing to good use with your open learners is to participate yourself. For example, join some discussion lists and experience at first hand the things that work and the things that go wrong with such means of communication.

4. *Explore the computer conferencing system from which you can choose:* There are several systems available around the world, each with their own formats, features and idiosyncrasies. If most of your open learners are not particularly computer literate, go for a system that makes it as easy as possible to log-on and to add messages.

5. *Make sure that all of your open learners will be able to access all the conferences which you want them to:* Ideally, you may also intend them to be able to download and/or print chosen extracts from the conference for their own personal study purposes. You can only build a computer conference into an open learning programme as an essential component if all of your learners are able to participate. If the conference is just an optional extra for those able to join it, other learners who cannot may be able to claim to have been disadvantaged.

6. *Provide good 'start-up' pages:* These are essentially the main topics of the conference and are listed sequentially in the main directory of the

conference. Conferencing takes place when participants add 'replies' to these pages. The replies are normally listed in the sub-directory of each start-up page in the order in which they are received.

7. *Make each screen speak for itself:* Especially with 'start-up' pages, which introduce each topic in the conference, it is best that the essence of the main message takes up less than a single screen. Further detail can be added in the next few pages (or 'replies'). Encourage learners contributing their own replies to keep them to a single screen whenever possible, and to send several replies with different titles rather than one long reply addressing a number of different aspects.

8. *Use the conference as a notice board:* Get into the habit of making the conference *the* best way to keep up with topical developments in the field of study, as well as administrative matters such as assessment deadlines, guidance for learners preparing assessments, and so on. Try to make it necessary for learners to log-on to the conference regularly; this will result in a greater extent of active contribution by them.

9. *Use the conference as a support mechanism:* This can save a lot of tutor time. Elements of explanation, advice or counselling that otherwise may have had to be sent individually to several different open learners can be put into the conference once only and remain available to all. Whenever your reply to an enquiry or problem raised by an open learner warrants a wider audience, the conference is there to do this.

10. *Make the conference a resource in its own right:* Add some screens of useful resource material, maybe with 'hot-links' to other Internet sources that are relevant. It is useful if some such material is *only* available through the computer conference; this ensures that all your learners will make efforts to use it.

11. *Try to get learners discussing and arguing with each other via the conference:* The best computer conferences are not just tutor-student debates, but are taken over by the students themselves. They can add new topics, and bring a social dimension to the conference.

12. *Consider having some assessed work entered onto the conference:* If learners *have* to make some contributions, they are more likely to ascend the learning curve regarding sending in replies, and to do so more readily in non-assessed elements too. One advantage in having an assessed task 'up on the conference' is that each open learners can see everyone else's attempts, and the standards of work improve very rapidly.

13. *Think about the possibilities afforded by audio-conferencing and video-conferencing:* Either, or both, of these processes can be used very effectively to support open learners to help them to learn from each other and to reduce their isolation. Some of my suggestions about audiotapes and video, mentioned earlier in this chapter, can be linked

with the advice above about interaction and communication, to make audio-conferencing and video-conferencing play valuable roles. In particular, it is important to ensure that there are definite, agreed purposes for each occasion where such conferences are used, as well as the freedom to follow up matters which arise during each conference.

Using Multimedia for Open Learning

Learning packages can contain, or refer out to, range of other kinds of material. We explored the use of tapes in a separate set of suggestions, but the present set aims to alert you to the questions you should be asking yourself about *any* medium. This could range from CD-ROMs, the Internet, intranets, interactive videos, and anything which adds sounds, still pictures, moving images, graphics to the experience of learners working through open learning materials.

1. How does the medium help open learners' motivation? Ideally, any multimedia component should help open learners to want to learn from them. If there are too many steps to getting going with the multimedia elements, there is the danger that learners can be put off and maybe stopped in their tracks.

2. Can the medium be used to provide some learning-by-doing? Perhaps the biggest danger with some multimedia packages is that however sophisticated the media used, open learners may only be spectators rather than players. Where it is not possible to cause learners to interact directly with the materials, it remains possible to get them to make decisions, answer questions, summarize conclusions and to write down these for later reference.

3. Can the medium be used to give open learners feedback? The danger is that the information presented using multimedia is often fixed, and cannot then respond to what open learners may be thinking about it, or to the problems or misunderstandings that may be in their minds. It is best to ensure that some self-assessment questions address directly any important information presented in multimedia formats, so that feedback responses can be designed for learners to address such difficulties.

4. How does the medium help open learners to make sense of things? There are often excellent answers to this question. For example, sounds pictures, moving images and colourful graphics can all play useful parts in helping open learners to get their heads around things with which they have been grappling.

5. Why is this medium better than other, cheaper media? For example, why is a computer-based package better than a print-based one? There are many good answers to this question. The best answers are when the medium chosen does something that just cannot be done by other media, for example, moving pictures showing body language and facial expression, where such dimensions are crucially important for getting particular messages or attitudes across to open learners.

6. How relevant will the medium-based element be to the overall learning programme? One of the dangers with media-based learning is that too much 'nice-to-know' material may be involved, and not enough emphasis placed on 'need-to-know' material, and that open learners may not easily be able to distinguish the two categories.

