Chapter IV

RESEARCH METHODOLOGY

“No pessimist ever discovered the secret of the stars or sailed an uncharted land, or opened a new doorway for the human spirit”

- Hellen Keller
CHAPTER IV
RESEARCH METHODOLOGY

4.1 AN OVERVIEW

As discussed in Chapter I, the aim of this study is to critically study the implementation and performance of the NPTEL in Gujarat. The research aims to study the usage, utility, preferred features and qualitative aspects of NPTEL and such other e-content. The study also seeks to understand the choices and preferences of students and faculty in terms of new features that could be added to Open Education Resources (OER) like NPTEL including various modes of learning. The inputs of students on aspects of life such as the physical, ethical, aesthetic and spiritual dimensions and the modes of learning are also sought. Based on the study, analysis and findings, the aim is to evolve service oriented architecture (SOA) based design for comprehensive, sustainable, integrated degree programs in ‘on-line’ or dual mode. These could have a focus on knowledge, research, extension, training and central importance to value based education which can lead to high access, equity, quality and humanness in technical education in the country.

4.2 BACKGROUND

The primary survey conducted for this study has been designed to elicit or draw responses that would or could lead towards a suitable architectural framework. The primary survey, in turn, has been designed on the basis of the literature survey done in the course of this research.

Dual mode here refers to a degree program where some of the credits can be earned in the conventional college with the rest of the credits being earned from an online program offered through a virtual University, which is proposed in this thesis.
1. The study of NPTEL is undertaken to see how this study and findings can give leads and throw light on the ‘transformative potential’ and ecological transition as there is a paradigm shift from the conventional learning systems to the OER based systems. As these efforts are undertaken, particularly in the context of a developing country like India, great care should be taken so that the deployment and use of technology does not become like the overkill solution of using a sophisticated, high calibration vacuum cleaner to clean up the dirty floor of a modest hut in a tribal village of, say, Ratan Mahal taluka of Gujarat! What are needed are perhaps, a sturdy broom and a skilled person to clean the place. This is like the famous statement of NYU Prof. Postman’s reference to the ‘headlamp washer wiper predicament’ of societal submission to the seduction of technology. This research, has, therefore been very conscious of this and tried to critically see how OER can address the persistent, vexed problems of access, achievement and equity. This is especially seen in the context of globalization and IT savvy generation.

2. There have been numerous challenges with the traditional education as obtained today. Instead of leveraging ICT to do more of the same interventions, this is an attempt to study the new pathways for transforming education. This addresses the basic triple ailments of fixed and rigid curricular system, lecture system and examination system.

3. The paradigm has changed from one of scarcity to one of abundance in terms of educational resources and tools. This needs

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74 Toru Iiyoshi and M.S. Vijay Kumar- "Conclusion: New Pathways for shaping the Collective Agenda to Open Up Education"
a proper appreciation of the dynamics of community and peer learning, new roles of education institutions and faculty members, synergy and orchestration of choices of content, learning tools with standardization on the lines of internet based resources.

4. As the world advances with conflicts across nations, societies, communities and families, education is, perhaps, the one possibility that can positively impact and address these issues. In the context of globalization with its problems and opportunities, how can a new, sustainable, education address the issues of building citizens with humane qualities and excellent capabilities, well endowed in various dimensions of life?

5. The issue of harnessing ICT and OER to move towards a true 'boundarylessness' in respect of geography, languages and disciplines; a new education through a new framework that facilitates the straddling across heterogeneities of learned and the local communities; across the divides of research, education and extension; across integrated learning, thematic and specialized education.

6. ICT could offer great possibilities if a new educational culture and policy is offered through a nimble, scaffolding or architecture to break the 'inertial frameworks', both of pedagogical and technological patterns that are rigid, inflexible and limit choices. These are real obstacles to realizing the potential of access and quality.

75 Toru Iiyoshi and M.S.Vijay Kumar- "Conclusion: New Pathways for shaping the Collective Agenda to Open Up Education" from 'Opening up education'
A transformation of the attitude of educators and teachers to engage each other and students in a process of sharing, learning and building on each others’ pedagogical practice and insights is desired. So is the need for capacity building of the various stakeholders. All these core values, principles and features can be cast into a framework like the Service Oriented Architecture (SOA).

