CURRICULUM DEVELOPMENT FOR HIGHER EDUCATION IN AGRICULTURE : ARISING ISSUES

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Introduction

The present system of higher education for agriculture has been in operation in our country for more than three decades. The second Education Commission (1964-66) used the expression 'education for agriculture', rather than 'agricultural education', recognising the importance of agriculture as a professional area of study that required support from various disciplines and components of education. The system, introduced after the establishment of the Agricultural Universities, was developed by synthesising the institutional approaches of the Land grant colleges,the structure of our educational systems, and the special needs of our farming situations. Certain innovative approaches to structuring of programmes and teaching of courses have been introduced. These include a) introduction of Trimester/Semester pattern, b) structuring of the syllabus in discrete units of courses, c) greater emphasis on practical-based instruction, d) continuous internal evaluation and e) the integration of teaching, research and extension education functions. However, to avoid straight jacketing and preserve moderate diversity in the Under Graduate curriculum, each Agricultural University has been encouraged to develop its curriculum according to the needs of (a) the region. (b) the students' aspirations and (c) the employer and his job requirements.

'Curriculum' in Latin means to 'keep running', that is, to say that the inputs to education need to be changing with 'changing' needs; true to its etymology, our Agricultural Universities have been changing their curricula every few years. These changes have been made more through intuitive approximations or the influences of pressure groups, rather than systematic and scientific studies or approach. The

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Based on the key note address delivered by the first author at the "National Symposium on Agricultural Education", Haryana Agricultural University,Hissar, February 3-5,1990.

Committees of Deans, appointed by the Indian Council of Agricultural Research (1965, 1978), have examined the existing curricula critically and suggested broad guidelines on the content, composition and organisation of the Curriculum to meet emerging needs. These have been very useful to academic bodies of universities to develop needbased instructional systems which blend academic rigour with practical orientation.

As we approach the last decade of this century, we are faced with explosion of knowledge in several areas of study and of new technologies, and consequent demand for updating the curriculum. Under these circumstances, it has become necessary to approach 'curriculum development' in a scientific way. Higher professional education in Agriculture has to grapple with a large number of systems-based issues, and to seek to reconcile various factors such as development of appropriate knowledge, skills and attitudes among learners, arising national/regional/work needs and demands, market forces, socio and techno-economic environment, the empathy of various clientele groups, etc. Such an approach is thus dynamic in concept and implementation. These 'arising needs' to curriculum planning, development and implementation are discussed here:

Goals of Higher Education

With explosion in knowledge and technologies, and with a new awakening that education is a socio-economic input for establishing a desirable future, the educational system is presently conceived as both a means and an end.

For times immemorial, education has been considered as an end in itself with the primary goal of transmitting knowledge; at the turn of the present century it became broad- based to conceive education as a means of bringing out the potentialities of the *learners.* Further changes came up when the UNESCO Commission on education (1972) declared that education is a life-long process and its purpose is to establish *a learning society i.e.* a society which knows 'how to learn to learn, to grow and transform itself to the needs of an ever-changing world.

Since 80's such modern concerns like 'Green peace politics', 'sustaining ecological well-being', 'Greenhouse effects, etc. have stressed the importance of education as a means to establishing a desirable future. Accordingly, the focus of education should be on

facilitating the development of "education for capability" i.e. helping the learners develop such competencies (like knowledge gathering and applying skills, attitudes, values, learning to learn, professional leadership, creativity, etc.) with which they could become capable and autonomous to keep learning and contributing professionally to establish a desirable future (Wilber, 1983). This means that educational Curriculum should resolve the issue of 'what to teach' in terms of society, environment, science and technology interrelationships, and the issue of 'how to teach' in terms of (a) holism rather than analytical discrete units and (b) facilitating experiential learning rather than rote-learning of information. Holistic approach is defined as " a functional, integrated, synergogic generalized model of education that focusses on the whole learning-teaching situation, and varies the teaching-learning strategy to meet the needs of the learner, the teacher and the situation in an effort to attain educational outcomes greater than the sum of their parts" (Renike, 1985).