7. How will the choice of medium affect open learners' opportunities to learn? For example, will they only be able to study the particular elements concerned when they are sitting at a networked computer terminal or when logged on to the Internet? Will this mean that they have frequently to stop learning until they can gain such access? Will there be alternative coverage of these elements of learning for any learners who have not got easy access to the medium, and can it be guaranteed that they will not end up disadvantaged?

8. How easy will it be to edit and change the medium-based elements? Open learning materials are never 'finished'. There are always adjustments and changes that are indicated from piloting, feedback from learners and from assessments measuring how well learners actually succeeded in their learning. Some media are much easier to edit and change than others. Changing a CD-ROM or videodisk is a much more complex (and more expensive) business than changing a file in a computer-based package.

9. What other media could have been used? There is rarely just one way to package up a particular element of learning. It is useful to explore at least two or three alternative ways of using media to deliver each element of learning, and then to make an informed decision about *why* a particular medium is chosen.

10. How will learners revise and consolidate what they have learnt from the medium? What will they have to take away? Will they be able to make a structured summary of what they learnt while working with the medium, which will bring all the important points back to their minds when looking at it later?

8

Preparation of Teaching Aids

The different types of teaching aid material mentioned above can be procured from the variety of sources. It can be borrowed from the audio-visual libraries, institutes or departments. Being priced commodity, it can be purchased from the commercial establishments. However, educa-tionally as well as economically it is always better to get them prepared in the schools itself. Consequently, the teacher has to share the big responsibility of guiding his students in the preparation of such material. For this purpose, he must try to acquire the necessary knowledge and skills for its proper preparation. Consequently let us try to discuss some essentials regarding the preparation of the important types of teaching aid material generally used in the Computer Science Education & Teaching.

Preparation of Charts

Various types of charts are frequently used in teaching concepts, principles, processes and applications, *etc.* in Computer Science. Therefore a teacher of Computer Science must try to learn the basics for the preparation of these carts. For this purpose one can begin with the task of learning simple sketching and line drawing for the necessary visual display in the charts. As a result with some practice one can acquire necessary confidence in the drawing and preparing of different types of charts like time charts, table charts, flow charts, tree charts, *etc.* for the better. The following points may be kept in mind in their preparation:

(i) In view of the teaching-learning requirement, it should be properly considered that what is that which is to displayed and conveyed through the chart in preparation.

(ii) How can the required ideas and information be represented through the lines, sketches, figures and symbols of the charts should be properly analysed. For this purpose it is better to draw some rough sketches, designs and patterns and then selected the most appropriate one for the actual drawing.

(iii) The selected rough pattern, design or plan should then be carefully transferred into the chart under preparation with the help of neat and clear of the lines, figures and sketching, *etc.*

(iv) In the last, due care should be taken in colouring and lettering of the charts as to give it an appealing outlook and making it self-explanatory for the clarification of some teaching points.

Preparation of Pictures and Diagrams

After getting practice in the drawing of simple sketches and figures on charts, the teacher should learn and practice the drawing and preparation of some difficult graphics like pictures and diagrams. In the beginning, it becomes quite difficult to draw them in the way these are being drawn in the textbooks or other printed media. The beginning, therefore, should be made with the task of their copying by resorting to the techniques outlined below:

Tracing

In this technique a tracing paper is placed over the printed figure or picture. Since every thing is visible through the tracing paper therefore it becomes quite easy to trace or copy the visible figure or picture on the paper with the help of a properly sharpened pencil. After getting the copied sketch, the attempts should be made to equip it with suitable colour and proper shades.

In both these appliances the top consists of plane glass and there lies beneath a source of strong light. *i.e.*, high-powered lamp for illuminating the picture or copying material placed over the glass top.

As a result when a piece of paper on the illuminated picture or figure the tracing task becomes quite easy and one can easily sketch the desired figure and picture. Later on, he can add colours and provide shading for making it more attractive, visible and worthwhile experience.

TEACHING IN AREAS OF FORMAL PREPARATION

The evidence base on the effects of teaching in or out of one's area of preparation is relatively small. Results of extant research suggest that assigning teachers to subjects or areas of the curriculum in which they have formal preparation and certification is important. There is a significant, positive relationship between formal preparation and quality of instruction and student achievement. Goldhaber and Brewer (2000) recently have reported such evidence in the areas of secondary school science and math, for example.

HOMEWORK

Our understandings about the forms and effects of homework is primarily informed by a series of extensive reviews of evidence carried out by Harris Cooper. The corpus of individual studies included in these reviews runs in excess of 120. Harris' reviews indicate that homework has both positive and negative effects. On the positive side, homework may contribute to immediate achievement in learning, long-term academic outcomes, independent problem-solving as well as less directly academic capacities such as greater self direction and greater self discipline. Parents also may become more involved in the schooling of their children, another positive effect.

Evidence concerning homework also suggests possible negative effects such as students' loss of interest in academic material, fatigue, lack of opportunity for leisure and community activities, as well as pressure from parents. Homework sometimes exacerbates differences between high and low achievers. Evidence about both the positive and negative effects of homework by now is quite robust.

