

THE VIRTUAL UNIVERSITY

Models &
Messages

Lessons from
Case Studies

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NetVarsity, India

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A commercial enterprise



United Nations
Educational, Scientific and
Cultural Organization



International Institute
for Educational Planning

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List of abbreviations

| | |
|------|--|
| ICT | Information and Communication Technology |
| IIT | Indian Institute of Technology |
| IT | Information Technology |
| NIIT | National Institute of Information Technology |
| PC | Personal computer |
| SEED | School for Employee Education |

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1. The NetVarsity and its context

The National Institute of Information Technology (NIIT) is a global Information Technology (IT) solutions corporation that delivers software and learning solutions, as well as IT training, to customers all over the world. Based in New Dehli, it has a network of some 2,500 centres operating in 38 countries. It currently has close to 500,000 students enrolled worldwide.

NIIT was founded in 1981 by entrepreneurial IIT (Indian Institute of Technology) Delhi college friends, Rajendra S. Pawar and Vijay K. Thadani. P. Rajendran, who was also at IIT Delhi, joined them a few months later. They had an early vision of a society that would need to cope with the information age in the future, but that was unprepared to do so at that time. Their mission was: 'Bringing people and computers together, successfully'.

By 2002, NIIT was the 13th largest IT training company in the world and among the top five publicly listed IT companies in India. The company has been growing steadily, driven by demand for its software solutions products and development of its learning solutions business. NIIT grossed US\$200 million in revenues in 2001.

NIIT began with a vision of massive requirements for IT talent in a world moving into an information-based economy. Its mission has been to deliver IT training to a broad spectrum of people, from students seeking a career in computers to IT professionals requiring advanced skills, and from managers seeking a competitive edge to schoolchildren using computers as a learning tool. One of NIIT's achievements has been to make this education easily accessible to people, in their own neighbourhoods, and now even within their own homes through the Internet.

Education and training

NIIT pioneered IT education and training in India in 1981 and over the years it has developed a range of curricula for people with diverse requirements. NIIT's focus is on providing advanced training on a myriad of software platforms and creating 'industry-ready' professionals who have the necessary 'hot skills' for a career in IT.

The entire education offerings from NIIT are divided into three separate categories: Futurz, Curriculum for Advanced Technology Studies and SWIFT.

Under Futurz, NIIT offers students a series of programmes, including the four-year comprehensive GNIIT classic programme, which is NIIT's flagship programme. The GNIIT course lasts four years and is equivalent to a Bachelor of Computer Applications degree course in the formal education system. The fourth year is a professional internship, where the student is placed in an appropriate industry for the final year. GNIIT is the only IT curriculum in India that offers such industry training where students are placed in organizations to gain work experience.

NIIT has also initiated a US\$94.62 million student loan programme with the International Finance Corporation (the World Bank's private investment arm) and Citibank that will allow around 40,000 students with limited financial resources to enrol in GNIIT programmes over the next five years.

NIIT's Curriculum for Advanced Technology Studies provides training on advanced technologies to experienced IT professionals, helping them to upgrade their skills and stay ahead of the competition. Alliances with technology leaders like Computer Associates, IBM, Microsoft, Oracle, and Sun Microsystems are giving NIIT a preview of the technologies of the future. These alliances also enable NIIT to launch its latest training offerings well ahead of others and help its education business to grow at a steady pace.

NIIT has taken initiatives to demystify computers for people from all walks of life. With its SWIFT India programme, NIIT provides simple and affordable solutions for people who no longer want to be intimidated by computers.

Recognizing the growing importance of the Internet as a tool for delivering training, NIIT made its foray into the distance learning/e-learning domain through NetVarsity, the online university it founded in 1996. NetVarsity was in fact India's first online learning facility, based on the model of a conventional university. NIIT converted its online learning business into a new subsidiary, NIIT Online Learning Limited (NOLL), in April 2000.

In order to be able to cater to the IT learning needs of schoolchildren (primary and secondary levels) the company set up an independent business unit that focuses on the implementation of projects within specified quality and time norms. NIIT has already committed itself to a dominant share of this business in the three Indian states of Karnataka, Punjab and Tamil Nadu. West Bengal has also entrusted NIIT with the task of introducing computer education in 100 schools as a pilot.

NIIT training is available at 2,497 learning centres in countries including China, Malaysia, South Africa, Thailand, the USA, Viet Nam and Zimbabwe.

NIIT also develops software. At the start of the 1990s, less than a fifth of NIIT's revenues came from software development, which was on the periphery of its IT learning business. Today the two businesses represent an almost equal share of NIIT's activities.

It is important to note that the interplay of the vast range of related services in NIIT's software and learning businesses creates a synergy that benefits both businesses, somewhat akin to a hospital being attached to a medical college. The experience gained while working on software projects is used to provide students with real-life situations, making them hands-on practitioners. In turn, these practitioners provide the essential human resource input to create software solutions.

NIIT has set up one of the world's largest educational multimedia software development facilities. Its software business has been assessed at Level Five, the highest maturity level that can be achieved under the Software Engineering Institute's Capability Maturity Model for Software Process Capability. (This is a global standard in software development that originated from Carnegie Mellon University in the USA; it is the most respected standard in the industry.) NIIT became the twelfth organization in the world delivering quality software as per this specified benchmark. NIIT's knowledge solution business has also been assessed at Software Engineering Institute Level Five, making it the first content developer in the world to be so assessed.