Service Oriented Architectures (SOA) entails collaborating by distributing or delegating jobs, tasks or responsibilities to other collaborators, entities, companies, partners and so forth, to do a job that formally one person, company or organisation would have done themselves. The reason for this delegation to other parties is either because it is more efficient to do so (resource-wise) or because they would deliver better outcomes. This concept has gained tremendous currency in the IT world. In the IT world, services are changing the fundamental model for software development and deployment. They continue to introduce new ways for building distributed applications where services are not to be connected with one another during the development process but do so instantly during run-time.

Service Oriented Architecture or SOA is an abstract description of how the different parts of the system interact and communicate to achieve a desired result (Kaye 2003). In the context of OER and e-learning, SOA shows great potential to facilitate the opening up of choices of ‘services’- in terms of curricula, learning methods and modes, modes of assessment, social e-engagement for research, extension and community interface. The architecture facilitates the
finding, binding and invoking of services which are all available and accessible through an ‘enterprise service bus’.

In its simplest form, a SOA could be described by the following diagram (figure 4.1):

Fig. No. : 4.1 The Service Interaction Model, taken from (Strategic Planning Aligned Strategy 2006)

In SOA the architecture has three main players as can be seen in the previous figure above: provider, discovery agency and requester which publish, find or interact with a service respectively. The communication between these parts could be done through interfaces or through messages.

The main feature of SOA is that it is a movement from the tightly-coupled into a peer-to-peer model where any node could be a client or a service. There is no special machine/mechanism to manage the network’s resources; instead all responsibilities are informally divided among all peers.

SOA is an application architecture within which all functions are defined as independent services with well defined, invokable services. It is a great
facilitator of enterprise building as the fundamental unit of designing, building and composing services, which in this case could refer to components of courses or modules related to various student and faculty applications ranging from scholarship awarding to on demand, online examination. Based on the same principles of SOA, a Service Oriented E-learning reference Architecture, SOELA can be developed. This is composed of the human-machine interface layer, application appearance layer, business process layer, service layer, component layer, infrastructure layer and the E-learning Service Bus (ELBS), all held together neatly by security policies.

4.3 OBJECTIVES OF THE STUDY

The main objectives of the study are:

i. To study the awareness, usage and rating of e-content including NPTEL by engineering students of various Institutions and the differences and similarities in preferences and choices across different income groups, students, faculty members, gender and caste.

ii. To assess if a standalone Virtual University for technical education is preferred.

iii. To gauge the preferences of students for collaborative working with other students, mentors and faculty members for training, research, extension and industry linkage using online modes.

iv. To study the need for more choices of courses based on national and international standards.

v. To assess the preference of students for OER in local language.
vi. To understand the preferences of students in respect of different dimensions of life such as physical, ethical, aesthetic and spiritual dimensions.

vii. To understand the possible modes of providing integral education addressing various dimensions of life.

viii. To study the need for robust system of “On demand On line examination” framework to certify students taking the course with built in opportunities for self assessment, quiz and assignments.

ix. To study the need for standardized course modules and provision for periodic faculty training and assessment as well as induction of teaching fellows in an online mode using a transparent, country wide merit based selection system.

x. To study the requirement of students for accessing various student services, faculty services and other services related to educational governance.

xi. To have a comprehensive SOA\textsuperscript{76} based framework for uploading “standardized” courses in CBCS\textsuperscript{77} format with different learning modes that will cover technical subjects and life enriching inputs aiming towards becoming responsible citizens and humane professionals. This will lead to increased access, quality and equity.

4.4 HYPOTHESES TO BE TESTED IN THIS STUDY

1. There is no difference between the usage patterns of non-users and users of NPTEL.

\textsuperscript{76} Service Oriented Architecture
\textsuperscript{77} CBCS- Choice Based Credit System
2. There is no difference in the awareness of NPTEL between students and faculty members.

