Chapter III

RESEARCH AGENDA

“The one who has eye of knowledge, not some other is the one who sees....Such a person sees the thing that he wants to see, whether they are far away, subtle or concealed”

- The Buddha
CHAPTER III
RESEARCH AGENDA

Background

This chapter begins with a detailed description of the National Programme on Technology Enhanced Learning (NPTEL). After some background information on the usage and user profiles based on secondary data, the areas of study as a part of the research agenda are highlighted. The aspects of NPTEL to be studied as a part of research are then highlighted. Those features that relate to dimensions of life other than the intellectual and professional are also discussed for inclusion in the study. The concept of 'Service Oriented Architecture' is then studied and its suitability for providing quality, wholesome education is discussed. The provision of spaces that are conducive to learning by trying to understand what constitutes learning is then detailed. The basics of a framework that could be used based on the findings, including the possible configuration at the ground level are then detailed that could give shape to the research findings.

3.1 INTRODUCTION TO THE NATIONAL PROGRAMME ON TECHNOLOGY ENHANCED LEARNING (NPTEL)

A specific area of technical education has been selected for the purpose of this research. In the domain of technical education, the focus is on the critical study of the NPTEL program. This is an e-governance effort supported by the Ministry of Human Resources Development and implemented by the Indian Institutes of Technology and the Indian Institute of Science, Bangalore. The primary aim of the program is to create course content in engineering and science.
It is estimated\textsuperscript{59} that about 1,60,000 teachers are needed for engineering education for a student population of about twenty lakhs (two million). As against this, only about 4000 teachers are trained by Higher Education Institutions every year. Further, since the teaching profession is not one of the more attractive career options for students from the societal status and economic point of view, a large number do not take up teaching.

Against all this, India is fairly ripe in terms of availability and deployment of technology for rolling out ICT and e-learning initiatives on a large scale. Students are also very familiar with gadgets and ICT equipment and ready to take to internet based content, chat etc. Efforts such as the Open Learning Initiative (OLI) of Carnegie Mellon University and the Open Course Ware (OCW) of the Massachusetts Institute of Technology (MIT) are attempts in this direction that are also opening up education.

While there is a great deal of similarity between the Open Course Ware effort of the Massachusetts Institute of Technology (MIT) and NPTEL, the differences are that the syllabi and curricula of the targeted client institutions are factored into the contents of NPTEL, whereas in OCW, only courseware from MIT is made available. NPTEL is generated by the eight top National Institutions of Science and Technology. NPTEL also organizes a series of workshops for teachers and students of the client institutions to create awareness collect feedback and facilitate the adoption and internalization of the contents created by NPTEL.

It had its genesis in 1998, when a delegation from the IITs and Indian Institutes of Management (IIMs) attempted to understand technology

\textsuperscript{59} "Engineering Education for Everyone- A Distance Education Experiment at IIT, Bombay" IEEE 2008 by Kannan M. Moudgalya, Deepak B.Phatak, R.K.Shevgaonkar.
enhanced learning by visiting some Universities in USA. Following the visit, IIT Madras and the Carnegie Mellon University (CMU) Pittsburgh, USA jointly organized a workshop in 1999 to carry this idea forward. This was followed by discussions with various interest groups and stake holders and resulted in the genesis of the present day NPTEL. Contents for 100 courses as web based supplements and 100 self-contained video lecture courses were to be developed by all the eight partner institutions over the next three years. This mainly focused on five engineering branches, i.e. Civil, Computer Science, Electrical, Electronics and Communication and Mechanical Engineering as well as core science courses that engineering students across India were generally required to take.

NPTEL also provides for course-specific web spaces which facilitate threaded discussions where students, teachers and other users anywhere in the world can participate. All these would, it is learnt, be incorporated eventually into a digital library for each subject and a list of FAQs addressing the common doubts and clarifications of students and users. While there are 110 video (approximately 4500 hours) lecture courses from phase I, NPTEL plans to ready about 400 video lecture courses (with about 16000 hours of lectures) by the end of phase II, (from 2008 to 2011 or three years) which will NPTEL would, perhaps be the largest single repository of technical courses in the world in the streaming video format.

NPTEL is implemented through two committees – the National Programme Committee (NPC) headed currently by Sh N.K.Sinha, the Joint Secretary,

61 Interview with Prof. Ananth, Director Madras on 11th and 12th March, 2011. It is now learnt from Prof.Mangala Sundar that Phase II and Phase III have been merged to cover the period from July 2007 to June 2012 during a telephonic conversation on 26th April, 2011.
62 The proposal for implementation of NPTEL Phase-II to be implemented during 2008 to 2011 (three years) is under consideration as viewed on 26th April, 2011. 
http://www.education.nic.in/tech/tech_schemes.asp#Support%20For%20Distance%20Education%20& %20Web%20Based%20Learning%20%28NPTEL%29
Higher Education, Ministry of Human Resource Development (MHRD) and the Programme Implementation Committee (PIC), headed by Professor M. S. Ananth, Director IIT Madras. The NPC oversees policy matters and financial sanctions. The PIC has members from all IITs/IISc who are NPTEL Coordinators in each IIT/IISc and members from representative user institutions. It oversees implementation of the programme.

Typically, the members of the PIC are faculty members in IITs and IISc who have full time academic responsibilities such as taking classes, guiding PhD/MS/M Tech/M Sc scholars, doing project work, research, consultancy etc. A number of them are overall NPTEL coordinators who coordinate all developments in their respective Institutes. In addition, they meet once every three months or so to study the progress and issues related to coursework development. A team of 350 or more faculty members, with the Director, IIT Madras, Professor M. S. Ananth as the overall coordinator, has agreed to make course contents for this national program.

As pointed out earlier, while the curriculum of NPTEL is primarily anchored on the AICTE standards, it is also pegged to the curricula of some of the leading technical Universities like the Anna University in Tamilnadu and the Jawaharlal Nehru Technological University (JNTU) of Andhra Pradesh. Each video course and web supplement usually comprises of about 40 sets of lectures, each of one hour duration. The project funding has been to the tune of Rs. 20.5 Crores (205 million Indian Rupees) which was for the project deliverables of 129 web and 110 video courses. The web courses are available on the web site http://nptel.iitm.ac.in, which is constantly updated. The video courses are telecast through Eklavya channel, a 24/7 television channel provided

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63 Web site of NPTEL and discussions with Ms. Usha Nagarajan of NPTEL, Chennai.
64 Ibid.
exclusively for educational broadcasts by Doordarshan, Government of India. The video lectures are also streamed through YouTube.

As India gears towards becoming a leading, global knowledge society, Engineering and technical education would be one of the main propellers of this growth. NPTEL has been specifically rolled out with the aim of enhancing higher and professional education using the strategy and tools of distance education and open and continuous learning. Of the over 5,00,000 students graduating as engineers, Industry studies show that less than a quarter of them are employable soon after graduation.