1.1 International context

NIIT aspires to be a global leader in information technology solutions, and part of this mindset is being a creator of technology. Any company with global aspirations cannot operate on the strength of somebody else's technology alone. NIIT's goal, therefore, is to be a net creator of technology. It will use available technology, but it will also create its own.

In the years to come, NIIT aims to expand its presence as a global player and strengthen its pre-eminent position in the knowledge management area by helping to create knowledge solutions for customers.

NIIT has very clearly outlined the goals for its key businesses. In the global learning business, the aim is to become the world's largest IT education and training company, while in the global software business the target is to become the best by setting new benchmarks in software development productivity, customer satisfaction, employee satisfaction, and product quality.

NIIT's growth strategy has been to address a global marketplace, in recognition of disappearing borders and increasing Internet use. In the early 1990s, less than a tenth of NIIT's business came from abroad. Today, half of its revenues come from the USA, Europe, and the Asia-Pacific region.

From a situation where NIIT has achieved all its growth through its own means, the company is accelerating its efforts to tap a wider share of the market through its equity-based strategic alliances with other technology companies.

Headquartered in New Delhi, India, NIIT operates in thirty-eight countries through 100 per cent-owned subsidiaries in the Americas, the Asia-Pacific region, Europe and Japan. NetVarsity is featured in all of NIIT's global plans.

1.2 National context

NIIT does not award degrees and is not authorized to do so. The issue of 'recognition' by the formal (state) system of education in India has been debated many times within the company. The company feels that it is not feasible for its educational processes to adhere to the norms laid down by the formal system. These norms include such factors as faculty qualifications, staff-student ratios, space, fees and curriculum. In a company that operates privately in the IT skills area, many of these norms do not apply. For instance, faculty qualifications are no indicator of faculty skills. Since NIIT has no state subsidy and is a tax-paying entity, its fee structure must be substantially different from regular universities. Most important, the curriculum at NIIT needs to be changed once every six months or so, in keeping with the rapid pace of change in the industry. The university system in India has no process that can permit or certify such changes. However, the Indian Government has several large distance learning institutions, where some of these issues are being studied. The Indira Gandhi National Open University and the National Open School are both in communication with NIIT in regard to developing suitable models of IT higher education.

The Internet is available in most places in India. Connections are reliable and of reasonable bandwidth (28.8 Kb/s over phone lines) in most cities. It is felt that the telecommunications infrastructure in the country is adequate to support the use of Information and Communication Technology (ICT) in education.

2. The creation, organization and current programme of the NetVarsity

In 1996, NIIT decided to set up an Internet-based education portal, in view of the anticipated growth of Internet accessibility.

2.1 Creation

The task of setting up the education portal was given to the R&D centre of the company, and the project was funded with NIIT's own resources. The decision was taken to set up the web servers in the USA because the Internet infrastructure in India at that time was both new and unstable. The initial design of the website was created by the head of the R&D Centre at NIIT (the author of this study). The site was created and hosted in a period of about two weeks and came online in July 1996.

The objective of the initiative at the time was to see whether sufficient people would be attracted to a (free) education portal. If so, a business model was to be created. The audience was expected to be international due to the nature of the Internet and to the fact that IT skills training is sought after globally.

Courses on various aspects of IT were taken from NIIT's regular education divisions and converted to suit a web-based audience. The portal also included a virtual 'library' of links, a 'coffee shop' where students could chat with each other, and a 'swimming pool' where sports-related links were provided.

The NetVarsity consists of a server in the NIIT office in Atlanta, USA, connected to a service provider through a T1 link (a T1 line can carry 24 digitized voice channels, or it can carry data at a rate of 1,544 Mb/s per second). As mentioned above, it was decided to locate the server in the USA because the reliability of the Internet link was greater there than in India, but another reason was lower cost. This proved to be a good decision as the server has operated with almost no down time from 1996. It was based on Windows NT and Microsoft Back Office technology. The server and its contents were controlled from New Delhi, India, by a team of seven people, who constituted the staff of NetVarsity.

After NetVarsity's creation, it was decided to use an 'atomized' instructional design consisting of 'Skillettes'.¹ Skillettes are short units of instruction designed to be used on the Internet. During 1997–1998, NetVarsity offered short courses or just stand-alone Skillettes for a price ranging from US\$5 to US\$25. During NetVarsity's first year, there were about 10,000 hits per month and total annual revenue was about US\$700. Since this was not sufficient income to maintain the programme, some modification was necessary. In addition, it had been noted that students were having difficulty concentrating on screens with only text and pictures. They became bored easily, with the result that they did not complete their courses.

¹ 'Multimedia design for the Internet', Sugata Mitra, presented at the Parallel Convention, 13th Commonwealth Conference of Education Ministers, Gaborone, Botswana, 1997.

The first modification consisted of a link to the NIIT Intranet to allow faculty members from NIIT to interact with each other through a technology forum. This connectivity among 800 teachers working throughout India resulted in tremendous synergy and improvement in quality.

The second modification, in 1998, consisted of improving access for NIIT students by supplementing their virtual classroom education through a site called 'Tech Edge'. This site provided general information, state-of-the-art courses and a help desk. It was divided into four services:

- Ask an Expert: A help desk that referred questions to a panel of experts;
- Global Forum: A chat and threaded discussion forum for students and faculty;
- First Access: A section with short courses on emerging topics and technology;
- Online Testing: A section where students could take mock tests to check their understanding of courses before they took an actual examination.

In 1998, nearly 40,000 students used the site.