3. NPTEL leads to enrichment of knowledge.

4. NPTEL helps in passing examination.

5. Overall NPTEL rates high in terms of quality, faculty, curriculum and presentation.

6. NPTEL should become a standalone programme of study offered by a Virtual University.

7. There is no difference in usage of NPTEL and 'other e-content'.

4.5 RESEARCH CONCEPTUALIZATION, DESIGN AND EVOLUTION

As the research was conceptualized, background reading and exploratory work was carried out in the areas related to e-content and NPTEL from papers, journals, books, magazines, web sites and individuals connected with the NPTEL project. Based on an understanding of various aspects of technology enhanced learning, interviews were held with important professionals and stakeholders of NPTEL. Focus group discussions were also held with a group of faculty members and students of engineering colleges to get their inputs and understand their perspectives. While data related to usage of web content was available, there was no comprehensive evaluation or assessment of NPTEL, nor was a comprehensive evaluation tool kit available. Based on all these, it was decided to evolve a toolkit and carry out an assessment of NPTEL across different Engineering colleges of Gujarat. It was decided that responses from students and faculty members would be collected to study the convergence or otherwise, in respect to
various aspects. Based on these responses, the objectives, hypotheses, the analyses to be done and relationships to be studied, required statistical methods, tools, techniques and applications would be used\textsuperscript{78}. Since Gujarat has the IIT, Gandhinagar and the NIT, Surat, it was also decided to solicit responses from these National level institutes along with responses of State run colleges located in urban, rural and tribal areas of the state, across a geographic spread.

4.5.1 The Universe

For this study of NPTEL, which is basically a national programme, as the name suggests, it was decided to define the universe as comprising of all the students and faculty members studying in engineering colleges of India. Being a web based OER, the accessibility of NPTEL to anyone across the world is accepted. Further, in the context of a learning society which emphasizes on lifelong learning, this is used by people other than students and faculty. But, for the purpose of this research, the target group for NPTEL has been taken as students and faculty members in the whole of India and this has been considered as the Universe.

As per MHRD Annual report 2009-10\textsuperscript{79}, there were 2,872 degree institutions in Engineering and Technology as on June 30, 2009 and these institutions had an intake of 10,71,896 students. Since, there are four years of the study in the engineering and technology, maximum total number of students can be $10,71,896 \times 4 = 42,87,584$. However, looking to the problems of drop out, non-filled seats during the admissions in the first year etc., if a moderate multiple of three is considered, then number of students in engineering and technology in the whole country can be estimated as $10,71,896 \times 3 = 32,15,688$.

\textsuperscript{78} The Research thesis of Haresh J Jani, "Quality Management in Indian Companies through ISO 9000"

\textsuperscript{79} http://www.education.nic.in/AR/AR2009-10/AR2009-10.pdf, p.152 (Viewed on 4-4-2011)
Similarly, as shown in the table below, for the selected colleges of Gujarat, the total student strength is 11776 while the faculty strength is 319. This gives a student faculty ratio of about 36.9. Now, against the extrapolated student strength of 32,15,688, dividing this by the ratio in Gujarat, we get 87,122 teachers who are possibly working in engineering colleges across the country.

Actual data from the eight selected colleges of Gujarat is tabulated below.

**Table No. : 4.1 Students Faculty Data**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of College</th>
<th>Students</th>
<th>Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Engineering college, Chandkheda</td>
<td>2376</td>
<td>70</td>
</tr>
<tr>
<td>2</td>
<td>Engineering college, Dahod</td>
<td>1476</td>
<td>38</td>
</tr>
<tr>
<td>3</td>
<td>Engineering college, Modasa</td>
<td>2586</td>
<td>64</td>
</tr>
<tr>
<td>4</td>
<td>Engineering College, Morbi</td>
<td>1896</td>
<td>80</td>
</tr>
<tr>
<td>5</td>
<td>Engineering College, Bhuj</td>
<td>1942</td>
<td>27</td>
</tr>
<tr>
<td>6</td>
<td>Engineering College, Bhavnagar</td>
<td>1500</td>
<td>40</td>
</tr>
<tr>
<td>7</td>
<td>National Inst. Of Technology, Surat</td>
<td>2210</td>
<td>180</td>
</tr>
<tr>
<td>8</td>
<td>Indian Institute of Technology, Gandhinagar</td>
<td>354</td>
<td>52</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>14340</strong></td>
<td><strong>551</strong></td>
</tr>
</tbody>
</table>

(Source: Directorate of Technical Education, Gandhinagar)

Extrapolating from this data relevant to colleges of Gujarat, we get the estimation of the number of faculty. Thus, the universe can be assumed to be 32,15,688 engineering students and 87,122 engineering faculty members.