Goals of Higher Education in Agriculture

The Joint Indo-American Teams (1955,1960) wanted the curriculum to be directly linked to the needs of the farmers, and the Research Review Team (Parker, 1963) suggested that ICAR should provide necessary linkages and supports for the development and management of the agricultural universities in relation to regional needs. The Agricultural Universities Review Committee (Randhawa, 1978) emphasized the need to give a) more weightage to 'practicals', b) orientation to rural work and service, c) integration of teaching, research and extension education at the classroom level and d) orientation towards producing non-elite graduades who could take to farming or self-employment as agrobased entrepreneurs. The Deans Committee (Anant Rao, 1981) suggested that the Undergraduate programme should be a terminal course, providing a) a broad general exposure to knowledge, b) work experience and c) production, oriented training such that the graduates could serve as Agricultural / Veterinary professionals at the national/ regional levels, in extension/in-put service sectors, and as planners and administrators. It emphasized the need to instil a national outlook and values in the students and to provide for employment-related optional courses. The UNESCO-ICAR Regional Workshop on "Curriculum Development" (1982) advocated a conceptual approach requiring the 'Curricula' to be expressed in behavioural terms (:what the learner would be able to perform by undergoing a Course), and to have backward links with the entry-level behaviour of the learners, and forward links with the skills required of a professional.

Issues of Development in Agriculture:

From the foregoing discussions, it will be clear that higher education in agriculture has to be forward-looking and future-oriented. However, as 'tomorrow grows out of today', it is necessary to take stock of yesterday's failures, today's weaknesses, tomorrow's developmental needs and plan for an educational strategy to produce capable Agricultural professionals suitable for arising times (Raman, 1989).

The most important of tomorrow's needs is increasing food production to 230 million tonnes within a decade,which may be called the *Numbers game* in production. Associated with this is the *Strategy Game* which requires the development of a 'System of Sustainable Agriculture' that takes into account the environmental and ecological factors as covalent issues in sustained production. The underpinning of these needs is the third generation socio-economic issues of equity and access to factors of production at all levels of operation *viz.* the national, regional and the individual farmer, which may be referred to as the *Balancing game.*

Agricultural education has to cope with advancements in Science and Technology and as such, newer courses in Biotechnology, Environment Science, Remote Sensing, Bio-Energy, Integrated Pest Management, Career Development, Bioclimatology, Veterinary Bio-engineering and the like have to be formulated and accommodated in the existing degree programme to the extent possible (Jeyaraj, 1990). Restructuring agricultural universities throughout the world to meet these new challenges requires not merely the addition of new departments, but new ways of knowing as well as new theories of knowledge and its diffusion. There have been major changes in cognitive theory, the theory of research, and philosophy of science. Thinking is shifting from a focus on the part to a focus on the whole, where knowledge about how the parts fit together is given as much if not more weight than knowledge about the parts (USAID Review Team, 1988). In short, teaching and research in Agriculture needs to be 'Systems Agriculture' and the graduates to be produced 'Professional Systems Agriculturalists' (Bawden and Valentine, 1988).

The emerging challenges can be met only by integrating the best in frontier technologies with the best in traditional practices in terms of creativity in R & D Systems' (Swaminathan, 1989). For this to happen, the educational system needs to be responsive in terms of orienting the

learners to creativity, systems approach to solving field-problems, inter-disciplinary courses in Social Sciences, exposure to technology alert and assessment, enrichment courses to first-generation learners and job-related non-degree programmes.

Frames of Reference for Development of Higher Education in Agriculture:

The following frames of reference emerge from the foregoing discussions:

1. Relevance to national, regional and farmer level production needs,

2. Appropriate professional competencies and perspectives in relation to advancements in frontier subjects,

3. Development of broadly generalised competencies to produce capable 'Systems Agriculturalists' for integrated farming and other work situations,

4. Learning-centred (Transactional) facilitative curriculum integrating the learner with 'Systems Agriculture', with his entry level behaviour, society and farming situations.