The third modification to NetVarsity was the introduction of Microsoft certification courses. This was the first hybrid education model that NetVarsity used: students would do self learning at home, then access a learning programme on the NetVarsity website and use TechEdge for the four services listed above. The Microsoft certifications are in high demand all over the world as they have de facto recognition, being authenticated by Microsoft. NetVarsity is the only online organization providing these courses. During 1998/1999, over a hundred students completed their online courses and received certification. These courses generated a revenue of over US\$100,000 for NetVarsity.

In 1998, NetVarsity was an online institution of seven persons operating from New Delhi, with a web server in the USA and networking around 50,000 learners and teachers together in a commercially viable manner. The model was deemed worth developing further.

In 1999, it was decided to introduce NetVarsity into the GNIIT programme, the NIIT flagship course described earlier. In the new version, called iGNIIT, launched in 1999, students who are admitted to the programme are automatically enrolled in NetVarsity. Each semester consists of 144 hours of courses, and almost all are expected to be taken in a physical NIIT facility, that is, in the classrooms or laboratories of a NIIT centre. An unspecified amount of extra time is to be spent on the Internet with NetVarsity. NetVarsity provides each student with a learning plan, self-paced online tutorials, mock examinations, projects, the TechEdge services and so on. Out of the 9,000 students who were admitted to the iGNIIT programme as of 2001, 4,000 were expected to graduate soon.

The NetVarsity experience, as described above, represents a purely Internet-based model of instruction that has evolved into one that is intimately connected with the large 'bricks-and-mortar' infrastructure of NIIT.

Lessons learned

- Students do not seem to be attracted to learning only from a web portal.
- Students do not want to pay for content that is solely conceived for – and available on – the web.
- Drop-out rates are high (50 per cent or more), even for the few students who paid for using the portal.

- Interactive environments are popular and attract both students and teachers.
- Hybrid education models (conventional classroom and Internet) can encourage students to use the web-based learning mode.
- Certification from a recognized organization is important to students.
- Attention spans are low on the web, and instructional design needs to be modified to take this into account.

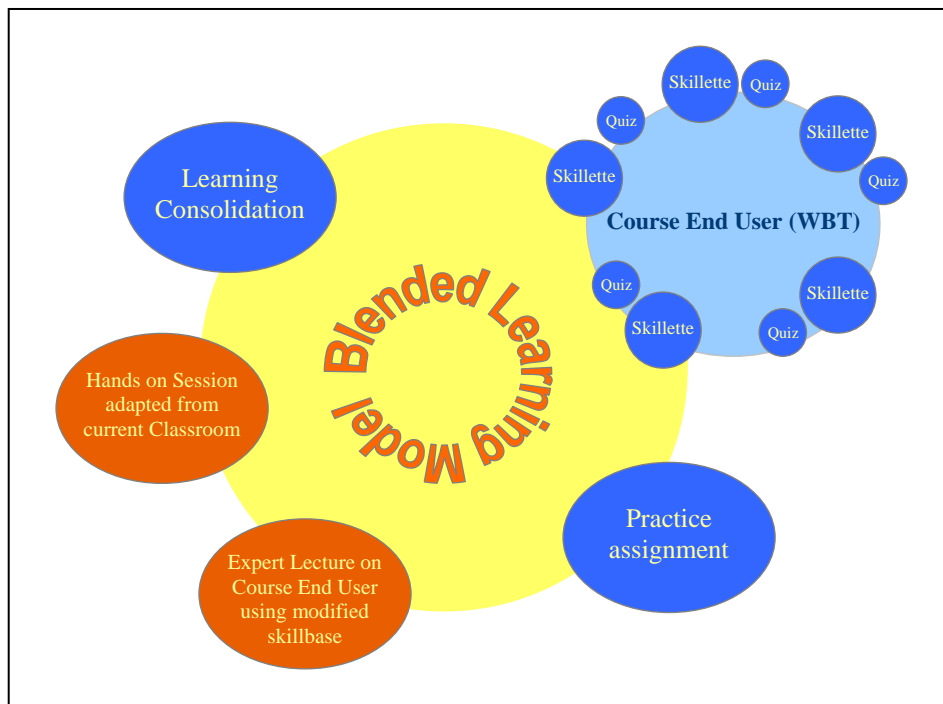
It can be expected that institutions will use a hybrid system that includes e-learning only if such a system is more cost-effective than the classical system, while providing the same instructional efficiency.

2.2 Organizational structure

While NetVarsity started as a department of NIIT, it is now a separate company called NIIT Online Learning Limited. The company follows standard corporate law procedures. It has a board, which is constituted of industrialists, academics, technology experts and marketing experts. The company has a Chief Technology Officer and a Chief Pedagogy Officer, in addition to the Chairman and Managing Director. A technology team, an operations team and an administrative team run the company. There are about twenty-four persons in NOLL at any given time. This includes a continuous help-desk team.

NOLL is currently in the process of building a team of experts and other resource persons who will work for the company using the Internet.

Figure 1 The hybrid model at NetVarsity



Source: Developed in-house by NetVarsity.

Table 1 NIIT and NetVarsity students by gender

| Gender | IGNIITians | NetVarsity* | No. of students |
|--------------|--------------|----------------|-----------------|
| NULL | 81 | | 912 |
| Female | 1,503 | 26,106 | 27,609 |
| Male | 3,673 | 76,738 | 80,411 |
| Total | 5,178 | 103,754 | 108,932 |

* The NetVarsity heading refers to those students who enrolled directly through the NetVarsity web site.