The unbridled mushrooming of Engineering Colleges across the country has severely affected the quantity and quality of teachers and faculty members. There is a severe shortage of faculty members now. Often, faculty members from existing engineering colleges are ‘poached’ or enticed to accept offers from new Institutions, resulting in a higher teacher turnover, which in turn disturbs the academic rhythm at the colleges. One way of addressing this gap is to provide excellent quality content using technology, which is what NPTEL has been doing for nearly seven years now. Another very important concern is the employability of graduates passing out of engineering colleges. According to a study by Hewitt, Talent Assessment & Preference Study, Gujarat International Finance Tec- City (GIFT) July, 2008, the employability of engineering graduates is pegged at 20 percent. The Nasscomm –McKinsey report states that in the IT and ITES sectors, only 25 to 30 % of the engineering graduates are employable.

The research output is also very poor as is evident from the findings of the Times Higher Education report. “Brazil, Russia and India have no institutions at all in the 2010-11 Times Higher Education World University
Rankings...(for India) ...Government spending on research represented 0.9 per cent of gross domestic product in 2009. ...India still has a relatively low number of postgraduate researchers. The number of Indians holding postgraduate degrees increased from 2.4 per cent of the population (20.5 million) in 1991 to 4.5 per cent (48.7 million) in 2005. But this level still trails behind that of Western economies such as the US, where almost 10 per cent of the population have postgraduate degrees...... A slow increase in publications saw India's tally, as measured by Thomson Reuters' Web of Science database, reach about 20,000 a year in 2004. However, since then the pace has picked up with a 10 per cent annual increase, and by 2020, India's output is expected to surpass the total publications of all the G7 countries...”

Tim Gore, director of the Centre for Indian Business at the University of Greenwich, observes: "Although Kapil Sibal, the human resource development minister, is determined to reunite research and teaching in universities and create a number of 'world-class' research-led institutions, this will take time to achieve.”

Against all this background, it was felt that the proper deployment of a program like NPTEL can, perhaps, go a long way in addressing these problems and concerns of higher education and that is the primary agenda of this research.

3.2 SECONDARY DATA ON NPTEL

As seen in the table below, the 129 web courses cover various disciplines of technical education ranging from core Sciences to Computer Science and Civil Engineering. The details of the Web courses and Video courses developed so far are given in the table below:

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65 Times Report on Higher Education: Building sectors, 'Bric' by brick, 16th September 2010. China's growing strength may yet be matched by Brazil, Russia and India, writes Richard Reynold.
The team at IIT, Madras has been promoting NPTEL using many different methods. These include the postal dispatch of Posters and brochures to more than 3,500 institutes across the country. Similarly, it is learnt that emails and bulk sms are also sent to Principals and placement officers of various colleges across the country. Personal visits have been made by the team from BodhBridge which is working closely with NPTEL in nearly 350 engineering colleges across the country (Maharashtra, West Bengal, Rajasthan, Gujarat, Tamil Nadu, Andhra Pradesh, Kerala, Karnataka, etc.). This has been supplemented with online competitions and the selection of student ambassadors across different campuses.

Based on information available from NPTEL in their progress report sent to the Program Implementation Committee for the period ending March, 2010, students and faculty from 93 Universities across the country and 175 Companies of the Private and Public Sector are using NPTEL data. Some of the organizations whose Working Professionals are using NPTEL material include Microsoft India, Juniper Networks, Siemens, Samsung, GE
Healthcare, TataElxsi, Indian Navy, Larsen & Toubro Ltd, Mahindra & Mahindra Ltd R&D, Accenture, Infosys, TCS, IBM India, DRDO, BARC, Robert Bosch, Nycomed Pharma Pvt Ltd, Reliance Industries etc.

The data available with NPTEL shows that there has been a doubling of the number of visitors who come to the NPTEL web site. This has grown from 1.5 Lakh views per month to 3 Lakh views per month over the one year period as shown in the graph below.

Graph No. : 3.1

The analysis of the usage of NPTEL shows that 47% of the users are students while 43% are working professionals and about 10% are faculty members. Similarly, the growth in viewership of NPTEL on You tube shows that from November 2008 and April 2010, the subscribers have
increased over five times from 6,536 to 37,441 while the channel views have increased from 0.19 Million to 2.67 Million across the same period.

Growth in the NPTEL Channel Views on Youtube

(From 0.9 Million views to 2.6 Million views)

**Table No. : 3.2 NPTEL Channel Views on Youtube**

<table>
<thead>
<tr>
<th></th>
<th>As on Nov 1, 2008</th>
<th>As on June 1, 2009</th>
<th>As on Oct 5, 2009</th>
<th>As on April 18, 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Channel Views</strong></td>
<td>1,92,224</td>
<td>9,41,199</td>
<td>14,93,623</td>
<td>26,71,757</td>
</tr>
<tr>
<td></td>
<td>(0.19 Million)</td>
<td>(0.9 Million)</td>
<td>(1.49 Million)</td>
<td>(2.67 Million)</td>
</tr>
<tr>
<td><strong>Subscribers</strong></td>
<td>6,536</td>
<td>18,377</td>
<td>24,658</td>
<td>37,441</td>
</tr>
</tbody>
</table>

As the chart below shows, there are about 276 Institutions which subscribed for a complete set of NPTEL materials until March 2010:

**Graph No. : 3.3**

The total number of Institutions which subscribed for complete set of NPTEL Material until 31st March 2010 is 276.
This reflects a rather poor picture as this translates to only about 9.61% of the total engineering colleges\textsuperscript{66}. Further, even this percentage is much skewed as is seen from the chart with merely five states contributing to the already poor coverage. These states are Tamil Nadu, Maharashtra, Kerala, Uttar Pradesh and Andhra Pradesh. Of course, the fact that there is at least some subscription activity related to NPTEL in about nineteen States shows that there may be some base level awareness and interest in NPTEL in nearly nineteen States and even in some of the remote institutions.

\textbf{Graph No. : 3.4}

The pie chart above gives the frequency of usage of NPTEL. It shows that more than half the users of NPTEL only use it once a week. Only 8\% of the users use NPTEL at least once a day, while 15\% of them use it about three times a week.

\textsuperscript{66} 276 Colleges out of 2872 Colleges - As per MHRD Annual report 2009-10\textsuperscript{66}, there were 2,872 degree institutions in Engineering and Technology as on June 30, 2009.
An analysis of the purpose for which NPTEL is used shows that 32% of the usage is for academic examination followed closely by 30% which is motivated by interest in the subject followed by 25% who use it for competitive examinations. Interestingly, it is also found useful for interviews, teaching, research and reference in that order.
The Charts above throw light on the depth and standard of the NPTEL material, the overlap with their respective syllabi and the perception of pace of the teaching on NPTEL. Since there is an overwhelming perception of the pace of teaching being comfortable, this may be indicative of the fact that this is mainly used by those who are already having a certain standard and grasp of learning or it reflects that the lecturers are indeed simplifying the subjects to an extent that the users almost unanimously feel that the pace is comfortable for them.
3.3 CONSTRAINTS

Having studied the secondary data related to NPTEL users and usage, some inputs related to the possible constraints may now be seen.