These homework effects vary by the age and grade level of students. Positive homework effects are greatest for secondary school students but diminish by about 50 percent for students in grades seven and eight. Homework appears not to foster additional learning among elementary students, although small amounts are sometimes advocated for their contribution to good work habits and the like.

The positive effects of homework for junior and senior secondary students are most likely to occur when homework material is not too complex or novel. Furthermore, homework effects peak for junior high school students after one to two hours a night. Secondary school students can expect effects over longer periods of time.

STUDENT GROUPING

The grouping of students for instruction is influenced by decisions made at both the school and classroom levels, and decisions at both levels often require intervention by those assuming leadership roles. This is because both heterogeneous and homogeneous ability-grouping practices are advocated for the accomplishment of the same goals.

At any point over at least the last 50 years, a synthesis of available empirical evidence would have suggested, quite unambiguously, that students having difficulty at school, especially those disadvantaged by their socioeconomic backgrounds, learn more when they are working in heterogeneous rather than in homogeneous ability groups. Relatively high expectations for learning, a faster pace of instruction, peer models of effective learning and curricula that are more challenging are among the reasons offered for this advantage.

In spite of this evidence, over this same period, the vast majority of teachers and administrators have enacted practices that separate students by ability; their argument is that homogeneous grouping produces greater learning by allowing

for the concentration of instructional resources on the same set of learning problems. Many teachers have regarded implementing heterogeneous grouping practices in classrooms as very difficult. Nevertheless, this is one of the rare examples of professional "common sense" being just plain wrong.

Changing the common sense beliefs of teachers about heterogeneous grouping effects on the learning of struggling students requires those providing leadership to bring relevant evidence to the attention of their colleagues in accessible and convincing ways, to encourage actual trials with heterogeneous groupings under conditions which include opportunities for practice, feedback and coaching and to help teachers generate "the kind of assessment information that will make the impact of tracking and detracking more visible".

CURRICULUM AND INSTRUCTION

A considerable amount of evidence suggests that the best curriculum for socially, economically or culturally disadvantaged children will often be the rich curriculum typically experienced by relatively advantaged students. But this is not often the case. Rather, the typical curriculum experienced by such children is narrowly focused on basic skills and knowledge and lacks much meaning for these students. Why this should be the case has much to do with a widely mistaken understanding about what kind of curriculum these children will most benefit from. In a comprehensive synthesis of empirical evidence, Brophy (undated) touches on the main features of a "rich" curriculum, one similarly beneficial for most students no matter their background.

This is a curriculum in which the instructional strategies, learning activities and assessment practices are clearly aligned and aimed at accomplishing the full array of knowledge, skills, attitudes and dispositions valued by society. The content of such a curriculum is organized in relation to a set of powerful ideas. These ideas are "internally coherent, well-connected to other meaningful learning and accessible for application" (p. 7). Skills are taught with a view to their application in particular settings and for particular purposes. In addition, these skills include general learning and study skills, as well as skills specific to subject domains. Such meta-cognitive skills are especially beneficial for less able students who might otherwise have difficulty monitoring and self-regulating their own learning.

In schools serving diverse student populations, instruction, as well as the curriculum, should meet the same standards of effectiveness that would be expected in schools serving relatively advantaged students. But such standards are not often met. A significant proportion of these schools lack minimally adequate instructional resources and are in physical disrepair. Many teachers do not find it satisfying to work with students in especially challenging schools; they move on to less demanding environments at the first opportunity citing the lack of psychic rewards from seeing their students succeed. Teachers want to feel certain about their ability to meet the goals they have for students, and to know when they have done so. Rewards of this sort are more easily available to

teachers in less challenging schools. Teachers in especially challenging schools often have low expectations for pupil performance and require their pupils to spend excessive time on drill and practice activities aimed almost exclusively at improving basic academic skills.

Brophy's synthesis of research suggests that effective instruction is conducted in a highly supportive classroom environment that is embedded in a caring learning community. In this environment, most of the class time is spent on curriculum-related activities and the class is managed to maintain students' engagement in those activities. In effective instruction, teachers pose questions aimed "to engage students in sustained discourse structured around powerful ideas," and provide the assistance students need "to enable them to engage in learning activities productively".

In contrast to the features of effective instruction identified by Brophy, Cummins' (1986) research suggests that much of the instruction used with children designated as "at risk" places them in a passive role. Such children, he argues, need to be encouraged to become active generators of their own knowledge, to "assume greater control over setting their own learning goals and to collaborate actively with each other in achieving these goals".

At-risk children also may require "culturally responsive" teaching. This is teaching based on the premise that culturally diverse students pose opportunities instead of problems for teachers. Teachers adopting this perspective identify the norms, values and practices associated with the often diverse cultures of their students and adapt their instruction to acknowledge, respect and build on them.

Classroom Management Strategies for Difficult Students

Teachers in middle level schools face overwhelming demands and challenges in their classrooms. They are expected to know content and pedagogy, develop engaging lessons that meet the needs of diverse learners, and use a variety of instructional strategies that will boost student achievement while they simultaneously develop positive relationships with, on average, 125 students each day who are experiencing the personal, social, and cognitive challenges and opportunities of early adolescence.