Source: Internal data from December 2002.

2.3 Current programme

In 2002, NetVarsity launched a completely new education model based on the experience described above. The new model, often referred to as a ‘fusion’ or blended model combines the GNIIT course with web-based content. Under this fusion model, certain topics are not taught in class at all. This model provides students with the option to study something in class or on the web. The model is applied across the board, such that all GNIIT students are automatically enrolled in NetVarsity and are required to complete twenty hours of the course each semester on the Internet. The remaining 120 course hours are spent in the conventional manner, in classrooms and laboratories of a NIIT centre.

For students who do not have access to the Internet, a CD-based version of the twenty hours of web-based instruction is also available. This is necessary in the Indian context where the availability of the Internet cannot be guaranteed.

The structure of the course model is illustrated in Figure 1.

At the end of 2002 there were over 100,000 students enrolled at NetVarsity. Table 1 details the student-body composition enrolled at NIIT and NetVarsity according to gender.

NetVarsity has a large and varied student body. Courses attract relatively young students, with nearly 70 per cent of them being between the ages of 18 and 25. Their educational background varies from less than ten years of schooling to graduate and postgraduate degrees, with most of the students having at least two years of college before enrolling at NetVarsity.

The course materials are developed by a team of academic staff as well as by external experts. NIIT’s own academic staff members generally consist of university graduates with an average age of about 27 years. There are equal numbers of men and women in the group. Support staff consists of four technical administration staff and seven software developers.

Development of the organization during the next few years will depend on the success of the fusion model described above.

Lessons learned

At this point, the main lesson from the NetVarsity experience seems to be that it is not commercially viable to operate a purely Internet-based learning programme unless it is linked in a direct way to a formal educational organization.

3. Administrative issues

It was expected that the issues involved in the administration of a virtual university would be different from those of a 'real' university. In view of this, a planning workshop was conducted with a senior educator from the Indian Government as the principal consultant. Each of the functions of a conventional university were analysed and an equivalent in the virtual environment envisaged.

3.1 Administration

The actual operations over the last few years show interesting differences with regard to the originally envisioned structure. In our experience, many of the functions become redundant or can be automated in the electronic system. For example, the function of the registrar could be almost entirely eliminated. In the corporate environment, the chairman of the company takes the place of the Chancellor. The Chief Technical Officer effectively becomes the Registrar. The main administrative tasks relate to development of new instructional materials, answering queries and other student concerns, and upkeep of the network.

3.2 Costs and financing

All NetVarsity costs are covered by funds from NIIT. Total annual expenditure amounts to approximately US\$1.6 million. Fifty-two per cent is allocated to direct expenses which include technology infrastructure, incurring 23.9 per cent of overall expenses, services (including Expert Technical Services, Help desk, and e-Consumer Relations Management – CRM) and course material. Only 4 per cent of direct expenses is spent on course material, while nearly 18 per cent is expended on services. Sales and marketing, personnel and administrative costs constitute indirect expenses, which amount to 48 per cent of the annual budget.

In practice there may be a 30 per cent saving, especially on direct expenses, because of lower costs for technical infrastructure and expert services.

3.3 Technological infrastructure

The technological infrastructure of the NetVarsity is as follows.

Functional components of the NetVarsity architecture

Core NetVarsity portal

This is the common entry point for students, partners, experts and general visitors. It gives an overview of NetVarsity, its products and services, handles registration and subsequent sign-on, and connects visitors to designated components of NetVarsity, which deliver specialized services/functionality.

Online shopping and e-commerce engine

This module encapsulates the e-commerce capability for B2C (business to consumer) transactions and includes features such as a product catalogue, shopping cart, credit-card

payment interface, etc. It also includes connectivity with the payment gateway services provider, and modules for learning delivery and revenue recognition.

Product and content management – Online manager application

This module provides the back-end functionality for managing products, including geo-specific pricing, merchandising, sales promotion, and cross-selling and up-selling.

Sales tracking, revenue recognition and financial accounting system

E-businesses have special requirements and statutory obligations vis-à-vis their order processing, payment collection, revenue recognition and financial accounting processes. This module is built to handle a huge number of low-value orders. It also implements a sophisticated revenue recognition system that operates on a daily basis.

Loyalty programme, CRM help desk, and MGM applications

These interrelated applications leverage the large registered user base to generate awareness about NetVarsity, reward users for desired behaviour, promote and support usage, and address any problems faced by users.

Content delivery and global load-balancing system

This module integrates the NexGen Web-Based Training engine with NetVarsity and handles the actual delivery of learning content. It tracks usage, ensures activation and expiry of courses in the LearnDesk. The module is being enhanced to support multiple geographically separated content delivery servers to address response time, scalability and fault-tolerance requirements. It will also be enhanced to support encryption and time-based licensing of content to third parties.

Asynchronous technical web services

These are a collection of web services, such as ExpertsAnswer, Online Testing, etc., which are designed to support e-learning. The services architecture is based on the Net platform, and the services are being designed to service multiple portals (rather than just NetVarsity) thus opening up the possibility of service revenues.

Magic Key activation and pre-paid retail product management system

This module allows us to distribute pre-configured product offerings that can be activated based on a Magic Key. It can be used for bundling offers to partners or for retail product packs of NetVarsity, which can be sold over the counter at cybercafes, bookstores, etc.