3.3.1 Heterogeneity

It is evident that the typical classes in our colleges and institutions have a great degree of heterogeneity and diversity in terms of the basic understanding, learning needs, interests and choices. While the spread of subjects may be fairly wide, the provision of learning methods and depth of courses would possibly have to be varied to address the varied needs.

3.3.2 Lecture mode alone

NPTEL currently transmits the teaching through the conventional mode of lectures. The use of various other techniques such as showing of films, group discussions, presentations, seminars, animations and so on could make the process of learning easier and cater to different needs.

3.3.3 Clearing of Doubts/ clarifications addressing mechanism

The dissemination of the concepts and course ware is done using lectures but the space and provision for addressing doubts and questions is currently not available online in a synchronous mode. While there are provisions for chatting and responding to doubts posted by other visitors etc., it may be worthwhile to explore the possibility of the faculty member or at least a full-fledged teaching fellow to do this on a regular basis.
3.3.4 Awareness
For a program of this scale and size, the usage in terms of web site clicks and Youtube visits prima facie seems less. While there are several measures including workshops and mass emails, postal despatches of posters etc. some innovative methods may be thought of to spread the awareness and, perhaps, have more and more people use NPTEL.

3.3.5 Syllabus overlap or matching
There have been efforts made by the NPTEL team to try to have as much overlap as possible with the AICTE syllabus as also the syllabus of some selected Universities like Anna University etc. However, it may possibly be a good idea to have a more rigorous mapping of the syllabus done to facilitate the users from various engineering colleges to benefit. In fact, the system as it is obtained now is driven by examinations and the absence of an exact overlap with the syllabus and course contours may make it less useful and attractive for a majority of students.

3.3.6 Hands on experience or Laboratory Experience
This is another area of great concern as technical education ought to have a major emphasis on ‘hands-on’ experience by students actively working in the laboratories. Any system which is not able to address this need would, at best be a poor cousin of the excellent educational Institutions such as the IITs.

3.3.7 Bottlenecks on account of faculty members / College management
This is an issue that may plague many institutions where the faculty members themselves are an obstacle of sorts as they are not open to the idea of students using e-content such as NPTEL and actively discourage them. Having faculty members who have the right attitude, are oriented
and aware of the benefits of such software would, perhaps, be required for the benefits to truly reach the students. These benefits are also mentioned in the Edge 2011 report with reference to the case of Apollo Group.

‘Online delivery of education offers significant benefits such as cost savings related to travel and opportunity cost, shorter course duration with online courses leading to faster completion with greater choices.’

Fig. No. : 3.1

Case Study: Leading international HEI offers a comprehensive online education programme

Apollo Group is the leader in for-profit higher education. It is estimated that Apollo has 360,000-380,000 (75-80%) out of its 476,500 students enrolled as exclusive online students, mainly through University of Phoenix Online. This is a huge growth from 4,300 students enrolled in its online programs in 1997. Apollo reaches its online students via 100 programmes across varied specializations.

3.3.8 Degree granting possibility

If the purpose of programs like NPTEL is to also provide access to quality education in a true sense, then it should also factor in the possibility of giving a degree. This may be the need of many deserving students who may not have made it to the IITs or be unable to join Engineering programs offered by various colleges.
3.3.9 Research facilitation

As highlighted earlier in the report, since the extent of Research in the Colleges and Universities of India is very low, there is an urgent need to promote research at all levels, from schools to colleges. In this context, mentoring for research needs special guides and researchers who may be available in the institutions like the IITs and IISc but may not be available in the large number of engineering colleges that have sprung up in recent years. This is a need that NPTEL is not addressing now but perhaps needs to address.

3.3.10 Employment Related modules or exchange for apprenticeship or internship

A major issue with higher and technical education is the low employability that it provides. In this context, the provision of courses or modules specifically related to employability including the possibility of having apprenticeship or internship with the employers is something that is currently not addressed in NPTEL.

3.4 RESEARCH AGENDA

Given the very high importance of technical and engineering education and the high demand for engineering professionals by the Industry, there has been a near explosive growth of engineering colleges. This brings with it the related issues of access, quality and equity. As detailed in the previous chapter, a majority of the technical colleges in the country are plagued by various ills and inadequacies related to curriculum and student choices, poor infrastructure including laboratories, ineffective and poor teaching, learning methods, lack of attention to employability and extension, lack of creative, innovative spaces and research opportunities, flawed examination and evaluation systems, weak educational eco-
system and poor governance. Yet, in our country, the IITs acknowledged as centers of excellence also coexist. A specific effort by the IITs and IISc, namely, NPTEL is studied against the backdrop of all these constraints in technical education in this research. This also examines whether the sound principles of e-governance are incorporated in the NPTEL. Thirdly, even the education provided by the IITs may not have sufficient sensitivity in terms of curriculum and methods of educating the engineering graduates to make them humane professionals, working in harmony with themselves and their environment and the Universe. The research also studies these dimensions of education and tries to assess the perception of students and their preferences and proclivities in respect of their integral development. The possible methods of providing these inputs to students are also studied in order to create humane professionals.

3.4.1 Governance Principles

In the conceptualization and implementation of NPTEL, which is an e-governance project of the e-learning genre, this research through quantitative and qualitative research will try to study how and to what extent the basic principles of Governance have been invoked and addressed.

3.4.1.1 Participation – access, gender, geographic spread, caste, income

A program of this genre ought to have special provisions and features to facilitate participation, referring to both the students and the faculty members. Needless to say, in the context of participation in the creation, sharing and dissemination of knowledge, one concern that has to be structured very carefully is the maintenance of quality and standards. But, having said that if there is any faculty member
who has demonstrated his or her quality credentials, his or her lectures and courseware, based on their merit, must be allowed to be a part of the courseware.

3.4.1.2 Fairness

This is a basic pillar of Governance which, in this context, refers to access to all, affordability and addresses the needs of students and learners from various geographical areas in terms of their language, caste, community, economic, social and cultural barriers. Similarly, such content would also have to cater to the needs of both male and female students, differently-abled learners both in terms of comprehension and in terms of access and reach.

3.4.1.3 Transparency

The processes followed both in the creation of the Open Education Resources and in serving those to the students and learners ought to be above board and merit based. There would have to be a set of rules based on transparent norms to be followed, preferably through a decision making process involving committees of people who are themselves selected through a transparent, merit based process.

3.4.1.4 Dignity / Decency- harmful

The contents and the processes followed in the serving of the technology enhanced learning should not hurt the sensibilities of people. They should actively work towards nurturing and enhancing the dignity of the providers and recipients of the services or contents. In particular, while the process of opening up educational resources is a great boon, great care must be taken to ensure that nothing offensive or harmful for the development of young learners and students must be given or accessible to them.
3.4.1.5 Accountability
This is yet another very important dimension of good governance. While a large amount of resources are spent on such projects and the associated facilities and infrastructure, the deliverables which are specific measurable and those benefits that may be intangible would have to be specified and measured quantitatively and qualitatively at periodic intervals. While failures and genuine mistakes would be a part of any such project, there should be embedded processes and mechanisms for receiving and factoring in feedback and related issues or problems.