**4.5.1a Delimitation**

This thesis is titled as “A critical study of e-Governance in Gujarat”.

This study is limited to a study of ‘e-learning’ across Technical Education Institutions located in Gujarat, carried out in 2010.
4.5.2 The Population
Since the study is effectively a critical assessment of NPTEL in Gujarat, all faculty members and students in engineering colleges of Gujarat have been considered as the population. According to data from the Directorate of Technical Education, Gujarat, the total number of engineering colleges located in Gujarat is 83 with 39,340 students and about 1403 faculty members in 2010-2011, which.

4.5.3 Sampling Unit
Based on the population detailed in the previous section, it follows that a respondent who is either a faculty member or student from an engineering college in Gujarat will be considered a sampling unit.

4.5.4 Size of the Sample
As the research work progressed, it was decided to draw data from eight different colleges representing national and state institutions, different geographical areas and rural, urban variation as well as tribal and non-tribal area difference. Proceeding in this manner, the number of colleges covered in this research was a total of eight.

4.5.5 Sampling Design
All students and faculty members from engineering colleges of the country have some heterogeneity in terms of attributes like gender, caste, economic background, state of origin, institute of study and so on but also demonstrate some degree of homogeneity in respect of usage of e-content or NPTEL, preferences for mode of learning, need for online teaching and research facilities, orientation to various dimensions of life, requirement of online educational services. To study the respondents and their needs, a selection of these aspects, also referred to as ‘variables’ in research, is essential. Therefore various variables pertaining to these attributes were selected.
4.5.6 Sources of Data
The study uses primary and secondary sources of data.

4.5.6.1 Sources of Primary Data
In this research, total 906 responses from eight colleges were received. However, 31 responses were rejected because it was observed that they were incomplete. Hence, 875 responses were considered for final analysis. It was observed that as high as 767 respondents had used on-line e-content. However, out of these 767 respondents, there were 287 respondents who had used NPTEL.

4.5.6.2 Sources of Secondary Data
Secondary data sources include published material from Papers, Brochures, Reports, Books, Newspapers, Magazines, Websites and information collected and compiled from discussions and conference interactions on NPTEL.

4.5.6.3 Instruments for Data Collection
In this study, three instruments were used for data collection, which are personal interviews with the leaders and members of the NPTEL team, structured questionnaire and unstructured qualitative inputs based on personal interviews and focus group discussions.

4.5.6.4 Discussions with Stakeholders
Prior to preparing the questionnaire, detailed interactions were held with the Director of IIT, Chennai Prof. M.S. Ananth and the NPTEL coordinator, Prof Mangal Sundar. The discussions centered on a general understanding of NPTEL, the indicators for the evaluation rubric and the visualized goals and aims of NPTEL. Focus group discussions were held
with engineering college students and faculty members. These discussions helped in getting greater conceptual clarity in respect of evaluation metrics for OER like NPTEL, with special reference to the perspectives of students and faculty members in engineering colleges. The questionnaire was evolved after factoring in all these inputs.

4.5.6.5 The Instruments [Questionnaire]

A structured questionnaire with a large number of close ended responses and a few open ended responses was deployed in an online mode to collect the data. The entire questionnaire is attached as Annexure- III. The questionnaire is divided into five parts. They deal with the following:

I. General Information of the Respondents

This part of the questionnaire deals with information related to the following:

a. Institute name

b. Respondent category- student or faculty

c. Gender

d. Caste

e. Economic background

The findings and interpretation based on these responses are presented in chapter V.

Usage of NPTEL or e-content:

The rationale of this part was to gather information related to usage of NPTEL or e-content. The information solicited was:

a. Whether NPTEL is used
b. If e-content other than NPTEL has been used
c. The extent of usage
d. Awareness levels and sources
e. Willingness to pay price and the amount.

The analysis and interpretation of these responses are presented in chapter V.

II. Quality of NPTEL or any other e-content used

These set of questions were separately posed to users of NPTEL and other e-content. This was an important part of the questionnaire which gave insights into the quality perceptions of OER. The information sought is as follows:

a. Rating in respect of knowledge enrichment
b. Utility in passing examinations
c. Faculty, content, presentation and overall quality rating
d. Utility in standard tests like GRE or GATE.
e. Preference for NPTEL in local language
f. Provision for virtual and actual laboratory in NPTEL

The study and findings related to these questions are dealt with in Chapter V.