Teaching is complex and cannot be reduced to discrete tasks that can be mastered one at a time. Teachers must "win their students' hearts while getting inside their students' heads". As Haberman (1995) suggested, this winning of the hearts occurs through very personal interactions, one student at a time. This perspective is supported by research suggesting that teachers who develop such relationships experience fewer classroom behaviour problems and better academic performance.

How can teachers engage students through enhanced personal interactions while simultaneously managing classroom climate and instruction? The purpose of this chapter is to suggest specific strategies that integrate knowledge and skills from education, counseling, and psychotherapy to help teachers develop

a strong management system based on the development of personal relationships with students. These techniques are specifically adapted for use by teachers and more clearly delineate the nature of developing relationships and deepening them for the purpose of making education more effective.

Classroom Management and Relationship Building

Research indicates that teachers' actions in their classrooms have twice as much impact on student achievement as assessment policies, community involvement, or staff collegiality; and a large part of teachers' actions involves the management of the classroom. Classroom management is critically important in the middle grades years when students are more likely to experience declines in academic motivation and self-esteem. Research indicates that these declines can be linked to the classroom, and particularly to teacher-student relationships. When surveyed about their goals, adolescents have claimed that academics and the completion of their education are important to them. However, repeated studies of sixth through ninth graders have shown interest in academics, motivation for academics, and academic achievement levels decline dramatically during early adolescence, and especially during seventh grade.

One of the keys to effective classroom management is the development of a quality relationship between the teacher and the students in the classroom. Marzano, Marzano, and Pickering (2003), in a meta-analysis of more than 100 studies, reported that teachers who had high-quality relationships with students had 31% fewer discipline problems, rule violations, and other related problems over a year's time than did teachers who did not. This significant statistic justifies further investigation into developing relationships.

.A critical component of developing relationships is knowing and understanding the learner. Teachers must take steps to learn and understand the unique qualities of middle grades students, who are at a crucial time in their development.

Although they are good at disguising their feelings, they have been described as actually craving positive social interaction with peers and adults; limits on behaviour and attitudes; meaningful participation in families, school, and community; and opportunities for self-definition. Teaching middle grades students is unique in its demand for unconventional thinking; therefore, middle grades teachers must be willing to break the rules and transcend convention. The strategies that will be described for dealing with the most difficult of students are in many ways just that—unconventional.

Teachers who adopt a relationship-building approach to classroom management by focusing on developing the whole person are more likely to help students develop positive, socially-appropriate behaviours. The characteristics of effective teacher-student relationships are not related to the teacher's personality or whether the teacher is well liked by the students. Instead, the relationships are characterized by specific behaviours, strategies, and fundamental attitudes demonstrated by the teacher. This approach involves taking personal interest in students; establishing clear learning goals; and modeling assertive, equitable, and positive behaviours.

Research indicates that the most effective classroom managers do not treat all students the same. Effective managers employed different strategies with different types of students. Teachers with effective classroom management skills are aware of high needs students and have a repertoire of specific techniques for meeting some of their needs.

Adelman and Taylor (2002) reported that 12% to 22% of all students in schools suffer from mental, emotional, and behavioral disorders, and relatively few receive mental health services.

The Association of School Counselors noted that close to one in five students has special needs and requires extraordinary interventions and treatments beyond the typical resources available to classroom teachers. It is often these very students who create the most daunting challenges for teachers.

Strategies for Building Relationships

Teachers who truly understand young adolescent learners are best able to build strong relationships with students. According to Wolk (2003), "Teacher-student relationships permeate the classroom, with relationships both helping and hindering learning and affecting everything from curriculum to choice of teaching methods." Wolk asserted that for most teachers, "their relationships are their teaching". Current literature on building relationships as a means to manage classrooms includes recommendations such as using gentle interventions, finding time for bonding, avoiding punishments, and building activities that ensure success for all students.

These strategies, though helpful, may still leave teachers struggling with the most difficult students. Ideas from the fields of counseling and psychotherapy can be applied to these classroom struggles.

Rogers and Renard (1999) asserted that we need to understand the needs and beliefs of our students as they are—not as we think they ought to be". What follows are specific strategies from the fields of counseling and psychology that teachers can apply in classroom settings when dealing with difficult students. The strategies of empathy, admiring negative attitudes, leaving the ego at the door, and multicultural connections will be explored.

Building Empathy

Probably the most important aspect of a positive helping relationship is empathy on the part of the helper. In actual practice, empathy on the part of the teacher results in the student feeling understood. Empathetic relationships are especially important for difficult adolescents. Unfortunately in education, empathy is a concept largely misunderstood and even trivialized as a form of affection or caring. To the contrary, caring and empathy are not at all the same. Adler (1956) defined empathy as "seeing with the eyes of another, hearing with the ears of another, and feeling with heart of another". The end result of having been shown empathy is that the person "feels understood." This is crucial to reaching and relating to young adolescents.

Many teachers simply assume they understand the student's problems and dilemmas, and mistakenly try to communicate their understanding in ways that only distance the student. For example, a female middle grades student once told a disappointed teacher that things were really hard at home and studying was difficult.

The teacher responded by saying, "Well, you have to get past it and study anyway. I have been teaching for a long time, and there isn't any excuse I haven't heard."