3.4.1.6 Effectiveness
This dimension of Governance refers to the effectiveness of an intervention in terms of the extent and speed of realizing the stated deliverables and objectives. The costs and benefits involved, in terms of monetary and other resources as against the human capital generated or the reaped demographic and other dividends would also have to be studied.

3.4.2 Constraints and Opportunities of NPTEL
In this part of the sub-section, having delineated the constraints earlier on, we redefine the constraints and opportunities that NPTEL provides.

3.4.2.1 Syllabus Definition
While there is a heterogeneity of syllabi that prevails across various Engineering Colleges of the country, the NPTEL team comprising faculty members form the IITs and IISc could provide a wide range of courses with different variations in the constituent units or modules to possibly facilitate the colleges to peg it to their syllabus. Further, the NPTEL could possibly play a role in standardizing the curricula across various Universities, also providing for room for localization and local context.
3.4.2.2 Faculty Involvement

While faculty involvement may seem an important factor that leads to the adoption of NPTEL, a series of workshops and teacher training modules may specifically help develop the faculty both for improving their knowledge and making them appreciate the offerings of NPTEL. This may make the process of classroom teaching more effective even for new and inexperienced teachers. Such processes can also help prime and identify faculty members who could be active participants in the creation and dissemination of this e-content.

3.4.2.3 Absence of Infrastructure such as Laboratories

This bottleneck relates to the non availability of quality infrastructure such as laboratories and throws open great possibilities of virtual laboratories and simulators that will enable a large number of students to have the hands on experience of actually carrying out experiments and learning by doing. This research sought to understand if this was perceived as an important need by students and faculty members.

3.4.2.4 Research orientation

As described earlier on, research is still not completely and seamlessly woven into the curriculum of most colleges. What is the students’ and faculty perception on this and what could be mechanisms for enabling such a provision is also being studied.

3.4.2.5 Extension opportunity:

- with local communities

There is a perception that higher education and especially technical education further distances students from their local communities...
and context. What are the perceptions of students and faculty on this and what could be possible interventions is also studied in this research.

• with Employers

Given the issue of poor employability, which has been highlighted by many reports, the need to orient students to industry and employer contexts and needs has been articulated. To what extent is this true and can this be addressed are some of the questions that are studied in this research.

3.4.2.6 Examination

This is an area that has been demanding a great deal of attention. While the current system of education is plagued with many ills related to examinations, how can these be addressed and whether ICT can provide an opportunity to do that is studied in the report. Qualitative and quantitative inputs are gathered to get some inputs and leads on this. Whether the use of ICT can provide for special opportunities to address the common ills of examinations is also studied and understood in some depth.

3.4.2.7 E-Edu services

The Times Higher Education Report has identified the management of educational services as one of the bottlenecks of Indian higher education. This aspect is also posed to faculty members and students for their inputs. The time taken for these services and the repetitive nature of many of these tasks is also understood in the qualitative study.

3.4.2.8 Industry exposure

The issue of industry exposure from the point of students participating in an apprenticeship or internship in various industrial units and
organizations has already been addressed. This also refers to experts and practitioners from Industry actually taking lectures and classes. These aspects have also been analysed in the course of the research.

3.4.2.9 Content Switch over in Local language

Given that a large number of students belong to rural areas and their exposure to and knowledge of English may not be of the required rigor to comfortably partake of the lectures. Whether e-content in the local language is preferred or not is also one of the aspects that is studied.

3.4.2.10 Networking for research and placement

As discussed in an earlier section, the possibility of networking students and faculty from various technical institutions to jointly participate in research activities in niche areas and specific topics was also studied in the course of the research. Similarly, the possibility of a Nation-wide online repository of data related to student profiles to facilitate placement services both in an online and on-site mode was also studied.

3.4.3 Integral Education

The question of whether students are aware of the need for life enrichment at all is studied. This first needs an understanding of what is life enrichment. The concept of life and what it stands for is often understood very superficially. This could be very injurious for the population as a whole as this is crucial for the proper development and growth of each individual, on which depends the progress made by families, communities, societies and nations. This entails an understand of the perspectives of life, starting with the basic needs of food, water, shelter on to the higher and highest ends and aspirations of life. What is needed is a wholesome understanding, or more importantly, the tools for
cultivating an integral understanding of what life is. In the absence of such understanding, with clarity of values and perspectives, students often find themselves unable to deal with the ups and downs and vicissitudes of life.

In this context, life has the physical, mental, ethical, aesthetic and spiritual dimensions, each of which can be honed in students and their ability to appreciate these dimensions and strive for excellence and integrality across these could be an integral part of the teaching, learning and growing process. This process could be accomplished by drawing lessons from the lives of great men and women who have lived life fully and deeply and contributed to human life, for instance.

This is of particular importance as this sense of identity or ‘who we are’ and the greatness of the civilization and legacy is like a powerful spring board that helps and propels in the journey of excellence. The sense of Nationalism also instills a sense of oneness and belonging with those who inhabit or hail from the defined geographical area of the nation. There is the concept and reality of the soul of the nation, which is realized as the people of the nation introspect and delve deeper as they search for the truth of their being, as indicated by Sri Aurobindo. With clarity of the nation’s soul and a feeling of mutuality and harmony comes the spirit of internationalism, which is based on a robust pride of the progress of the human race. Sri Aurobindo says, “...it is necessary, if the subjective age of humanity is to produce its best fruits, that the nations should become conscious not only of their own but of each other’s souls and learn to respect, to help and to profit, not only economically and intellectually but subjectively and spiritually, by each other.” Similarly, the possibility of individual nations coming together in a structure in special ways which facilitate the diversity of each constituent and promotes its uniqueness,
has been stated as, "the unity of mankind is evidently a part of Nature's eventual scheme and must come about....only ....under conditions and with safeguards which will keep the race intact in the roots of its vitality, richly diverse in its oneness."

As India is often referred to as a country with a very promising demographic dividend, in order to harvest this dividend, and take her place as a world leader in the coming decades, it is imperative that our students not only be educated on the intellectual plane, but get to learn the science and art of living. A study of this dimension has been attempted in the research.

3.4.3.1 Orientation for Life Enrichment

This research attempts to understand if students are aware of various aspects of life and the means to enrich it. The rationale is that students of higher and technical education ought to be sensitized to be a humane, courageous, ethical and compassionate citizen and professional.

3.4.3.2 Relation to other Dimensions of life

Another aspect of integral education that has been studied refers to education for the different dimensions of life. Whether there is sensitivity towards and the need for education related to the physical, ethical, aesthetic and spiritual dimensions is also attempted.