Weaving of other dimensions of life towards integrated online learning

This part is very important as it relates to the making of humane engineers. It was to get an insight into the preferences and choices of respondents on various aspects of holistic education, covering
the physical, ethical, aesthetic and spiritual dimensions as an integral part of their studies. The questions dealt with the following issues:

a. Which dimensions of life are to be emphasized?

b. The different modes of teaching and learning for developing the other dimensions.

c. Including these as a part of the curriculum.

d. Including values of nationalism and internationalism in the curriculum

e. Preferences and weightage for autobiographies in the course

The results and their interpretation for these set of questions are presented in chapter V.

III. Preferences of new feature in NPTEL and generic e-content

These questions were very important in understanding the design features and preferences of students for the NPTELs of future. It broadly sought information on the following:

a. Whether collaborative online teaching was preferred?

b. Their preferences of different choices of courses

c. Their views on collaborative, online mentoring for research and extension.

d. Preference to carry out teaching or research activity as a part of their course

e. Provision for online assessments, quiz and assignments

f. Their views on an On Demand Online Examination leading to certification.
The responses for the future features of such OER, including NPTEL and their interpretation are presented in chapter V.

4.5.6.6 Methods of Data Collection

As explained earlier, the questionnaires were first prepared based on background reading, reflection, consultation and inputs of experts related to NPTEL and e-content.

Once the draft questionnaires were ready, they were tested to ensure clarity and their suitability by testing it with a small set of experts representing various domains and stakeholders including about twenty students and faculty members. The questionnaire evolved and was finalized after the pilot testing and focus group discussion. This questionnaire was then administered using an online survey tool across eight different engineering colleges which were reasonably representative, from the geographic basis, rural and urban basis, tribal area and non-tribal area basis and state as well as national level institutions. Their details are shown in the table below:

<table>
<thead>
<tr>
<th>Place of Institute</th>
<th>No. of Respondents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bhuj</td>
<td>65</td>
<td>7.4</td>
</tr>
<tr>
<td>Bhavnagar</td>
<td>203</td>
<td>23.2</td>
</tr>
<tr>
<td>Morbi</td>
<td>66</td>
<td>7.5</td>
</tr>
<tr>
<td>Chandkheda</td>
<td>68</td>
<td>7.8</td>
</tr>
<tr>
<td>IIT, Gandhinagar</td>
<td>43</td>
<td>4.9</td>
</tr>
<tr>
<td>Modasa</td>
<td>42</td>
<td>4.8</td>
</tr>
<tr>
<td>Dahod</td>
<td>278</td>
<td>31.8</td>
</tr>
<tr>
<td>Surat</td>
<td>110</td>
<td>12.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>875</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
The principals and faculty members of the colleges were contacted and personally spoken to, guided and the survey was followed up. The online survey link was sent to them as an email and the students and faculty members were in turn requested to fill and turn in the forms. Given the examination and vacation periods of various colleges, the scheduling was done appropriately with on site and on line help in case of technical problems or clarifications. As explained earlier, of the total 906 responses from eight colleges, 31 responses were rejected because they were incomplete. Thus, 875 responses were considered for final analysis.

4.6 DATA ANALYSIS TECHNIQUES

On completion of the survey, the online survey tool provided raw data corresponding to the responses. These were then carefully coded, labeled and converted into a suitable form for rendering statistical analyses possible. Since mistakes in this can have serious implications and lead to wrong findings and interpretations, data preparation is also very important. On properly transferring and porting the data, the analysis can be started. The data obtained against various questions from 875 valid respondents were, therefore, properly coded and used for analysis.

In respect of the different questions, suitable data depiction and analysis techniques were employed to check meaningful outcomes. Decisions as to which of the statistical techniques should be used were made on the basis of the various criteria like (a) the conceptualization and research design (b) objectives of the study, (c) premises on which hypotheses are to be tested and (d) scales or response options provided to the questions. The following paragraphs provide a bird's eye view of various data analysis techniques, which have been used in this study. These
techniques\textsuperscript{80} have been explained in detail in Chapter V at the appropriate places for better understanding.