The student, of course, had no indication that the teacher understood at all and was actually discouraged by the teacher's unempathetic response. If this teacher had taken the time to show that she understood the student's dilemma, she would have learned that the parents of the student were verbally fighting with each other every day, threatening each other with divorce, and arguing over custody of the children. They also fought about the father's drinking.

The teacher could have easily encouraged the student with an empathetic response such as, "It must be really difficult trying to study while listening to your parents fighting and wondering what is going to happen with your family." Such a response would have communicated understanding to the student that she would have found valuable and that would have enhanced the level of respect she had for the teacher. Such a response also would have encouraged the student to communicate with the teacher so that the teacher and student could brainstorm ways to keep the student on task with her various assignments.

Admiring Negative Attitudes and Behaviours

At first glance, this approach would seem to violate all that we know about behaviour modification, but it is based on a well established area of research called "positive psychology". This approach looks upon negative student behaviour as a skill he or she has been practicing and refining for many years. Most of these skills have their beginning in the student's family life. In the case of a manipulative female teen, for example, being manipulative might have been the only or best way of getting her needs met in her family. It is to be entirely expected that she would bring these same skills to school in an effort to meet her needs there as well.

Rather than engage in a power struggle with such a student, a teacher should acknowledge the skill that the student has worked so hard to develop—and then redirect it. Give her credit for all of the years she has practiced the skill. This will also lead to an increase in the student's perceived empathy from the teacher. After acknowledging the skill, reframe the skill and then redirect it. It is important that this skill be applied with sincerity. Any hint of sarcasm could lead to further alienation between the student and the teacher.

Let us extend the example of a manipulative, young adolescent girl. She is engaged in a behaviour that, in all likelihood, annoys both adults and her peers. However, there is a skill that may be present in the girl that can be reframed as the "ability to influence people." Rather than address the girl's manipulations

as such, mention to her, "I have noticed that you have the ability to influence people, is that true?" She will probably reply with something like, "What do you mean?"

The teacher can respond by saying, "Well, I have noticed that you can get people to do what you want them to do. Am I wrong?" It would help if the teacher used specific examples. At this point, the student will likely look at the teacher somewhat suspiciously and smile, saying, "Well that's true sometimes, I guess." The teacher can then respond, saying, "You have a valuable skill there. If you used it in other ways, you may find more successful ways of getting your needs met. This skill could be valuable in certain careers, such as corporate management, sales, or even counseling." The young adolescent is usually quite surprised to hear something that she has previously been criticized for now being admired and looked upon as something potentially valuable.

Another example of the application of this approach would be the case of a young adolescent who consistently displays the infamous "bad attitude." Quite at variance with the usual characterization of the bad attitude, we look at it as a skill that is often practiced and has a particular goal. The goal is to display and announce defiance and, to a certain degree, independence. Instead of fighting the attitude, punishing it, or even ridiculing it, try admiring it, putting aside any disgust or exasperation. "Wow," the teacher might say, "You sure do have an impressive attitude. It is very well constructed, and I can tell you have been working on it for years."

One's first thought on reading this might be to conclude that such an approach is simply crazy. However, a large percentage of young adolescents respond to this tactic with a smile and a greater willingness to continue the discussion. Admiration is extremely rare in the lives of young adolescents, and we dare say, much rarer than love. To receive it from an adult is precious indeed, and it often inspires immediate loyalty and respect towards a teacher. When communicated genuinely and honestly, it also increases the level of perceived empathy from an adult.

Disruptive behaviours, when displayed by a student who takes charge in his or her own way, can sometimes be reframed as great leadership skills. The teacher can ask the student to use those abilities to help lead the class. In the case of the disruptive class clown, the reframe would be along the lines of admiring the student, then reframing the clown act as natural comedic skill. A possible redirect could consist of a challenge to the student to use that skill in a creative way and in an appropriate setting that can be set up by the teacher according to the personality of the student.

Multicultural Connections

Developing relationships with students who come from culturally different backgrounds can be challenging and requires specific skills from new and experienced teachers alike. The recommendations for forming relationships made earlier in this chapter are essential when cultural differences are present. That is, having empathy, admiring negative behaviours, and leaving one's ego at the door

can go a long way towards bridging the gap between culturally or linguistically different (CLD) learners and the teacher. The challenges within the cross-cultural encounter lie in overcoming the additional barriers that prevent teachers from letting down their guard to empathize and develop stronger relationships with students. These barriers exist due to a fear of the culturally different, a lack of knowledge about the differences and similarities between cultures, persistent negative stereotyping, and general intolerance. To overcome these barriers and develop multicultural competence, a teacher must overcome his or her fears and unresolved issues regarding cultural difference. This can be achieved by gaining deeper knowledge about himself or herself and the culturally different student.

Practices from the field of counseling have great promise for enhancing relationships in the culturally diverse classroom. In counseling, multicultural competence consists of being acutely aware of cultural attitudes, beliefs, knowledge, and skills of both the counselor and the client.

Training new counselors involves an examination of how the new counselors feel about themselves and culturally different clients. Such competencies can easily be used as a guide for classroom teachers who want to enhance their relationships with CLD students.