3.4.3.3 Individualized Learning Modes and Heterogeneity

There has also been an attempt to understand which modes of learning are preferred by students for understanding and assimilating values and enriching various dimensions of their lives. A great deal of choice can be provided by ICT enhanced learning to cater to individualized subject interests, styles and pace of learning. This is studied in the course of the
research. The diversity of needs of students, given their distinct swadharma\textsuperscript{67} and swabhava\textsuperscript{68} is to be respected. This is also attempted in the study and the responses are used for building a suitable model for rolling out technology enhanced learning.

Nationalism and Internationalism are some of the dimensions in response to which the responses of students are studied. As explained, in the beginning of this sub section, response related to feelings of nationalism and internationalism has also been studied.

\textbf{3.4.3.5 Provision of Choosing and reading autobiographies}

Often the inspiration for students comes from the life and works of some personalities that may serve to encourage them to think of various aspects of their personality that may not be strictly addressed in the course of the course work and evaluation. Whether students would like to know more about some of the personalities that may have inspired them has been studied in the course of the research and names of personalities whose biographical sketches they may like to read have been asked.

\textbf{3.4.3.6 Role of Intrinsic values in Education}

The understanding and meaning of intrinsic values is something that is often perceived as something that is badly needed as an integral part of education to build a harmonious community of learning and teaching in the college, to start with. However, these are possibly not included in the

\textsuperscript{67} Swadharma can be understood from the following lines. Whatever a man’s work and function in life, he can, if it is determined from within or if he is allowed to make it a self-expression of his nature, turn it into a means of growth and of a greater inner perfection. And whatever it be, if he performs his natural function in the right spirit, if he enlightens it by the ideal mind, if he turns its action to the uses of the Godhead within, serves with it the Spirit manifested in the universe or makes it a conscious instrumentation for the purposes of the Divine in humanity, he can transmute it into a means towards the highest spiritual perfection and freedom. \url{http://www.searchforlight.org/Gita/Swabhava%20and%20Swadharma.htm}

\textsuperscript{68} Own inner nature, spiritual temperament, essential character (svabhava) as given by Sri Aurobindo in his ‘Essays on the Gita’ \url{http://www.searchforlight.org/Gita/Swabhava%20and%20Swadharma.htm} viewed on 15\textsuperscript{th} April, 2011.
curriculum. This was an aspect that was addressed to students and their inputs on this were also studied as a part of the research.

**3.4.3.7 Learning modes for Intrinsic values**

Having given some thought to what are the intrinsic values as perceived by young students, the mode of teaching or learning of these was also posed to them and has been studied as a part of the research. Given that ICT can be a complete game changer, the need to explore innovative ways of making the learning happen in more engaging, interesting and fruitful ways is also studied.

**3.5 SERVICE ORIENTED ARCHITECTURE (SOA) MODEL FOR ALL THESE FEATURES**

The research also attempts to understand if a service oriented architecture or SOA model which provides for a stock of loosely coupled services in the form of courses, tutoring, research project work, conduct of testing and evaluation as well as services of linking up and providing internship and placement services, which can be used by students and faculty members on demand, would be preferred.

**3.5.1 SOA Based Model for Technology enhanced Higher Education.**

The foregoing sections have detailed the approaches that have been adopted for carrying out the research. Based on all these inputs, the research tries to study if these findings lend themselves for the evolution of a model based on Service Oriented Architecture. The research and study is conducted keeping the SOA lens in mind. This is to observe and see if the preferences and options articulated by the respondents lend themselves to be tied together in the SOA framework.
The gist of SOA principles as enunciated in the book, Service Oriented architecture- A Field Guide for Executives by Kyle Gabhart and Bibhas Bhattacharya are reproduced in the following pages.

"There are four core SOA value propositions, viz. reduced integration expense, increased asset reuse, business agility and reduced risk. SOA also has several emerging values such as alignment, time to market, visibility, and modernization, which make it very useful. In the following paragraphs, common SOA features are examined, including business and IT alignment, process automation through SOA, service reuse, service composition like LEGO blocks, smoother integration through open standards, and improved business responsiveness.

At first glance, service oriented architecture (SOA) sounds like a techie thing with little relevance to business and delivering customer value. But service orientation is more than just a technical architecture; it is a movement within government organizations and private industry that is transforming business value chains, organizational alignment, and technical delivery capabilities.

Service orientation is about taking those monolithic solutions and breaking them up into flexible, reusable, and configurable components. These components, or services, are available to service requests from anywhere in the network without the traditional barriers of operating system, programming language, or platform technology. Additionally, these can be reconfigured and a chain of services rearranged in a fraction of the time that traditional solutions can be changed in order to respond to changing business needs.

In the context of the electric utility industry analogy, service orientation allows enterprises to respond more readily to electricity demand (service
requests) and to adjust power supplied by power plants (reconfigure
service providers) to adjust to the demands of the grid (network).

Finally, there is the issue of economics and deregulation. Just as a
deregulated power industry permits new providers to join the grid and sell
power to customers, so, too, does a service oriented enterprise model.

The key in both cases is industry standards, transmission protocols, and
robust infrastructure. By service orienting the enterprise, businesses
introduce the potential to connect systems and databases within their
internal enterprise and even connect to trusted partners and third-party
service providers. Why maintain an address cleanup capability when you
can simply invoke address services maintained by the U.S. Postal Service
(or similar national postal service)? Why maintain your own geographical
tracking and management capabilities when you can simply call services
made available by Google Maps?

SOA can be expressed very simply: SOA is about connecting customer
requirements with enterprise capabilities, regardless of technology
landscape or arbitrary organizational boundaries. It represents a shift
within the enterprise toward breaking up organizational silos and
monolithic information systems to enable flexibility in how customer
solutions are assembled. Chiefly, SOA aims to align technology
investments and initiatives with business goals through an enterprise
governance plan. Service orientation is an enterprise strategy with far-
reaching implications into business capabilities, organization structure,
technical infrastructure and the overall agility and efficiency of enterprise
operations.

A nominal, representative architecture can be identified in order to better
understand SOA and "what it looks like." A reference diagram depicting
The SOA layers is illustrated in figure 3.2. While any given implementation of SOA may be more or less complex than this model, this diagram provides a good starting place.

**Fig. No.: 3.2 SOA Architectural Layers**

**EXHIBIT 1.2 SOA architectural layers**

The layers illustrated in figure 3.2 are as follows:

1. **Operational resources.** Comprised of existing systems, applications, and databases, the operational resources layer represents the legacy enterprise. Your customer relationship management (CRM), enterprise resource planning (ERP), and product life-cycle management (PLM) systems are good examples of operational resources. Some of these systems are commercial off-the-shelf (COTS) services that are made
available through SOA leverage these existing investments and uncover new opportunities for utilizing these assets within a larger enterprise context.

2. Enterprise components. Sitting atop the operational resources is a layer of enterprise components. Enterprise components typically employ container-based technologies such as CORBA, EJB, COM, DCOM, .NET, and the like. These assets are responsible for managing custom business logic and interfacing with the operational resource layer to carry out this logic. Additionally, they support the scalability and quality-of-service requirements of the services exposed in the layer above. A service’s ability to support contracted SLAs is based on how well designed the enterprise component layer is that supports the service.

