EDUCATIONAL TECHNOLOGY IN IMPROVING QUALITY OF ENGINEERING EDUCATION

*P. D. Kulkarni,

SYNOPSIS

The paper emphasizes that in order to plan educational development in 'Engineering Education', the planner must view the educational system as operating at five levels. For educational development to occur, the system should change at all these levels & should be manned by educational professionals. Professionals in education draw their expertise from educational sciences & educational technology disciplines. There are various categories of educational professionals, but all of them should have a solid base in the foundational disciplines of Educational Technology. Here ET is defined as Technology of Education; use of scientific concepts, principles & techniques for improving educational practice. Attempt has been made to describe key concepts. Educational authorities should identify specific strategies at all levels to be able to change system. All strategies should aim at developing collective consciousness of the importance of Educational Technology to bring about change in orientation, Lastly, list of projects is made.

1. STRUCTURE OF ENGINEERING EDUCATION

The national level Engineering Education (EE) system operates at five levels which are listed in order of hierarchical importance.(Ref. fig 1)

a. National & State level.

b. Educational institution's level

c. curriculum level

d. Class-room level

e. Student level

Viewed from the social system perspective, the EE, has its own customers, purposes, inputs, processes, resources & management components.

Within the system, all these subsystems at each level are related to each other. The output at each higher level serves as an input to the next lower level. The major inference from viewing the EE as an educational system is that any attempt to improve quality of management education needs simultaneous attention to the quality of