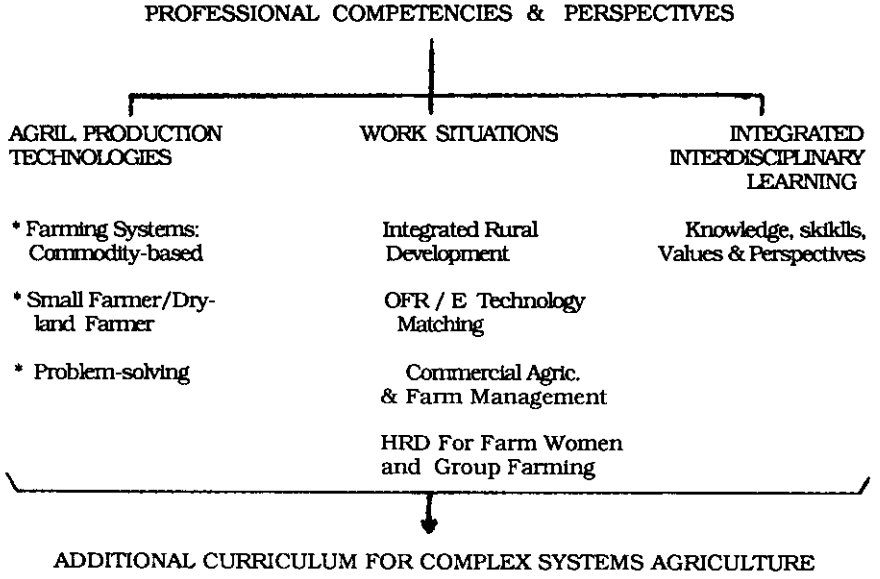

Fig. 1. ADDITIONAL CURRICULUM FOR COMPLEX SYSTEMS AGRICULTURE

Arising Needs for Curriculum Development:

Curriculum development, at the operational level, that takes into account the above issues and requirements, therefore, poses challenges of a magnitude never faced ever before. They call for an integration of national, regional and farm level needs to developing competencies and perspectives that are pluralistic and pragmatic. Some of these are:

Relevant Production Technologies:

At the national - level:

* Strategies and competencies for increasing food production in all areas (Cereal and foodgrains, vegetables, oil seeds, milk and milkproducts, meat, fish, etc.) keeping in view the national perspectives and values.

At the Regional and Farmer Levels:

* Integrated Production Systems in terms of sustainability in varied agro-ecological zones,

* Commodity based Farming Systems Technologies for varying situations (e.g. irrigated/dryland, mixed farming) and varying socio-cultural backgrounds and classes of farmers,

* Problem identification and problem-solving competencies in farming situations.

* Special production/amelioration technologies (e.g. watershed technology, wasteland development (in Agril. Curriculum), rearing of exotic crossbred animals, development of non-descript cattle (in curriculum for Vet. Edn.) home-level nutrition management, integration of child health/nutrition/sanitation (in curriculum for Home Sci. etc.).

Professional competencies and perspectives:

* Interdisciplinary integrated approaches (e.g. Soil -Water-Crop management, Integrated Plant Protection, etc. for Agriculture,

Integratead Mixed Farming System, for Livestock Production, Integrated Disease Management for Veterinary Education', Integrated Child Nutrition Development programme for Home Sci. etc.).

* Multi-disciplinary approach for development of integrated farming technology (e.g. Annuals, Perennials, Agrarian mix, Cropping Systems, etc. (for Agril. Edn.), Hygiene and Public Health (for Vet. Education).

* Computer Applications in Agriculture and, Interdisciplinary emerging areas of Science like Bio-Technology, Genetic Engineering, Bio-energy, Remote Sensing, Environmental Ecology, Information Management System,etc.

* Production Technology-related problem-solving competencies (e.g. for endemic / chronic / new arising problems).