3. Services. Capabilities from the enterprise component layer are selectively identified as services. The analysis, design, and development of these services is then funded and the services are deployed in order to expose these capabilities through well-defined interfaces. Service descriptions, quality-of-service (QoS) SLAs, and other key service metadata are also defined to accompany these important SOA assets.

4. Business processes. Individual services provide incremental value for an organization but will likely never transform the way business gets done. Business processes, however, represent powerful orchestrations of one or more services that solve a business problem. Services are bundled together into a logical flow (described as orchestration or choreography) to solve some sort of end-to-end business problem. For example, one service might provide access into
the purchase order mechanism for an ERP system and another provide access into customer account capabilities within the CRM system, but a business process could lump these services and perhaps others together in order to complete an order fulfilment request.

Deconstructing SOA: 7 Key Infrastructure Elements

Just as every SOA is likely to be different, the infrastructure that enables that architecture will also vary. There are, however, some common components and SOA infrastructure pieces that you are likely to encounter when exploring SOA enterprise solutions. These include:

a) Business rules engine. This allows business logic to be defined in such a way as to enable business owners (especially the line of business managers) to tweak and throttle key variables that drive certain business processes. Examples include tweaking insurability thresholds in the insurance industry and throttling service performance to respond to increasing seasonal demand in the retail industry.

b) Enterprise Service Bus (ESB). Considered by some to be the quintessential SOA infrastructure element, an ESB can be used to broker service transactions, map interfaces and data sets (enabling clients and services with differing expectations to communicate seamlessly), route traffic to appropriate services based on internal logic, and perform other value-added service-brokering solutions.

c) Policy server. Governing SOA to ensure that business objectives are met and that the enterprise is not exposed to undue risk is crucial. One mechanism for governing SOA is through the definition and implementation of policies, which are then applied to business processes as well as individual services. Policies...but essentially represent declarations regarding the use of service data and metadata or
other non functional qualities such as performance, security, or service reliability.

d) Service container. This is where the services actually live. Resource pooling and intelligent caching may be implanted here to improve performance. This is typically some sort of application server and may, in fact, be bundled into an ESB platform.

e) Process engine. This supports the definition, configuration, and execution of business processes (service orchestrations), and manages these processes and invokes service operations to fulfill process activities in a well-defined sequence. It may exist as a standalone installation or be bundled within an ESB platform.

f) Service manager. The service manager is responsible for service life-cycle management, monitoring service health and performance, client access tracking, and in some cases even enforcing policies and SLAs. The service manager may also manage service versioning. Finally, it might exist as a standalone installation or be bundled with a service container, a policy server, an ESB platform, or any combination thereof.

g) Service registry/repository. With few exceptions, this infrastructure element will exist for every SOA enterprise. Depending on the size and requirements of the enterprise, any of the previously identified infrastructure elements may or may not exist. The registry/repository is crucial, because it serves as the directory for service descriptions, interfaces, and other key metadata. Services also can be organized within the registry/repository according to a predefined or organization-specific taxonomy or categorization schemes to support service discovery. Some registries/repositories are deployed independently, while others are bundled with a
Service orientation is a powerful concept and represents a business model that has been successful in a variety of industries (most notably the electric utility industry). In SOA, the business process itself executes as software. It can automate many tasks SOA requires that you formally identify the players in the process. They are called service providers or simply services. Each service performs a set of tasks.

Once services are identified, their roles and responsibilities become very clear. SOA now requires you to look for ways to automate tasks. Task automation can significantly reduce error and cost. If the service provider is a human being, we need to look for ways to use software to automate the task. For example, we could have the system automatically launch the call center application and pull up the call log and order history before an employee begins processing a return. Not all human tasks can be automated. SOA and BPM recognize this reality and support human-based services as well.

Once all the services are implemented, either by using software or by assigning relevant tasks to the staff members, we can develop orchestration. Orchestration is a software program that controls the sequence of tasks in a process. Each task is performed by a service. With orchestration, human beings no longer manage the flow of activities in a business. SOA is a solution development approach that is ideal when the solution involves many software applications, people, machines, and business partners.

SOA takes a structured approach. First, the problems are identified. Then the business process is carefully optimized. Many of the
problems are solved right at this point. Next, we identify the players or the services in the business process. Then we implement the services. Finally, we create an orchestration that automates the whole workflow. The line-of-business managers are actively involved in the early phases. They define the business processes and work on fixing its weaknesses. In the later phase, IT gets involved. They are responsible for implementing services and the orchestrations. SOA shines at bringing both sides to the same table. The process model and service specifications act as the common language. Business process management (BPM) is a cornerstone of service oriented architecture (SOA). Every business exists to provide some kind of value. The most common recipient of this value can be customers, partners, shareholders, and employees.

The most common forms of value are goods, information, services, share price, and dividend. A business carries out a sequence of tasks to produce a specific value. This collection of tasks, their sequence, and the roles and responsibilities surrounding these tasks are collectively called a business process. In summary, then, these are the various components of a business process:

a) Trigger event. This starts a business process.

b) Input to the process. This might be information, goods, or contracts that must exist before the process can begin.

c) Tasks that need to be carried out. The tasks can be performed by people, machine, or software. Roles and responsibilities around these tasks are well defined. Just like a process, a task can also have input and produced value (output).

d) Sequence or order of the tasks.

e) Exception scenarios. How does the process deal with erroneous or unusual situations?
f) Output of the process. This is the final goal achieved by the process.

Business Process Management is a discipline that covers all aspects of defining and performing business processes. It has the following components:

i. Define the business process. This involves modeling the process. Business process modeling is a discipline in its own right.

ii. Establish the business process. This involves activities such as training the staff and writing software to automate the tasks. This is the groundwork needed before the process is put into practice.

iii. Put the process into practice and begin following the process.

iv. Monitor and control the process. We have to make sure that everyone is following the process. Performance level of the staff is monitored and managed using the usual management practices. The time and cost performance of the business process falls directly under the jurisdiction of BPM. How long does it take from order placement to shipment? How long on average does a machine sit idle waiting for a job? How long does a part have to wait before the paint machine can process it? These numbers, if you can gather them, can indicate the vital pulse of your business. For example, a machine sitting idle for too long indicates overcapacity. A part waiting too long to get painted points to a bottleneck.

v. Improve the business process. The urgency to fine-tune a process usually comes from the discovery that it takes too long or too much money to complete the process, that customers have shown dissatisfaction with the quality of service, or that the competition is doing things more accurately and faster. In other words, the source of pressure for continuous improvement can be either internal or external. BPM encourages an organization to form a dedicated
process management team that monitors the processes, KPIs, customer satisfaction figures, and the competition, and suggests enhancements to the process. The workflow now has become a sequence of activities—in other words, a business process. The role of each application in this integrated solution becomes clear. SOA replaced the IT centric notions such as data source and sink with management centric objects like tasks, roles, and responsibilities. SOA also does not mandate that these tasks be performed entirely by software. They can be performed by people, software, and by external organizations. In case of the last one, the exact nature of how a task is carried out may be completely opaque to the organization that owns and executes the process.