Channel management and B2B (business to business) order processing system

NetVarsity is rolling out Sales Partner and Reseller programmes, which will allow it to augment its online sales. These will address both online sales partners, such as B2C portals, and brick players including Systems Integrators, etc. The Reseller programme will enable NetVarsity to reach out to individual learners in small and medium-size enterprises. Unlike sales to individuals, these programmes will require a distinct sales tracking, order processing, registration, and course activation system in addition to the registration and management of partners themselves.

Partner zones and co-branding middleware

In special cases the core NetVarsity portal will need to be interfaced/integrated with partner sites through appropriate interfaces. NetVarsity is even considering publishing its course

Table 2 Software used by NetVarsity

| | |
|--|---|
| <p>Web servers (6)</p> <ul style="list-style-type: none"> ▪ Windows 2000 Advanced Server ▪ IIS 5.0 ▪ MTS (Middle Tier) ▪ Win 2000 SP2 | <p>Database servers (5)</p> <ul style="list-style-type: none"> ▪ Windows 2000 Server ▪ MS SQL Server 2000 (dual Proc Licences) ▪ Windows 2000 SP2 |
| <p>Content server</p> <ul style="list-style-type: none"> ▪ Windows 2000 Advanced Server ▪ IIS 5.0 ▪ Win 2000 SP2 | <p>E-commerce server</p> <ul style="list-style-type: none"> ▪ Windows 2000 Advanced Server ▪ IIS 5.0 ▪ 3.0 + Commerce edition Site Server ▪ Win 2000 SP2 |

Source: Internal data from December 2002.

catalogue in the form of a web service to select partners in the future. Another strategy is to create special zones within NetVarsity for handling special alliances.

Learning Units system – Commoditizing e-learning

Instead of selling courses, NetVarsity is considering selling Learning Units. Learning delivery can then be stated in the form of Learning Units and bulk consumers can buy Learning Units as required. This system will particularly benefit the B2B2C and B2B2E (business to business to consumer, and business to business to enterprise). The Learning Unit management system will enable buyers (as distinct from individual learners) to purchase, deploy, and activate Learning Units for their population of learners.

Synchronous technical web services

NetVarsity does not offer such a service now. However, services such as Instant Messaging, One-on-One Mentoring, and Virtual Classroom have been identified for possible deployment in the future.

Software

NetVarsity has invested resources and time in choosing the best software possible. It utilizes the software indicated in Table 2.

3.4 Intellectual property ownership and copyright

The NetVarsity name and its course materials are copyrighted and held by NIIT Limited, as are several other trademarks, such as Skillette. Several patent applications have also been made.

4. Academic issues

4.1 Programme development

The more than 300 NetVarsity courses currently span most of the IT areas, certain behavioural skills and sales planning. IT courses enable an individual to either acquire IT skills or upgrade his/her existing know-how. Sales planning is rapidly becoming an important criterion for measuring one's success. The courses help students to understand the art of selling. Lastly, behavioural-skill courses help students to complement the IT skill set with people skills. By far the major emphasis is on IT courses that support the GNIIT programme of NIIT, as described above.

The NetVarsity curriculum is developed by an in-house committee that uses market data from NIIT's customers on the requirements of IT professionals. All courses are offered in English.

Faculty are required to undergo training every year to upgrade their skills. This is also done through NetVarsity using a service called eSEED (School for Employee Education). Most processes used are certified by International Organization for Standardization certification, and software quality is controlled through the Software Engineering Institute Capability Maturity Model Level Five standard.

4.2 Teaching

Courses are designed and educational materials are developed at NIIT's centralized development facility in New Delhi. This is a 'factory' of over 400 persons, of whom about 150 are instructional designers, making this one of the largest facilities of this kind in the world. NetVarsity contracts out content development to this facility. In addition, NetVarsity obtains material from other sources, such as experts in certain areas. The 'First Access' service of the TechEdge section of the NetVarsity site is provided by NIIT's Research and Development Centre (Centre for Research in Cognitive Systems).

Courses are designed through a process that starts with a vision of the course, its objectives and target audience. The course is then carefully designed for content, interactivity, lightness etc. The final product is tested for effectiveness by student volunteers.

Faculty are trained in designing and constructing educational material for the Internet at NIIT's School For Employee Education (SEED). This is a residential facility in New Delhi. The training is also available over the Internet through eSEED. In 2001, SEED conducted 45,000 training hours at a cost of approximately US\$22 per day. It is planned that in the future 15,000 hours out of this training will be taken through eSEED at US\$7 per day, representing a saving of 66 per cent.

4.3 Learning

Some aspects of the learning process have been described above. It is felt by the author that collaborative and interactive methods are more effective than support from faculty alone.

Nevertheless, NetVarsity provides faculty support twenty-four hours a day, seven days a week.

Many students in India and elsewhere have difficulty in accessing the Internet on a regular basis. As a result, NetVarsity is increasing its course content for CD use and attempting to provide CD-based material to learners wherever required.