Teachers Personality and Maladjustment

All about how teachers personality and maladjustment affect the children. Read to know more about how teachers get affected because of various causes of service instability and why it leads to mal-adjustment in teachers.

Teachers Personality and Mal Adjustment

Teachers are in the most strategic position to facilitate a balanced personality development and a more adequate adjustment of the learner. The effectiveness of teachers in the personality development and adjustment of students essentially depends up on teachers on personality.

Causes of Teachers Mal Adjustment

The teacher's own adjustment not only contributes to better adjustment of pupils but is essential for his own efficiency and happiness. A maladjusted teacher not only destroys his own professional life but also ruins his or her student's life. There are many factors which contribute for the mal adjustment of teachers. Some of the important causes of maladjustment are discussed below

(1) Lack of professional attitude and spirit- most of the teachers in our schools accepted teaching as a profession not because of their interest in teaching but because they failed to secure other jobs. Such teachers naturally lack professional attitude and spirit.

(2) Work load- the duties and responsibilities of a teacher are always very high and an average teacher is always under stress. The constant stress creates emotional tension and anxiety that impair the mental health of the teacher.

(3) Insecurity of service- Services in privately managed schools are generally insecure. The teachers in such schools live up on the mercy of the management of that school. There is a constant fear of going out of that service. This creates anxiety and fear in the minds of the teacher.

(4) Poor salary and low status – in the present social set up of India teachers are poorly paid when compared to their less qualified compartments in other professions. Added to this in our society teachers are not getting enough respect and recognition. This may leads to the demotion of self concept of the teacher which ultimately results in maladjustment.

(5) Lack of recreational facilities- teachers seldom gets the time for recreation or rest. Lack of recreational activities in schools and teachers inaptitude in participate in them make their professional life dull and uninteresting.

(6) Low of physical health- teacher's bodily health is not satisfactory. Low income and lack of recreational facilities are the reasons for this. Low physical health is an important factor for low mental health.

(7) Maltreatment of management- Most private schools in our country are managed by the persons of particular cast, religion or creed. Consequently it becomes difficult for a teacher from a different cast to adjust. Most often he or she may get step motherly treatment from the managements. This causes worry and mental stress in the mind of a teacher.

(8) High moral expectations- teachers are often expected to behave like an ideal exemplary by the society. But this is not possible because of the high complexities of fast-moving society and it is natural that evils of society may affect his personality naturally in course of time. The failure to rise up to the expectations of the society creates frustration and conflicts in the mind of the teacher which results in maladjustment.

(9) Unhealthy inter-personal relation ship among teachers. - Inter-personal conflict and tensions among teachers is at peak due to the increasing number of professional organizations and teacher politics. Harmony, co-operation, love, unity spirit, good-will of the institution etc has vanished from the teacher's room.

(10) Lack of facilities- poor school plant, ill-equipped classrooms, faulty time schedule, lack of library and laboratory, shortage of teaching aids etc creates unnecessary stress and strain in teachers.

Sugesstions for Better Adjustment of Teachers

The following programmes will help to improve the mental health of teachers. Equitable work load- the present workload should be reduced by appointing more teachers or by pooling divisions where ever possible. Besides other duties should be divides equally among all the members of the staff.

Security service- rules and regulations should be modified to ensure the job security of the teachers. Necessary steps should be adopted to make sure those

teachers getting descent payments from their institutions. This will enhance confidence level of the teacher. Ensure democratic school environment-democratic operation of the school, open channel for communication between teachers and administrators, discussion rather than dictation of policies, absence of casticism, favouritism and groupism team-spirit and good will among teachers and by assigning equal responsibilities to all.

Improving teacher- teacher relations- inter-personal relations among teachers should be improved by providing better environment for developing team-spirit and good will among teachers.

Opportunities for professional growth-Teachers should be frequently equipped with in-service programmes to refresh their knowledge and modify their skills. It enables them to understand the new teaching methods and strategies available.

Arranging, seminars, workshops and conferences – by arranging, seminars, workshops and conferences teachers from different schools get mingled each one will get new experiences that is shared by other one and it will help them in their profession.

Impact of Teachers Personality and Adjustment on Children

A teacher's personality has a great bearing on the personality development of the students. It is stated that books can teach, only personality can educate. Various researches prove that emotional stability of the teachers affects the learners. The impact of teacher's personality development and adjustment on the wholesome personality development and adjustment of the pupils is discussed below:

Impact of teacher's character and personality: character and the personality of the students cannot be developed if the teacher who is the model to be followed lacks character and personality. Aim of education to mould the behaviour of the learner to a preplanned well accepted manner. Such modification of behaviour can be found in ones healthy attitudes, good habits, standard values, *etc.* the development of ones healthy attitudes, good habits, standard values etc depend up on the nature of experience one is exposed to. In schools teachers personality remains vital experience for the students to examine and imitate. The effectiveness of teachers in the personality development and character formation depends up on teacher's own personality and character. Through continues identification and introjection's child consciously acquires and learns the habits attitudes, personality and character from the teachers.

Impact of teacher's adjustment: teachers who are competent and emotionally mature make the total school atmosphere full of learning experience for the students. On the other hand incompetent and maladjusted teachers spoil the school atmosphere. Unsatisfied frustrated teachers cannot make students happy and well adjusted in the school. Teacher should be mentally alert and stable to develop alertness and stability in students. Teacher's behaviour will reflect the student's behaviour.