Competencies required for varied work situations:

* To serve the needs of *Integrated Rural Development* (as this would broadly cover work situations as in Extension/service/On-Farm Client-Oriented Research (OFCOR),

* Competencies in *Technology Forecasting, Assessment and Matching,* in relation to existing natural resource endowments, Indigenous Technical Knowledge (ITK), and needs of 'Sustainable Farming Systems' in given rural situations,

* *Commercial Agriculture and Farm Management,*

* *Special Courses* (Optional) *for women students* to serve farm women's needs (Rural Home Science, Off-farm enterprises for women, Family Welfare and Counselling, Home Economics, etc.),

**Development Education* to promote Self-employment in Farming/Agro-based enterpreneurship and

**Human Resources Development* (for promoting endogenous and exogenous factors) for extension with special reference to *Small farmer* and *group farming,* and learning to learn for career/personal development.

Transactional Facilitation for Learning and Integration:

This relates to issues of learning-teaching processes and organizational sequence between Courses in order to facilitate easy learning and effective internalisation for application on the part of the learners from course to course. (e.g. Courses relevant to 'Sustainable Farming Systems, ethnobotany, ethnoscience' may be introduced early, 'Village Stay' and Integrated interdisciplinary Courses later, etc.)

Emerging pattern for Curriculum change:

These changes which are warranted in our 'curriculum' may be brought about by a) replacing an existing course with a new course, b) re-orienting an existing course to serve emerging needs, c) changes in learning-teaching-testing methods, and d) enriching an existing course with additional illustrations, techniques etc.

But if these 'changes' are merely 'content oriented', they may not serve the needs, but may even be counter-productive. Hence, an integrated reorientation of the whole process is called for as indicated below illustratively for two such programmes.

Table 1. CURRICULUM PLANNING FOR ARISING COMPLEX SYSTEMS AGRICULTURE

EXISTING FOCUS	ARISING FOCUS
Discipline-based Courses	Integrated Inter-disciplinary Courses for Sustainable Agriculture
Commodity-based Production Technology	Farming Systems, Commodity-based and Farmer based Technology
Content-Centered Teaching	Experience-Centered Learning-Teaching
Given 'knowledge' Testing	'Problem-solving and situation -improving competencies' testing
Limited Linkage with Research & Extension	A Holistic approach, linking current Research and Extension

Similar orientations are required to be made for other programmes offered by the Agricultural Universities.

Table 2. CURRICULUM PLANNING FOR ARISING COMPLEX VETERINARY EDUCATION

EXISTING FOCUS	ARISING FOCUS
Discipline-based Courses	Integrated Inter-disciplinary Courses for Sustainable Animal Husbandry and Farming Systems
Product-based Production Technology	Livestock-farmer-based, product-based and Integrated farm-technology-based Production Systems
Content-centred teaching	Experience-centred Learning-Teaching
Given 'Knowledge' Testing	'Problem solving, Situation Improving-competencies' Testing
Limited Linkage with Research and Extension	A holistic approach linking Livestock Research, Industry, Marketing and Training

If the expected 'changes' are to achieve the desired re-orientation in the knowledge, skills, attitudes, values and creativity of our learners, we have to :

i) Study all the issues pertaining to

a) the teachers, their teaching and testing methods,

b) the learners, their metacognition, learning styles, experience and motivation.

c) the administration, its ability to develop the necessary infrastructures,supports, etc. and

d) the farm situations as gleaned from 'research'/extension, their needs and findings.

ii) Plan what 'changes' need to be introduced, and how to implement them,

iii) Monitor and evaluate the effects of introduction in terms of expected objectives and

iv) Undertake necessary measures for keeping up the developmental process on a continuing basis.

To do these systematically, there is a need for a body of educationally informed persons in each Agricultural University to size up the 'emerging' needs in a systems manner and manage the required Curricular changes in a holistic way organizing the administrators, teachers and students for appropriate collective action. In short, if curriculum development is to be carried out in a scientific manner there should be a body of informed persons involved in the continuous and ongoing cyclic process of curriculum planning, perspective building, identifying the steps of implementation, specifying the tools for evaluating the effectiveness of curricular changes, etc.