Table 3 eSEED feedback report

| Description | Ratings* | | | | | Average |
|--|-----------|-----------|-----------|----------|---------|---------|
| | 5 | 4 | 3 | 2 | 1 | |
| 1 How clearly did you receive the information about your nomination to the course from the Supervisor/HR? | 14 40% | 11 31% | 9 25% | 1 3% | 1 3% | 4.00 |
| 2 How clearly were the objectives stated by the eSEED interface before the course started? | 8 2% | 15 42% | 8 22% | 4 11% | 1 3% | 3.69 |
| 3 How do you rate eSEED's initiative in helping you achieve those objectives? | 11 31% | 17 4% | 6 17% | 1 3% | 1 3% | 4.00 |
| 4 How do you rate your participation/initiative in achieving those objectives? | 4 11% | 16 44% | 8 22% | 8 22% | 0 0% | 3.44 |
| 5 Quality of content | 9 25% | 16 44% | 7 19% | 2 6% | 2 6% | 3.78 |
| 6 Flow of the course | 12 33% | 12 33% | 8 22% | 2 6% | 2 6% | 3.83 |
| 7 Pace of the course | 5 14% | 13 36% | 12 33% | 3 8% | 3 8% | 3.39 |
| 8 Appropriateness of learning services planned for the eSEED course (My question, PAs, PTs, Chats (if applicable)) | 11 31% | 11 31% | 12 33% | 0 0% | 2 6% | 3.81 |
| 9 Effectiveness of learning services planned for the eSEED course (PAs, PTs, Chats (if applicable)) | 10 28% | 15 42% | 8 22% | 1 3% | 2 6% | 3.83 |
| 10 Timely feedback/evaluation as applicable | 15 42% | 8 22% | 10 28% | 2 6% | 1 3% | 3.94 |
| 11 General support/assistance | 14 40% | 12 33% | 6 17% | 3 8% | 1 3% | 3.97 |
| 12 Quality of the responses received from the eMentor | 4 29% | 3 21% | 4 29% | 2 14% | 1 7% | 3.50 |
| | | | | | | 3.77 |

Total number of responses: 36

* Ratings are from 5 (satisfied) to 1 (dissatisfied)

Laboratory and (physical) library work is done at NIIT centres, and registered students can use these anywhere in the world, irrespective of where they were registered.

The completion rate for purely web-based courses (i.e. courses where students are never required to come to a learning facility) is low, in the region of less than 50 per cent. However, student reactions to such courses are usually very good. The results of a feedback report for the eSEED programme are shown in Table 3.

Research

NIIT's Centre for Research in Cognitive Systems conducts regular research on learning in the ICT-supported environment. One of its many projects is 'The Hole In The Wall', a series of experiments that have been reported in the mass media and attracted worldwide attention. The experiment shows that given appropriate access to the Internet, groups of children can learn to use the computer on their own, irrespective of their social, economic or educational background.

At present, NIIT – with funding from the International Finance Corporation, the Government of India and the Industrial Credit and Investment Corporation Bank (India's second-largest bank) – is setting up 108 outdoor computers, connected to the Internet, throughout a large section of rural India to test the effectiveness of this approach. The pedagogical approach used is called Minimally Invasive Education (for more details refer to <http://www.niitholeinthewall.com>).

Other cognitive systems research projects include systems that can automatically interview students, remotely monitor examinations over the Internet, detect learning styles, and use bots (Internet robots) to help with the learning process.

5. Cooperation

While there has been dialogue between NOLL and organizations such as the Indira Gandhi National Open University, no cooperative projects have been started to date. However, a mutually beneficial cooperation in the future would be a welcome initiative.

6. Future development

Future development and institutional change for an initiative such as NetVarsity will depend on technological advances. The following points from a speech, ‘Multimedia, tool or toy?’ given by the author at the COMDEX conference, in Singapore in September 1996, examine potential developments in technology and e-learning delivery.

Proactive programming

Let us examine some of the issues dealing with proactive versus reactive computing. These terms are not generally used to describe computer programs, they describe human behaviour. Suppose that you are sitting harmlessly in your office and a visitor storms in hurling abuse. You could get up and start shouting at him while your secretary rushes about calling the security guards. That would be reactive behaviour. On the other hand, if you consciously control your rising adrenaline level, take a few deep breaths, wait until the visitor’s tirade is over and then ask him what the matter is – that is proactive behaviour. It is generally considered more effective to behave proactively.

If you think about it, almost all computer programs behave reactively. In particular, all Graphical User Interfaces are purely reactive. They wait passively for someone to do something to them before they do anything. Whatever they do is purely a reaction to user input. The most modern programming languages are described as Event-Driven. That is, they are blatantly reactive. They will operate only when an ‘event’ occurs. When you click on a button in such an application, the program responds as programmed. It does not pause to analyse the input or to ‘think’ about how it should react.

As in the case of human behaviour, if programs could behave proactively they would be more effective. This realization is around the corner and the next generation of algorithms will be based on the concepts of such proactive programming.

How could a program be made proactive? I think the first step is to analyse the inputs before reacting to them. For example, if you always type the word ‘and’ as ‘dan’, then a word processor that remembers this and automatically corrects the error would be a proactive program. In fact, such word processors do exist and form the first examples of commercially available proactive systems.

To be truly proactive, a computer needs to be aware of its environment and its user. This does not mean that we have to wait until personal computers (PCs) acquire eyes and ears and the necessary software to analyse what they see and hear. After all, nature took several hundred million years to figure out how to do this in biological systems. But there are organisms much simpler than us that can behave proactively using simple signals from the environment.

I think to begin programming proactively, we should look for signals that are already available to the PC but that we are ignoring today. What can a PC figure out about its user? Quite a lot, I think. For instance, it can figure out how quickly you can type. A person who types quickly on a PC keyboard is probably used to computers and knows a lot about them. Such a person does not need to be told something like ‘Click on the NEXT button to see the next screen’. So a proactive program could remove that redundant instruction when it detects a computer-aware user.