***Retd. Principal, TTTI Chandigarh and Educational Consultant, Pune.**

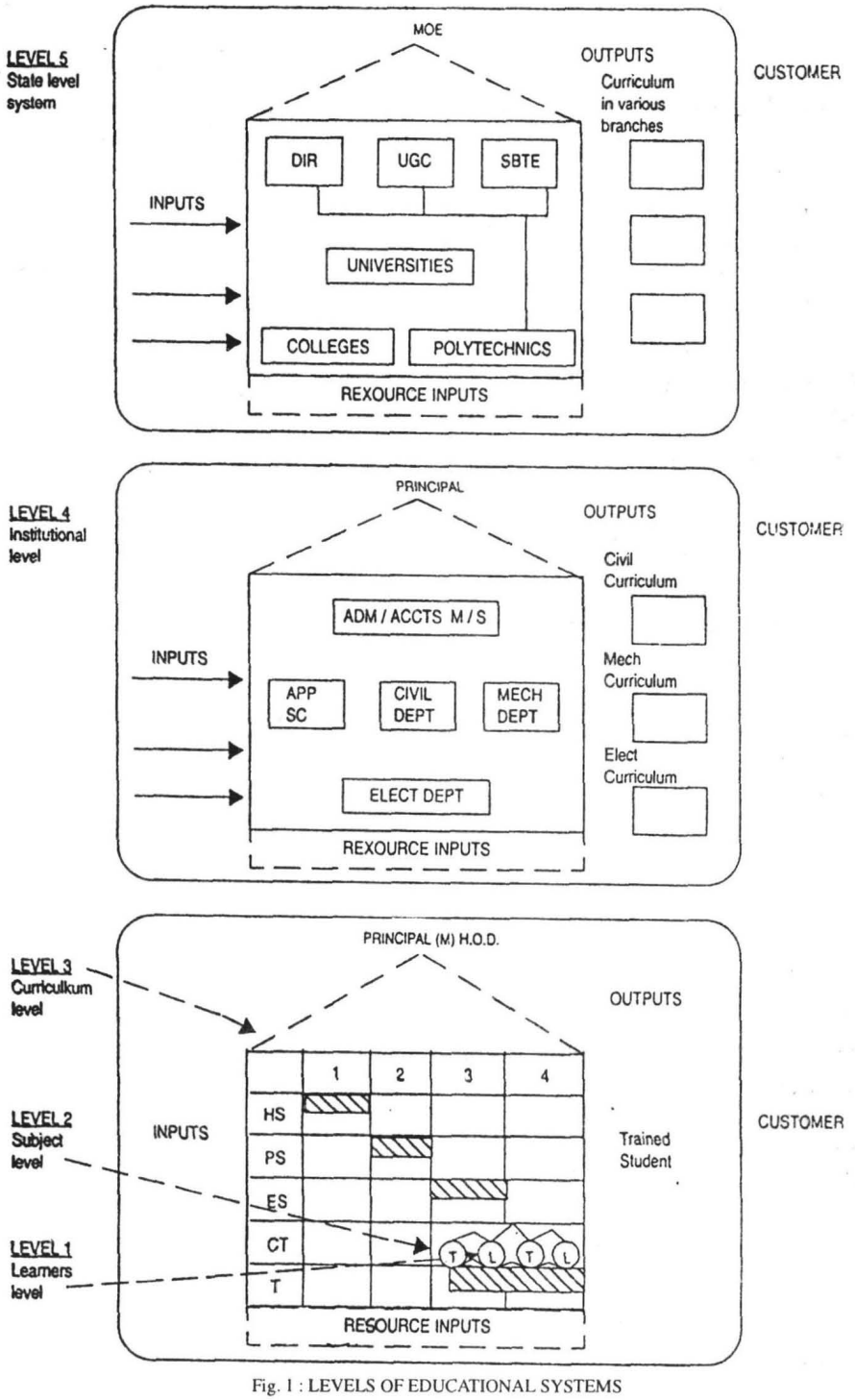

Fig. 1 : LEVELS OF EDUCATIONAL SYSTEMS

outputs at each level hierarchy. Quality of policy & resource support from ministries is essential to improve quality of institutional planning. The quality of institutional planning will improve quality of curriculum planning, which in turn will improve class room teaching. Both curriculum planning & class room instruction leads to better students learning.

2. NEED FOR SYSTEMS CHANGE & PROFESSIONAL INPUT TO EFFECT

Since 1991, there have been tremendous changes in economic, technological, knowledge sector, cultural & political climate in this country caused by globalization, stress on privatization & competition. There is stress on both economic development & social environment development.

One of the core sectors which will enable people & systems to face these rapid changes is the educational sector & Engineering Education is no exception.

But for this, the EE should have to shift from its past orientation on managing EE to a new one. For example:

a. EE can no longer assume that the key personnel in the system can manage education by learning on the job without learning the language of educational discipline. This is true at all the five levels mentioned above; students, teachers, HOD's, Directors & Ministry officials.

b. All of these must be professionally competent to manage.

c. Professionally competent means possessing knowledge & educational technology knowledge & skills not only to manage the present situation, but also steadily lead the system to better performance.

d. Disciplinary & professional knowledge means following Educational Disciplines

- Theories of learning
- Theories of knowledge.
- Social Systems Theory
- Basics of educational management
- Basics of managing for educational change

Professional Disciplines

- Self directed learning
- Instructional planning
- Instructional Material development & utilization
- Curriculum planning
- Institutional planning
- State / national level planning.
- Project Management in education.

3. PROFESSIONAL STAFF STRUCTURE FOR BRINGING ABOUT EDUCATIONAL CHANGE

In today's system, there is a line structure consisting of students (socialized into traditional ways of examination oriented learning), teachers (socialized into traditional ways of teaching for covering the syllabus), HOD (socialized into traditional ways of managing depts., focused more on research and teaching, but least in

bringing integrated learning among students); Directors (socialized into traditional ways of planning & managing institutes more as closed system with little attention to changing economic & social scenario & distributing resources for promoting research & teaching, rather than educational program; & state & national level educational level policy makers (socialized into traditional ways of policy making concentrating more on quantitative expansion, but having no idea on qualitative improvement). Most of them have no knowledge of the concept of educational project management.

EE need following staff - functionaires in the systems which will continuously assist the line managers to focus their attention on the quality of students learning.

a. Experts on self directed learning.
b. Instructional designers
c. Instructional material developers & utilizers
d. Curriculum planners
e. Institutional planners.
f. State level/national level Educational planners
g. HRD experts.
h. Industry Institute Interaction experts.
i. Project management experts.
j. Process consultants in education.

4. ROLE OF EDUCATIONAL TECHNOLOGY

The roles of all the above professionals is to keep their focus on students learning & plan & organize their processes & services (national/state level educational management & resource support to institutions, institutional planning & resource support to educational programs, curriculum management & resource support to class room teaching, instructional planning & educational services to students, students planning & execution of his learning activities).

But this is no more ecceletic as was viewed in the past. These professionals, especially the staff functionaires, have at their disposal today scientific knowledge & techniques for practicing their professions more professionally, without resorting to "common-sense" trial and error methods.

This spectrum of knowledge is covered under the super-ordinate concept : EDUCATIONAL TECHNOLOGY & comprises educational disciplines & technlolgy subjects listed in para 2 above.

Its main role is to focus on the principles & techniques used by learners to promote learning in a desired direction & help professionals at all levels to manage systematically their own professional levels activities.

5. TWO PERSPECTIVES OF "EDUCATIONAL TECHNOLOGY"

In the literature on "Educational Technology" the professionals take two distinct perspective.

a. Technology IN education.

b. Technology OF education.

1) In the first perspective, the focus is on the use of technological

hardware & software to enable professionals to carry out their professional activities more effectively & efficiently. The focus is on planning, installing telecommunication, reprographic & computer network to reduce the distance & time between the sender of the information & receiver of the information. This facilitates learning process, but does not cause actual learning. Learning is an internal process within learners. Hence the second perspective.