Impact of teacher's mental health: a mentally health and well adjusted teacher plays a vital role in promoting mental health of students. Only if the teacher is

free from worries, anxieties, and tensions then only he can impart the function of promoting mental heath and mental hygiene. Thus in order to develop sound mental health in student's teacher himself should pose sound mental health.

Impact of teacher's temperament: the general stability of the teacher is of utmost importance in balance and controlled emotional development of the students. Any slight mental imbalance or temperamental instability of the teacher will reflected in the student's behaviour.

Classroom Management - Creating a Learning Environment

Classroom management is the orchestration of the learning environment of a group of individuals within a classroom setting. In the early 1970s classroom management was seen as separate from classroom instruction. Teachers' management decisions were viewed as precursors to instruction, and were treated in the literature as if they were content-free. The image was of a teacher first attending to classroom management, and then beginning instruction without further reference to management decisions. Research in the 1980s, however, demonstrated that management and instruction are not separate, but are inextricably interwoven and complex.

A teacher's classroom-management system communicates information about the teacher's beliefs on content and the learning process. It also circumscribes the kinds of instruction that will take place in a particular classroom. A classroom in which the teacher takes complete responsibility for guiding students' actions constitutes a different learning environment than one in which students are encouraged and taught to assume responsibility for their own behaviours. Content will be approached and understood differently in each of these settings. Furthermore, more intellectually demanding academic work and activities in which students create products or encounter novel problems require complex management decisions. This correlation between instructional activity and management complexity further reinforces the interrelated nature of classroom management and curriculum.

The interwoven nature of classroom management and classroom instruction is especially easy to see from a student perspective. Students have at least two cognitive demands on them at all times: academic task demands (understanding and working with content) and social task demands (interacting with others concerning that content). This means that students must simultaneously work at understanding the content and finding appropriate and effective ways to participate in order to demonstrate that understanding. The teacher must facilitate the learning of these academic and social tasks. Thus from the perspective of what students need to know in order to be successful, management and instruction cannot be separated.

As a result of this broadened definition of classroom management, research has moved away from a focus on controlling behaviour and looks instead at teacher actions to create, implement, and maintain a learning environment within the classroom. Everything a teacher does has implications for classroom

management, including creating the setting, decorating the room, arranging the chairs, speaking to children and handling their responses, putting routines in place (and then executing, modifying, and reinstituting them), developing rules, and communicating those rules to the students. These are all aspects of classroom management.

Creating a Learning Environment

Creating and implementing a learning environment means careful planning for the start of the school year. The learning environment must be envisioned in both a physical space and a cognitive space. The physical space of the classroom is managed as the teacher prepares the classroom for the students.

Is the space warm and inviting? Does the room arrangement match the teacher's philosophy of learning? Do the students have access to necessary materials? Are the distracting features of a room eliminated? Attending to these and similar questions aids a teacher in managing the physical space of the classroom.

Teachers must also consider the cognitive space necessary for a learning environment. This cognitive space is based upon the expectations teachers set for students in the classroom and the process of creating a motivational climate. Effective teachers create and implement classroom management practices that cultivate an engaging classroom environment for their students. Two specific areas of cognitive space that teachers include in their plans are setting expectations (*i.e.*, rules and procedures) and creating a motivational climate.

Setting Expectations

In both elementary and secondary classrooms, the start of the school year is crucial to effective management. A significant aspect of this beginning is the teacher's establishment of expectations for student behaviour, which are expressed through rules and procedures. Rules indicate the expectations for behaviour in the classroom, and for how one interacts with one's peers and the teacher. Procedures have to do with how things get done. Rules can be, and frequently are, developed with the students' help, which increases the likelihood of compliance.

Ultimately, with or without student input, the teacher must have a picture of what code of behaviour is essential for the classroom to function as desired. Both rules and procedures must be taught, practiced, and enforced consistently. Included with the development of rules and procedures is the accountability system of the classroom, which must communicate to students how they are held responsible for the academic work that they do. Researchers have confirmed that effective classroom managers begin the year by setting expectations.

At the elementary school level better managers also consistently analyze classroom tasks, teach going-to-school skills, see the classroom through students' eyes, and monitor student behaviour from the beginning of the year. These characteristics are similar at the middle school and junior high level, where

better managers also explain rules and procedures, monitor student behaviour, develop student accountability for work, communicate information, and organize instruction from the first day of school. Research has shown that teachers whose students demonstrated high task engagement and academic achievement implement a systematic approach towards classroom management at the beginning of the school year. Therefore, one of the critical aspects of managing classrooms effectively, or managing classrooms in ways to enhance student learning, is setting expectations.

Motivational Climate

An essential part of organizing the classroom involves developing a climate in which teachers encourage students to do their best and to be excited about what they are learning.

There are two factors that are critical in creating such a motivational climate: value and effort. To be motivated, students must see the worth of the work that they are doing and the work others do. A teacher's demonstration of *value* shows students how their work is worthwhile and is connected to things that are important for them, including other learning and interests. *Effort* ties the time, energy, and creativity a student uses to develop the "work," to the value that the work holds. One way that teachers encourage effort is through specific praise, telling students specifically what it is that they are doing that is worthwhile and good. In combination an understanding of the value of academic tasks and the effort necessary to complete these tasks motivate students to learn.