4.6.1 Univariante Techniques

Univariante techniques are appropriate when there is a single measurement of each element in the sample, or there are several measurements of each element but each variable is analyzed in isolation. Univariante techniques can be classified based on whether the data are metric or non-metric. Metric data are measured on an interval or ratio scale. Non-metric data are measured on a nominal or ordinal scale.

4.6.1.1 Frequency Distribution (non-metric data)

For certain questions where one variable was to be considered at a time, percentages were used. Frequency distribution was carried out, to obtain a count of number of responses. Bar charts, pie charts, clustered column charts; percentages etc. were used for further analysis of such questions. Other statistics (associated with frequency distribution) like mean, mode, variance, and standard derivations were also used to find the central tendency and the variance of the data.

4.6.1.2 One-sample ‘t’ test, Two-group ‘t’ test, and one way ANOVA (Metric data)

For hypothesis testing, one sample ‘t’ test was carried out at 95% confidence level. To carry out further analysis of data of different industries or different scales of respondents, two-group ‘t’ test, one-way ANOVA, and Least significant Difference (LSD) multiple comparisons

\textsuperscript{80} Many theoretical details in this section are taken from (1) the book of Naresh K. Malhotra. Malhotra Naresh K., Marketing Research: an applied orientation. Delhi: Addison Wesley Longman (Singapore) Pte. Ltd., Indian Branch, 2001 & (2) Ph.D thesis of Prof. H J Jani entitled “Quality Management in Indian Companies through ISO 9000”
test were carried out. This helped two ways (a) in accepting/rejecting hypotheses and (b) making pair-wise comparisons.

4.6.1.3 Multivariate Techniques

Multivariate techniques are suitable for analysing data when there are two or more measurements of each element and where the variables are analysed simultaneously.

4.6.1.4 Dependence Techniques

To find the interdependent relationship if any, between the 21 statements, factor analysis was carried out. This was carried out for the users of NPTEL data as also for the entire group of e-content users, including NPTEL users. Factor analysis helped in data reduction and summarisation. Factors help in explaining the correlations amongst a set of variables.

4.7 QUALITATIVE RESEARCH

While conducting a research and trying to get an insight into various aspects of a project, using the quantitative techniques alone may not be able to capture the picture in completeness. The use of some techniques of qualitative research further makes the research more complete. This gives an understanding of the contexts, concerns, issues and specific flavors that are at the backdrop of various responses and findings.

4.7.1 Qualitative Study of NPTEL

The integration of NPTEL or other OER into the teaching–learning processes happens alongside the various routine activities, processes and constraints or problems of colleges, in general. The adoption and roll out of such an effort happens in the context of the above and the college specificities and the two
cannot be separated but would have to be studied together. For example, what was the starting point of the use of such OER, were there any staff trainings that was a kind of starting or turning point, what is the general milieu of learning and working together in the college?; these are some of the issues that need a careful understanding during research. This meets the description of Simon (1969), who defined empirical research as the knowledge obtained by consulting authorities, in books or in person.  

Qualitative Analysis

The rigor in this part of the research is not expected in a disciplined application of statistical tools, but in carefully observing, understanding and evolving a research strategy which suits the scenario being studied as it is revealed. Holiday (2002) while comparing Qualitative and Quantitative research methods explains their distinct characteristics. The following table explains their elements.

<table>
<thead>
<tr>
<th>QUANTITATIVE RESEARCH</th>
<th>QUALITATIVE RESEARCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Counts occurrences across a large population</td>
<td>a) Looks deep in to the quality of social life</td>
</tr>
<tr>
<td>II. Use statistics and replicability to validate generalization from survey samples and experiments</td>
<td>b) Locates the study within particular settings which provide opportunities for exploring all possible social variables; and set manageable boundaries</td>
</tr>
<tr>
<td>III. Attempts to reduce contaminating social variables.</td>
<td>c) Initial foray into the social setting leads to future, more informed exploration as themes and focuses emerge</td>
</tr>
</tbody>
</table>

81 A Study of Policy, Practice and outcome on implementation of Quality Management Program in Indian Engine Bearing Industry" by Himanshu M. Trivedi.
### Beliefs