2) The second perspective defines Educational Technology as the application of educational science concepts, principles & techniques for improving educational practice; learning, teaching, curriculum management, institutional management & state level educational management. It is this second perspective that this paper emphasizes & explains in following sections.

It starts with the looking at the learning as the process or capability of the learner for experiencing & being aware of the object of learning. Experience & awareness is not only characterized by the aspects that are focussed but also that are not focussed (but present in the object of knowledge) A further potential for difference is the point of view from which something is seen and experienced. The student is expected to appropriate knowledge (make knowledge their own) in the hope that in doing so, he will be able to master situations in the future which is not possible to define, in advance. This he does by learning in a learning situation that transcend's situation. (Bowden 1998). All other activities like teaching, curriculum planning, institutional planning are organized round this central concept.

6. KEY CONCEPT IN CORE EDUCATIONAL SCIENCES & EDUCATIONAL TECHNOLOGY DISCIPLINES.

Theories of Learning

This discipline covers three major schools of educational psychology; behaviourim, social learning & cognitivism (HIP). In brief, this discipline explains how a learner senses external stimulus, translates it into perception drawing on his prior knowledge, process new information for understanding, organizes mentally internally, new information & processes it for storage in LTM & retrieval from it for use in new situation. The important contribution of this discipline is the meta-cognitive strategies which emphasizes that the human mind is capable of self directed learning by consciously initiating learning by assessing new situation for learning opportunities, planning learning activities, monitoring learning & evaluating learning outcome. It also explains how affect (emotions) influence cognition; and also how social environment affects learning.

Theories of Knowledge

Today's complex situation needs learning & acquiring organized body of scientific & technological knowledge. This discipline explains how scientific

knowledge is generated (scientific method) communicated to community of scholars & stored & can be retrieved. It explains declarative procedural categories of knowledge, how it is used for classifying, explaining, predicting & planning activities of a professional. It also explains how the knowledge is organized into mono-disciplinary, inter-disciplinary, trans-disciplinary structures depending upon the object of knowledge. These ideas are very useful for curriculum design purposes.

Social System Theory

This is a very important discipline for the educational system to understand, because it deals with the behaviour of human systems in a social environment. It classifies social systems into a social group, family, formal organization & community. Any system whether formed or natural consists of 8 structures : Supra system, output, input process of conversion, boundary, interface, proposed output and feedback. Every system exhibits certain properties. Its outputs have emergent properties tendency to grow by ensuring entropy; openness by remaining sensitive to environmental influence; steady state by maintaining favourable balance of input and output exchanges.

Every system has dynamic properties. It maintains steady state by maintaining four functional prerequisites. It maintains external orientation by goal - setting & adaptation & internal balance by integration & pattern maintenance.

These concepts are very helpful for the educational system, because of all its levels one can view the systems as consisting of teaching system & learning systems & define systematically the helping role of teaching systems & client role of learning system and design input - conversion - output functions.

Basics of Educational Management & Management of Educational change.

These disciplines are different from the traditional management theories in the sense that its output i.e. student learning cannot be specified in advance. But basic concepts of management are applicable here.

Professional Disciplines :

Technology of self directed learning

This discipline guides a professional learner on how to consciously guide your consciousness to assess unfamiliar situations, assess learning requirements, planning for learning, processing new information & integrating it into the existing knowledge for storing & retrieving purposes; using it to understand unfamiliar situation & solve problems.

Technology of Teaching & Learning

This subject enables educational professionals to understand how to view teaching learning process as a form of activity system, designed to educate & train a learner in technical social, personal development skills in one subject. The procedure involves; assessing needs of industry of the quality of manpower, deriving subject objectives, content analysis, analyzing students entry behaviour choosing teacher aids & material aids to transmit information & take remedial measure on

receiving feedback from the learner.

Technology of Curriculum Design

The scope of this subject covers entire curriculum processes of diploma or degree courses & thus provide frame work for subject teachers to plan his teaching & learning. The procedure consists of assessing industry needs, deriving curriculum objectives, analyze curriculum objectives into subject areas, organize them vertically & horizontally, developing teaching / learning & coordination strategies, calculate resources & its norms.

Technology of Institutional Development

This subject explains how to view the entire educational institute as a system & develop it. This development process consists of studying the context in which the institution is placed, analyze environment & need of its customers, translate their needs in terms of institutional programs - R&d, education & training & extension service, assess students entry behaviour, specify resources, install management system, design institution's performance evaluation system.

Institution development goes through systems design, development, implementation & evaluation phases.

Technology of State Level Educational Planning & Management

This discipline helps educational professionals to understand & view the state level education as a system & design it to meet the needs of the industry & the community as a whole.