Other such involuntary signals from a user that can tell a PC something about him or her, could be reading speed and hand-eye coordination. Reading speed is easily measurable every time there is text on the screen that you have to read and acknowledge by pressing a button such as OK. Once a PC has measured your reading speed, it can tell when you are skipping things and when you are reading slowly and sluggishly. It could even tell from your reading speed whether you use English as a first language or not.

The way in which a person uses a mouse contains hidden information about hand-eye coordination, acuity of vision, and familiarity with Graphical User Interface environments. You might even be able to figure out whether the user is a child or an adult. Armed with such information, the program could decide proactively about what typeface and size to use, how long to keep text on the screen, where to place buttons and of what size, and many things like that. The result would be a program that adjusts to a user's convenience automatically. In a world where most people ignore others' convenience completely, this may be a nice relief, in cyberworld at least.

Another important factor that contributes to proactive behaviour is experience. Computer programs usually do not gather experience, even when they can. For example, I always keep what I write in a directory called 'docs'. Every time I want to save, I have to click through a maze of directories and sub-directories before reaching the 'docs' directory. I have been doing this for years but my computer is not programmed to remember this. If it was, it would have proactively saved my word-processed files in the 'docs' directory without asking me.

Such proactive interfaces are beginning to emerge and, I am told, several large software companies, including Microsoft, are working on them. I think the first major impact of proactive programs will be on computer-based education. One of the reasons why a human teacher continues to be far better than any automated system of learning is because teaching is a proactive process. The teacher observes the student and works out instructional strategies based on such observations and his/her experience. Teaching programs of the future should be designed to do similar things. Such programs will detect a student's learning style, psycho-social characteristics, physiological limitations and other parameters important to learning. They will then use their experiential data about other students they have 'taught' to decide on a teaching strategy. Finally, they will reach into their bank of educational materials to find appropriate content for the teaching task at hand.

One of the interesting features of such proactive teaching programs will be that two identical programs may become totally different in their educational approach over a period of time, depending on the student populations that have used them. They might even be programmed to solicit advice from each other.

Educational paradigms

Multimedia instructional materials have the following problems at the present time:

- They are reactive and merely respond to a user action. The response is always the same for the same user action. For instance, the response to a click on the 'Next Page' button would take the user to the next page without comment, regardless of whether the user spent one second or one hour on the page.
- They do not address different learning styles of learners and are designed for one common learning style.
- They do not recognize different physiologic responses from users. For example, differences in visual acuity and hand-eye coordination are disregarded.

- They do not accumulate user experience regardless of how many users have gone through the material. Neither do they develop an ‘average user’ profile.

There is a great deal of interest in the construction of learning materials for the Internet. Such materials, when available, have the following additional problems:

- They do not address the reduced attention span of users;
- They do not address the just-in-time nature of user requirements.
- They do not address the on-demand requirements of the user.
- They do not address the extreme heterogeneity of Internet users.

In order to address these issues, a new methodology for the creation of computer-based instructional materials suitable for use on the Internet has been created. In what follows, this approach is discussed.

The Skillette concept

It is proposed that education on the Internet be designed in modules called Skillettes. Each of these would be short units of instruction, with a focused and usable content. The usability of the Skillette is its most important component. Users of the Internet and, indeed, learners in general are increasingly expected to require on-demand and just-in-time education. This is a consequence of their reduced attention spans and the increased necessity to use what they are learning immediately.

A Skillette should have the following properties:

- It is not more than thirty minutes of instruction.
- It covers one specific and usable unit of education or training.
- Its usability (skill transfer) is discussed first and any conceptual material comes later.
- It is capable of adapting to user learning style.
- It is capable of adapting to user profiles, for example, reading speed, visual acuity, hand-eye coordination and attention span.
- It is capable of accumulating ‘teaching experience’.
- It is delivered over media that permits education-on-demand and just-in-time modes.
- It is designed to cater to heterogeneous entry profiles.

Current software and hardware are adequate for the production of such material. We produced a prototype Multimedia Skillette having most of the above properties (except for accumulating teaching experience and catering to heterogeneous entry profiles). It was observed that the production effort for such material is about 2.5 times more than for conventional multimedia computer-based training material. The effectiveness of the developed Skillette is currently being studied.

In addition to the above experiment, a large number of text-based Skillettes have been placed in an Internet-based virtual university (see <http://www.NIITnetVarsity.com>). The usage of such material since 1 September 1996 is being studied.

The limitations of current multimedia-based instructional material on the Internet may be removed through the use of adaptive Skillette-based instruction. This, indeed, may indicate the direction for distance education in the future.

Proactive Programming is currently found on CD-ROM. Such programming is bound to arrive and when it does it will make the management of distance learning easier and more customized.

E-learning experience and related strategies at NOLL

The e-learning experience of NetVarsity users essentially includes the following crucial activities:

- initial browsing experience, including registration and login;
- online content catalogue exploration and search;
- product/service selection and purchase;
- use of the LearnDesk and Web-Based Training;
- use of TechEdge, especially the Expert and Online Testing services;

The key performance criteria for these activities are as follows:

- Initial responsiveness and ease of use. For example, it is expected that the Home Page download time is four to eight seconds, or that registration takes not more than between thirty and sixty seconds.
- Intuitive navigation and context-sensitive search. Users expect to be able to complete transactions with minimum clicks, preferably from the Home Page itself.
- Reliability. Uptime should be 99 per cent or more.
- Customization and ongoing customer profiling. This is useful for both users and the services and marketing teams.
- Scalability. We will need to provide for greater than tenfold growth each year for the next few years. Scalability will be required both within a site and across sites as we increase our geographical reach.