SOA really confronts IT to think beyond software and understand how the business operates where not everything can be automated through software. In SOA, a business process literally runs as software. This is known as business process automation. An automated business process is also known as orchestration. Essentially, the orchestration software does the coordination of tasks that eventually complete a business goal. For the first time, key business operations are overseen, controlled, and managed by a piece of software. Even the most complex operations, involving suppliers, partners, government, human beings, and software, can be coordinated in this way. This phenomenon can be compared with the Airbus 320, which was the first major airplane to be piloted by software. There is a note of caution, however. Leaving the day to day supervision of a process to an orchestration software will require a lot of trust from the managers.
The process has to be very mature and well understood for you to be able to build all possible eventualities into the orchestration. On the positive side, managers will get involved with supervision only if an unforeseen scenario occurs. This will free up time for them to focus more on the time, cost, and customer-satisfaction performance of the process. Ronald Schmelzer, of industry think tank ZapThink, describes four key benefits to SOA:

(1) Reducing integration expenses (both development costs and maintenance costs), (2) increasing asset reuse (no need to reinvent the wheel each time), (3) increasing business agility (the pace of business has changed, but few enterprises have), and (4) reducing business risk (both operational and compliance risk). Use of loosely coupled, 'standards based' interfaces keeps integration costs low. By leveraging standard protocols, data formats, and interfaces, a great deal of traditional integration costs can be mitigated or even entirely avoided. Additionally, SOA's push toward loosely coupled system integration allows for a reduction in time spent writing and ultimately maintaining custom integration logic. The simple mantra is that one human being can produce a lot more with the aid of tools. The tools do the repetitive tasks at a faster rate and more accurately than a human can. Humans control these tools and perform some of tasks that the tools cannot perform.

In her paper titled "The Trouble with Enterprise Software," Cynthia Rettig portrays a damning picture of the current state of IT. She specifically cites complexity of today's enterprise software as the primary source of the problems. Software by nature is not a true thinking machine. Instead, all possible conditions must be explicitly coded. By some

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measure, a 25% increase in complexity of a task causes 100% increase in complexity of the software.

Automated business process, or orchestration, is perhaps the very reason for the existence of SOA. Since the beginning of time, the focus has been to automate individual tasks. Now we are moving into a new world where the entire business process (which is a sequence of tasks) is automated. In this world, the entire business becomes akin to a machine. Its internal operations, its interaction with the customers, partners, and suppliers, execute in a clockwork fashion in a never-ending symphony. Human tasks present a serious problem. Not all tasks can be automated through software. SOA vendors have a way to include human tasks in an automated business process. When the work is done, the employee marks the task as completed. Expect to develop a lot of such front-end user interfaces to support human tasks.

In most cases, automated business processes or orchestrations will be the consumers. SOA promises that once a service is developed, new business processes can use them as-is. This reusability of services allows IT to respond quickly to a change in business process or automate a new business process. For a service to be reusable, a few conditions have to be met. These include Completeness of capability, Universality and Interoperability. Services Can Be Composed Like LEGO® Blocks. With LEGO® blocks, most pieces can be coupled with any other piece. This is possible because the pieces use a uniform coupling interface. In SOA, this metaphor is important. For example, let us say that you have business processes that use the accounting system for invoicing and payment. If you design the accounting system service properly, we
should be able to replace the current accounting software with a new one and not have to change the business processes.

Thus, SOA is not a one-trick pony. It is a robust and flexible approach to addressing common challenges in enterprise architecture (EA). Service orientation is effectively being applied in the Defense, Financial, Media, Technology, and Travel sectors as well as many others. In looking at specific industry examples, common themes and motivations for service orientation emerge.

There have been various maturity models of SOA. One such model, called the Service-Oriented Architecture Maturity Model is given in the Annexure - I.

3.5.2 Platform for knowledge sharing or a ‘Multiversity’

As described in the SOA section, what is suggested is a common platform that will bring about standardization of various services related to Technical education. This could not only invoke the available OER like NPTEL, which are very useful and valuable for a country like India, but actually put in place a framework for transacting courses across different universities and institutions across the globe. This could really have a great impact on bridging the haves and the have-nots in education and bring in a great diversity and richness that has the potential to transform life if enough care is taken in the design of the curriculum and teaching methods. The question of whether such a configuration is desirable and beneficial has been studied in the qualitative and quantitative analysis in this research.
3.6 NEW EDUCATION

Even in the context of so-called ‘highly developed’ countries with very high GER in higher education, there are some serious questions that warrant attention. Are the conventional HEI really fulfilling the aims of education? Even if there are institutions which do offer a great degree of choice in curriculum, flexibility and choice in the modes of learning with the provision of assessment or examinations on demand, can it be truly said that the aim of education is indeed being fulfilled?

To understand this question, the aim of education is again recapitulated. The aim of education is the promotion of knowledge of the self, knowledge of the universe and the effective and harmonious relationship of oneself to the Universe. As this issue is understood, one question that comes up again and again is as follows. Does the form and content of education that is found in most developed countries represent what we really need in India or the world, for that matter? In the context of the issues of climate change and ‘the inconvenient truth’, the conflicts in Libya, Egypt, the middle east, the revelations of wiki leaks, the unfortunate Tsunami, the financial recession, the various scams, the politics of money and caste that have rocked the country and such events that have been experienced in the very near or distant past, the search is on for a true, wholesome education.

In this context, the words of Jawaharlal Nehru70, poignantly capture this. “What I am concerned with is not merely our material progress, but the quality and depth of our people. Gaining power through industrial processes, will they lose themselves in the quest of individual wealth and soft living? That would be a tragedy, for that would be a negation of what

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70 excerpts from Pandit Jawaharlal Nehru’s Azad Memorial Lecture (February 1959)
India has stood for in the past and, I hope, in the present time also as exemplified by Gandhiji. Can we combine the progress of science and technology with this progress of the mind and spirit also? We cannot be untrue to science, because that represents the basic fact of life today. Still less can we be untrue to those essential principles for which India has stood in the past throughout the ages."

Coming back to the present, the world is rocked by disturbing events, almost daily. As told by the newspapers daily, at the International level as well as the level of Nations, States, societies, communities, families and the individual too, greed, hatred, anger, jealousy, fear, violence and insecurity are threatening the very basic life.

Swami Vivekananda71 had warned, way back in 1893 that ‘Everything has a price, including progress. Progress can sophisticate a civilization and, at the same time, sacrifice the spirit.’ His prophetic words resonate deeply as we look around us today. ‘Such is the irony of progress that the faster a nation advances the faster dissatisfaction and corruption course through its veins. The main spring of the strength of every race lies in the spirituality... and the death of that race begins the day that spirituality wanes and materialism gains ground.’