The design process consists of analyzing the environment which the state level educational system as a whole serves, locate the customers, assess their manpower, information & consultancy needs, assess current structures & its capabilities, redesign them to suit new system objectives, specify resources, develop systems, implement & evaluate the systems.

The purpose of this system was to stress that the education has now become a profession, because its practice is based on educational sciences & educational technology. Without professionalizing people at all levels, the system will tend to be managed on the common sense basis which relies on past practices. In the current changing situation, the educational personnel need to be more pro-active i.e. need to see future trends, plan today to meet tomorrows changes in education; Without this, there is bound to be chaos.

7. *SPECIFIC STRATEGY IDENTIFICATION*

For bringing about changes in the Engineering education, there is need for taking collective actions at all level of the educational system.

First, the existence of the scientific & educational technology subjects should become a public knowledge & should be recognized as such by all key personnel's (Bowden).

Second, systems view requires all participating systems should collectively know each other's roles & functions working towards the common goals.

Third, all levels of systems must understand the importance of project management as distinctly different from routine management of educational

activities. Improving quality of education requires enormous learning by individuals & teams & time & other resources are required to be placed specifically for this purpose.

Fifth, we must recognize that in India, the management education is nationally organized system. This means, any effort to introduce qualitative improvement at any level - class room, curriculum, institutional, state level has impact on other levels. Thus, for any improvement in any levels, there must be complementary effort to support it at national, state, institutions, dept., class room & student level. Clear cut strategies must be laid down, taking into consideration the specific nature of the Educational change process & must be made known to all other levels. This is called deliberately attempting to create collective consciousness and creates a culture of shared knowledge, values, experiences & connected patterns of thought. "Such sharing is done by communicating, sharing language, understanding codes, EEsages, seeing the whole environment as loaded by meaning in a way that is reasonably similar for all people." (Bowden)

Constituting, developing & making use of the collective consciousness requires things to be said & made visible, it takes interaction & communication that goes on & on across the place. This creates trust which is conductive to work by making it easier for people to launch bold ideas in a collective context.

There is also a concept of collective competence which means competence of the system to deal with novel situation in future. The collective competence is the function of the level & mix of individual competence within the system & the extent to which the system manages to draw on & further develop individual competence by organizing itself in such a way as to enhance the development of collective consciousness. In this particular context, it is important by strategic actions to connect the competences of management teachers with the competences of educational professionals so as to achieve emergent properties of the educational system.

More specifically, there should be

a. National level strategy for changing institutional orientation towards educational quality.

b. Institutional level strategy for changes in the orientation towards curriculum design & development.

c. Curriculum level strategy for changes in the orientation towards subject level instructional strategy.

d. Subject level strategy for changes in the orientation towards students learning strategies.

e. Learner level strategy for bringing about changes in learning behaviour.

All the above strategies must keep in focus learners desirable learning strategies described in section 6.

8. PROJECTS FOR IMPROVING LEARNING

Here the experience of the last 9 years of launching of the world bank

assisted projects for 'strengthening of Technician Education is very illuminating'. For the first time in the history of the educational system, there was an attempt to launch a comprehensive educational development project which actually tried to cover all aspects of development mentioned above.

Based on these experiences, the states can be asked to prepare state-plans for qualitative improvement of the educational system by categorizing projects in two broad categories.

1.0 PROJECTS FOR IMPROVING EDUCATIONAL PROCESSES

1.1 Improving quality of Curriculum process.

1.2 Improving quality of Instructional Material development & utilization process.

1.3 Improving quality of class room Instructional process.

1.4 Improving quality of students learning

2.0 PROJECTS FOR IMPROVING FACILITATING PROCESSES

2.1 Improving quality of Industry Institute Interaction.

2.2 Improving quality of autonomy of educational institutions for promoting experimentation's.

2.3 Improving quality of comprehensive HRD framework for making educational professionals available to the system.

2.4 Proving quality of networking between various levels of the educational systems and also within sub-systems at each individual level.

2.5 Improving quality of project management capability at each level of the educational systems.

The second category of projects has also a support of research (Dibella) in addition to the experience gained during the 9 years of World Bank assisted Projects in the States.

CONCLUSION

During the beginning phase of the World Bank assisted project on Technician Education; it was very clear that the states systems have no ideas about how to initiate projects for educational development even when funds are available.

Even when they were helped with these ideas, the implementation was a total failure. What was achieved was the physical infrastructure development : building, equipments, books, vehicles. Some training was arranged, additional posts were created.

There was no visible improvement in the capabilities of students, teachers, HODs, Principals & DTE officials, 'nor will it' ever take place in future, unless there is collective consciousness of the existence of the disciplinary & professional knowledge in Education & need to use it for educational development.

AICTE, the apex body, has an important role to play in this respect.

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