It is possible to create a setting that appears to be well managed, where room arrangement, rules, and procedures are operating well, but where little actual learning takes place. However, when a teacher creates structure and order, as well as a learning environment in which students feel the excitement of learning and success, then the classroom can truly be said to be well managed. At the beginning of the year, teachers must set expectations and create a motivational climate for learning and combine this with orchestrating the physical space in order to both create and implement a successful classroom management system.

Maintaining a Learning Environment

A teacher's classroom management decisions do not stop after the planning and establishment that is crucial to beginning the school year. As the school year progresses, classroom management involves maintaining the learning environment through conscientious decision-making concerning students and the classroom.

Teachers in a classroom teach groups of children. Maintaining the learning environment, therefore, requires teachers to focus on group processes. Jacob Kounin's landmark findings from the late 1960s on the management of classroom groups identified that the means by which teachers prevent problems from occurring in the first place differentiated them as more effective managers. Kounin, whose work was reaffirmed by Paul Gump, a noted ecological

psychologist in Kansas in the 1980s, identified several strategies that teachers use to elicit high levels of work involvement and low levels of misbehavior. These strategies are: (1) with-it-ness (communicating awareness of student behaviour), (2) overlapping (doing more than one thing at once),(3) smoothness and momentum (moving in and out of activities smoothly, with appropriately paced and sequenced instruction), and (4) group alerting (keeping all students attentive in a whole-group focus). These tools help teachers to maintain the flow of instruction. A significant stumbling block to the flow of instruction is in attention to transitions between activities, lessons, subjects, or class periods. It is here that teachers are likely to feel that they are less effective in maintaining the flow of instruction. Effective transitions are structured to move students from one activity to another, both physically and cognitively. The goal of smooth transitions is to ensure that all students have the materials and mind-sets they need for a new activity.

While effective managers work with groups of students, they also are attentive to students' individual behaviours and learning needs. Maintaining a learning environment requires teachers to actively monitor their students. According to classroom management research, active monitoring includes watching student behaviour closely, intervening to correct inappropriate behaviour before it escalates, dealing consistently with misbehavior, and attending to student learning. In terms of monitoring both student behaviour and learning, effective managers regularly survey their class or group and watch for signs of student confusion or inattention. Maintaining effective management involves keeping an eye out for when students appear to be stuck, when they need help, when they need redirection, when they need correction, and when they need encouragement.

Teachers must also check for understanding, both publicly and privately. Maintaining a classroom management system requires the teacher to anticipate student actions and responses in order to be preventive rather than reactive. Excellent classroom managers mentally walk through classroom activities, anticipating areas where students are likely to have difficulty and planning to minimize confusion and maximize the likelihood of success.

Activities planned for these classrooms are paced to ensure that students have enough to do, that assignments reflect an awareness of student attention spans and interests, and that downtime is minimized between assignments or activities. The orientation of the classroom must be purposeful, with a variety of things to be done and ways to get those things done.

ASPECTS OF TEACHING LEARNING IN HIGHER EDUCATION

"Aspects of Teaching and Learning in Higher Education" is a comprehensive exploration of the multifaceted dynamics shaping educational practices within tertiary institutions. This scholarly work delves into various dimensions of the teaching-learning process, examining pedagogical approaches, curriculum design, assessment strategies, and the integration of technology in higher education settings. It offers a nuanced understanding of the diverse needs and challenges faced by educators and learners alike, addressing issues such as inclusivity, diversity, and student engagement. Drawing upon theoretical frameworks and empirical research, the book provides practical insights and evidence-based recommendations for enhancing teaching effectiveness and promoting student success. Moreover, it explores the evolving role of higher education in society, considering the impact of globalization, technological advancements, and changing workforce demands on educational practices. Through reflective exercises, case studies, and interdisciplinary perspectives, this text encourages critical inquiry and innovation in higher education pedagogy. Ultimately, "Aspects of Teaching and Learning in Higher Education" serves as a valuable resource for educators, administrators, and policymakers seeking to navigate the complexities of contemporary higher education and foster a culture of continuous improvement and excellence in teaching and learning. This book explores diverse facets of teaching and learning within higher education, offering valuable insights for educators navigating the complex landscape of academia.

Dr. Anil Kumar is associated with academics for more than 17 years. He holds the degree of M.A. from MGS University, Bikaner, and B.Ed. from Kota University, Kota, and M.Ed. from IGNOU, New Delhi and Doctor of Philosophy in Education from VBP University, Jaunpur (U.P.). He is supervising research work in the field of Education. At present he is working as Associate Professor, Faculty of Education, Tantia University, Sri Ganganagar (Rajasthan). He has been continuously involved in research work with a bulk of publication in renowned journals and attended various conferences and seminars and workshops to share and impart his knowledge and view. 06 Ph.D. Research Scholars have been awarded Ph.D. degree under his supervision. He has participated and presented papers in more than twenty (20) International/National Seminars and already three (03) books are published by him.