India is at a cross roads today. As she grapples with the problems of low GER, quality and equity, can she deal with them differently and not blindly follow the predominantly western approach and prevalent models that are clearly showing their inadequacy and lack of sustainability? Can she innovate to combine the progress of science and technology with this progress of the mind and spirit also? Given that Science is the basic foundation stone on which today’s world stands, she ought to be

71 These are from ‘Man Making Education Guide-Book 1’ by Pravrajika Brahmaprana of Sarada Convent, Santa Barbara, California. Published by Shri Ramakrishna Ashram, Indore. (Page 7).
relentless in her commitment to excellence in the pursuit of science. At the same time, can she cling to the truth that India has stood for, through the ages? This coming together of Education of Arts, Humanities, Science and Technology, fully anchored in Spirituality will possibly be the master stroke of India. This would be the winning formula in the World’s relentless quest for a perfect education.

If we go the business as usual way and blindly follow what the developed countries are providing in Higher and Technical Education, we may be missing something very important that India has always stood for. We ought to strive to truly build education that aims at building of professional excellence and a capacity to continually pursue excellence and create humane professionals as detailed in chapter II. For this, an appreciation of what could and perhaps, should be the aim of ICT in the process of learning at the micro level is in order.

The aim of ICT is not only to maximize access to education but also, and more importantly, to contribute to the excellence of the quality of education, in several ways, known or unknown and thus to provide a new architecture to education that would facilitate various kinds of processes. These processes would include the following:

a) The production of learning materials and data from various sources of ever higher expertise, scholarship and craftsmanship of presentation and communication.

b) Cultivation on the part of the learners the ability of impartial observation and unprejudiced judgment.

c) Leisurely pursuit of interests and desired level of acquaintance, familiarity, mastery and holistic vision.
d) Quietude and even silence, which are preconditions of concentration and reception of knowledge.

e) Voluntary pursuit of difficult terrains of detailed labour involved in gaining mastery and perfection even in the nooks and corners of areas of learning.

f) Facilitation in pursuit of learning through various modes of delivery such as lectures, demonstrations, creating or visiting exhibitions, power point projections, watching dramas, cinemas, film strips, videos – short or long, or simulating performances or improvised skits and plays, conceiving and executing individual or collective projects and individual contact with the members of circulating consultants, advanced peers, monitors and even renowned visiting professors.

g) Facilitation of designing curricula according to interest and combination of unorthodox subjects.

h) Facilitation of assessment, continuous, periodical or terminal or final, according to the need and readiness of the students.

i) Creation of a universal, Virtual Multiversity or a consortium or collaboration of many, many, Universities with points of presence even in far flung areas of the country.

That is the overall picture. The smaller building blocks to realise that aim are now to be created one by one.

At the micro-level or the point of presence on the ground, the emphasis would have to be on stimulating learning in the true sense. The emphasis in this paradigm is to stimulate constructivism, constructionism, social constructivism and self education. To facilitate an understanding of this,
the following paragraph explains these as drawn from the moodle web site on these at the URL-\textit{http://docs.moodle.org/en/Constructionism}

"From a constructivist point of view, people actively construct new knowledge as they interact with their environments. Everything you read, see, hear, feel, and touch is tested against your prior knowledge and if it is viable within your mental world, may form new knowledge you carry with you. Knowledge is strengthened if you can use it successfully in your wider environment. You are not just a memory bank passively absorbing information, nor can knowledge be "transmitted" to you just by reading something or listening to someone. This is not to say you can't learn anything from reading a web page or watching a lecture. Obviously you can; it's just pointing out that there is more interpretation going on than a transfer of information from one brain to another.

Constructionism asserts that learning is particularly effective when constructing something for others to experience. This can be anything from a spoken sentence or an internet posting, to more complex artefacts like a painting, a house or a software package. For example, you might read this page several times and still forget it by tomorrow - but if you were to try and explain these ideas to someone else in your own words, or produce a slideshow that explained these concepts, then it's very likely you'd have a better understanding that is more integrated into your own ideas. This is why people take notes during lectures (even if they never read the notes again).

Social constructivism extends constructivism into social settings, wherein groups construct knowledge for one another, collaboratively creating a small culture of shared artifacts with shared meanings. When one is
immersed within a culture like this, one is learning all the time about how to be a part of that culture, on many levels.

A very simple example is an object like a cup. The object can be used for many things, but its shape does suggest some "knowledge" about carrying liquids. A more complex example is an online course - not only do the "shapes" of the software tools indicate certain things about the way online courses should work, but the activities and texts produced within the group as a whole will help shape how each person behaves within that group.

The learning spaces to be created in the new paradigm would need to have spaces and facilitation for these processes to occur locally in face to face discussions just as it should facilitate such interactions on the internet with groups of learners and students. Typically, there would be discussions that contribute to building a culture of lifelong learning, which will be the hallmark of a new, knowledge society. It is thus important to understand motivations of individuals' behaviour in a discussion as detailed below:

**Separate** behaviour is when someone tries to remain 'objective' and 'factual', and tends to defend their own ideas using logic to find holes in their opponent's ideas.

**Connected** behaviour is a more empathic approach that accepts subjectivity, trying to listen and ask questions in an effort to understand the other point of view.

**Constructed** behaviour is when a person is sensitive to both of these approaches and is able to choose either of them as appropriate to the current situation.

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72 [http://docs.moodle.org/en/Philosophy](http://docs.moodle.org/en/Philosophy)
In general, a healthy amount of connected behaviour within a learning community is a very powerful stimulant for learning, not only bringing people closer together but promoting deeper reflection and re-examination of their existing beliefs.”

Moving over to the ‘points of presence’ or the Halls of Culture and Training (HCT) that have been detailed in the *Multiversity model* in chapter VI, it is felt that if the ambience, mechanisms and spaces for learning can actually be designed and created well at the micro level, this would go a long way to facilitate learning.

Learning is the core which enables the seeker:

a) to understand or place the object of knowledge in the context;

b) to ‘overstand’ or see the object of knowledge from different directions and dimensions and see it in a hierarchy.

c) to experience identity with the object of knowledge in a state of contemplative silence.

What could be the other specific tasks or action taken in this direction of providing integral education?

One such action could relate to the narration or provision of stories of truth, beauty and goodness. These could be drawn and compiled from various contexts and cultures of the world and be a central, core part of the OER that would be offered to the learners.

A study and practice of the theme of consciousness through a variety of methods could be bundled into the curriculum.

Material related to knowledge of the inner self could be compiled and presented to students. Monographs and books related to the values of illumination, heroism and harmony could be presented to students through OER. A list of such material such as monographs on personalities
that have led inspiring lives, Books such as ‘Good Teacher Good Pupil’, ‘Aim of Life’, ‘Beauty and Excellence of the Human Body’ are all presented in Annexure – II.

These are the various issues and ideas that have been studied as a part of the research by suitably framing these questions into the questionnaire to elicit the extent to which students and faculty members, who are the clients and customers of our current service of technology enhanced education, endorse these. The next chapter delves at length on the methodology that has been adopted to address and understand all these issues in the course of this research.