<table>
<thead>
<tr>
<th>IV. Conviction about what it is important to look for</th>
<th>d) Conviction that what is important to look for will emerge</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. Confidence in established research instruments</td>
<td>e) Confidence in an ability to device research procedures to fit the situation and the nature of the people in it, as they are revealed</td>
</tr>
<tr>
<td>VI. Reality is not so problematic if the research instruments are adequate; conclusive results are feasible.</td>
<td>f) Reality contains mysteries to which the researcher must submit, and can do no more than interpret</td>
</tr>
</tbody>
</table>

### Steps

<table>
<thead>
<tr>
<th>VII. First decide the research focus (e.g. testing a specific hypothesis)</th>
<th>g) First decide that the subject is interesting (e.g. in its own right, or because it represents an area of interest)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIII. Then devise research instruments (e.g. survey questionnaire or experiment)</td>
<td>h) Explore the subject</td>
</tr>
<tr>
<td>IX. Then approach the subject</td>
<td>i) Let focus and themes emerge</td>
</tr>
<tr>
<td></td>
<td>j) Device research instrument during process (e.g. observation or interview)</td>
</tr>
</tbody>
</table>

### Rigour

<table>
<thead>
<tr>
<th>x) Disciplined application of established rules for statistics, experiment and survey design.</th>
<th>k) Principle development of research strategy to suit the scenario being studied as it is revealed</th>
</tr>
</thead>
</table>

Qualitative research is increasingly used in a wide range of academic and professional areas. It develops from various aspects of anthropology and sociology and represents a broad view that to understand human affairs, quantitative survey and statistics are necessary but not sufficient by themselves to understand reality. It emphasizes the necessity to delve deep into the subjective qualities that govern behaviour (Holiday, 2002).
Trochim (2003) explains that one of the major reasons for doing qualitative research is to become more familiar and experienced with the phenomenon in which researcher is interested. This is where most of the more interesting and valuable new theories and hypothesis originate, and good qualitative research can play a major role in this theory development. Qualitative research has special value for investigating complex and sensitive issues.

**Interviews and discussions with the stakeholders**

As a practitioner who has implemented various projects related to e-governance, education and OER, there was a keen interest in understanding the dynamics of these efforts at the college and classroom level and figure out what makes these efforts tick. The role of interplay of technology and human interaction to make the teaching process more fruitful, fun and effective was of great interest. To study this from the qualitative aspect, interviews and discussions with the stakeholders were conducted.

**Questionnaire**

The complete questionnaires (for students and faculty members) used for the purpose is attached at Annexure – IV-A and Annexure – IV-B.

This table lists some of the questions asked during the interviews and study visit.

1. General Information about the Institution.
2. Information on the Respondents and their position.
3. How did you first hear of NPTEL?
4. How extensively have you been using NPTEL?
5. How useful or effective is NPTEL?

6. What is the quality of the NPTEL lectures?

7. What can be done to improve NPTEL?

Supplementary Questions for faculty members

1. What, according to you, is the current learning environment at the college?

2. Has NPTEL helped in enhancing the learning experience? Please give details.

3. What have you done to transform the education and help produce humane professionals? Any special interventions, innovations etc?

4. What was your first impression on using the NPTEL web site?

5. How have you or are you adapting NPTEL to suit your needs?

6. What did you like most in NPTEL?

7. What are the reasons for your success as a faculty member?

Supplementary Questions for students

1. How does NPTEL compare to books?

2. When did you first hear of NPTEL?

3. What are the challenges of education in your institution, or in general that NPTEL may have addressed?

4. Give specific instances of use of NPTEL. Did you like it? Why or why not?
5. What are the inputs that should be given to make sure the professionals educated in the Colleges become truly humane professionals?

6. Is there sufficient scope in the course to help you understand yourself and work on your inherent strengths in all dimensions of life?

7. Which have been the most engaging and fruitful learning experiences so far? Can you explain why?

The research objectives, particularly, the evolution of a new model based on technology enhanced learning needed some structured and unstructured interactions with stakeholders and interviews and discussion approach to do better justice to the subject and contexts. Some sample respondents and Institutions were selected for this. Data was collected using a structured questionnaire and some unstructured interviews, which have been recorded. These inputs are interpreted in the Chapter V.