NOLL is already working with a range of partners, including online and offline service providers. Given NOLL's overall 'brick-and-portal' strategy, there is a need to cater to both online and offline customers, especially through a flexible sales process.

Customers, employees, and partners all access the same common infrastructure. However, the system interfaces are quite different and in the future will require even more customization and personalization. For example, while an individual online customer may go through an online credit-verification check, corporate customers could place bulk orders using a pre-approved credit line. There may be alternative payment mechanisms for sales partners, especially those representing NOLL in other countries.

In light of the above, the strategy will entail the following:

- centralized information architecture deployment while retaining the flexibility of distributing content to edge networks closest to the learners. Thus, the core website applications and databases will need to work flexibly with distributed content servers. This functionality will be provided through an intelligent online learning management system;
- distributed order/service fulfilment capability. This could be both geographical and through multiple partnerships. The hosting infrastructure will be geared to supporting dedicated servers for servicing large customers who may require co-branded content delivery. Since, in the initial years, the majority of the customers will be in India, it has been decided to locate our core site in a world-class Internet hosting data centre in India.

This will allow fixed costs to be kept low, and ensure that capacity is commensurate with load. It will also permit scaling up quickly, if required. In-house skills will therefore be oriented towards overall quality and responsiveness of infrastructure rather than routine administration;

- data warehousing and mining to support eCRM. These will be distributed to support geography-specific sales and marketing initiatives;
- high availability and responsiveness by outsourcing hosting infrastructure and providing dedicated high-speed communication links to support back-end processes from remote locations;
- leveraging technology partnerships with world leaders, such as Microsoft, Citrix, Computer Associates, Network Associates, Intel, Compaq, Sun, Oracle and others.

Content-technology road map

Learning is currently delivered through our NexGen 1.0 Web-Based Training engine. This engine combines a rich visual user interface with Flash technology to support a high degree of interactive learning. The current version of Application Service Provider that it is based on is fairly scalable, and an industry standard dual processor server is capable of serving nearly 240,000 learning hours per year. However, in anticipation of growing requirements, we expect to upgrade this engine using the Application Service Provider.Net architecture when it is available.

In addition to the primary Web-Based Training engine, we will be working on delivery engines for our publishing model and light IT content. In both of these areas we will build on industry standards, such as XML and SCORM, to ensure easy content reusability. For cost-effectiveness of content, we will work with technology solutions that allow us to:

- combine presentations with audio and supporting text; and
- combine recorded video with presentations and text.

We believe that, in pedagogical terms, learners will be in a position to fully benefit from video technologies. Therefore we have tuned our content and delivery technology to evolve towards videos by doing selective deployment for certain courses/partners as of 2002.

In order to maximize responsiveness, infrastructure for content delivery will be distinguished from the sales and marketing part of the site. Through the use of load balancing and web-caching technologies from service providers such as Speedera, Akamai, and others we will ensure that content is delivered to users at the desired speeds.

Services-technology road map

Our ability to provide online mentoring and access to experts, as part of our overall 'brick-and-portal' strategy, will ensure that online learners will receive an educational experience comparable to that of their face-to-face learning counterparts, while benefiting from the any time, any place, any pace e-learning paradigm.

We are already supporting users through our CRM Help desk and twenty-four hours a day, seven days a week Expert Services. We see these services evolving from the current e-mail support to:

- one-on-one interaction through instant messaging solutions based on public infrastructure;

- one-to-many interaction through chats and online forums. However, our experience shows that while technology may make chats feasible, we need to ensure effectiveness by controlling group sizes;
- with deregulation, we expect that our call centres will also be able to support voice;
- we expect to support live interaction using video. This may be in combination with videocassette recorder functionality or through collaboration tools expected to be integrated in the Windows desktop environment. In this context our requirements have been included in the specifications of the NIIT CLiKS system.

We have decided to adopt a Web Services architecture that will be compatible with the Microsoft Net initiative. We are working closely with the NIIT Center of Competence in this area. Our strategy is to ensure that our services infrastructure is flexible to support pure services-oriented initiatives with other partners. For example, the ExpertsAnswer service can be syndicated to portals and other learning providers across the globe.

In this context, we will deploy a two-level services architecture. Level One will be the core in-house services team, while Level Two will be the outsourced/distributed services team. Thus, for example, we will leverage the vast distributed base of NIIT faculty, and will partner with select call centres to scale up our servicing capacity flexibly and cost-effectively. Over time, end-customers will typically interact primarily with the Level Two services team, and only escalations will be addressed by the Level One team.

7. Policy development, planning and management in the virtual university: lessons learned

In conclusion, the experience of NetVarsity has a number of lessons to convey.

- We feel that an effective model of an Internet-based learning facility is yet to be developed. However, it is evident from the NetVarsity experience that a viable and effective model can be developed.
- The lack of resources and technological infrastructure faced by developing countries such as India point to the appropriateness of a hybrid or fusion model, such as that used by NetVarsity.
- It must not be forgotten that trying to emulate a classroom environment over the Internet is an erroneous thing to do, as the power of the virtual environment will emerge through collaboration and self-organized learning.
- Proactive learning environments are essential for maximizing the student experience.
- Recognition or certification is important to students, but the formal education-system requirements for accreditation are inappropriate for an enterprise such as NetVarsity with an IT curriculum that requires constant updating to ensure its quality. The recognition from the industry standard is more appropriate.
- It also follows that a student loans scheme is an important way of assisting students with limited resources to study in an institution that operates outside the formal higher education system of the country.