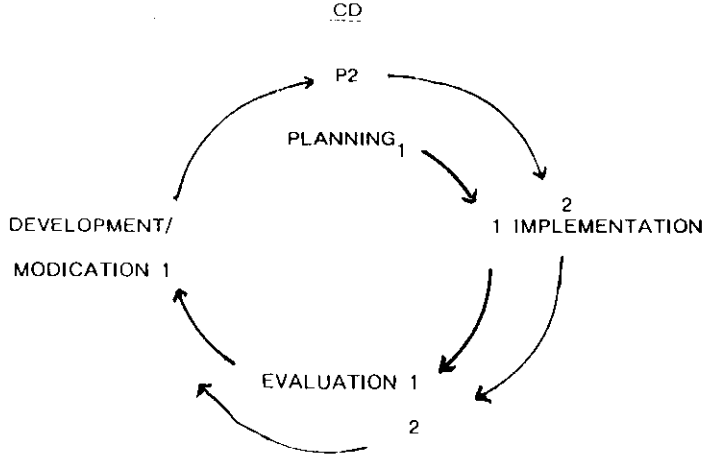

Fig. 2 CURRICULUM DEVELOPMENT PROCESS

Implications for Curriculum Implementation:

1. Agricultural Systems Learning requires the introduction of a number of integrated *interdisciplinary and multi-disciplinary Courses* for which the functionality of the existing discipline-based Science Courses needs to be evaluated in terms of educational parameters i.e. relevance, appropriateness and transactionality, and appropriately modified/ deleted. Issues relating to 'sustainability' need to be integrated in existing Courses.

2. For the development of professional competencies, which is crucial for the 'future', not only the required infrastructures need to be developed but also appropriate field-related and learning-centred interactions between the teachers, the students and real-life experiences fostered and promoted. These help to develop 'competencies' like: critical observations, systems-based perceptions, library-based learning, context related analytical and problem-solving skills, developing theory from practice, etc. It is necessary to give up our preoccupation with transmitting'yesterday's knowledge and testing (and incidentally encouraging rote-learning) of 'Content'/ information which may not serve 'tomorrow's' needs. Our orientation should be for developing capabilities and competencies.

3. Upgrading of the contents of the existing Courses and also of learning-teaching interactions can happen only in a climate of its active *linkage* with *Agricultural Research* and *Agricultural Extension Education.* Research findings from location specific research carried out at Regional Research Stations (NARP Centres) and experiences of extension educators in spreading agricultural technology and Rural Development are the sources from which real-life/work situations (: Cases/Scenarioes) could be brought into curriculum. These will help to organise experience-sharing in a systematic manner and to promote capabilities through activities like discussions, case methods and effective *experiential learning* programmes during 'village stay'. The learners, then, will understand the systemic interactions in play in the fields, and learn how to optimize/improve farm situations in terms of issues like sustainability, conservation and restoration.

4. Grouping discipline-based departments into integrated clusters of interdisciplinary schools or centres in terms of mutual functionality for holistic 'problem-solving' approach seems to be in order as 'discipline-based' approach seems to restrict vision and perceptions. Some

Agricultural Universities have already attempted such restructuring by establishing interdisciplinary problem-related groups like "Centre for Crop and Soil Management Studies", "Centre for Plant Protection Studies","Centre for Plant Breeding, Genetics & Bio-technology", "Centre for Rural Development Studies", etc. By developing interdisciplinary perceptions and thinking, such Centres can develop and offer interdisciplinary Courses to meet arising 'needs'.

The interactions, between the sub-systems engaged in the process of Curriculum Implementation, as presented systematically in Fig.3 - need to be properly and positively developed and sustained at the institutional level. As Curriculum Development is a continuous process, there is a need to keep the required 'interactions' within the faculty in good repair by organizing regular perception-building exercises and involving them fully in the exercises. The Curriculum for these exercises need to be holistic, develop systems thinking and reflect the character and needs of all the interacting subsystems. A knowledge of the process of identifying this approach, and in turn, the principles of "systems-based educational process" will be helpful in this regard.

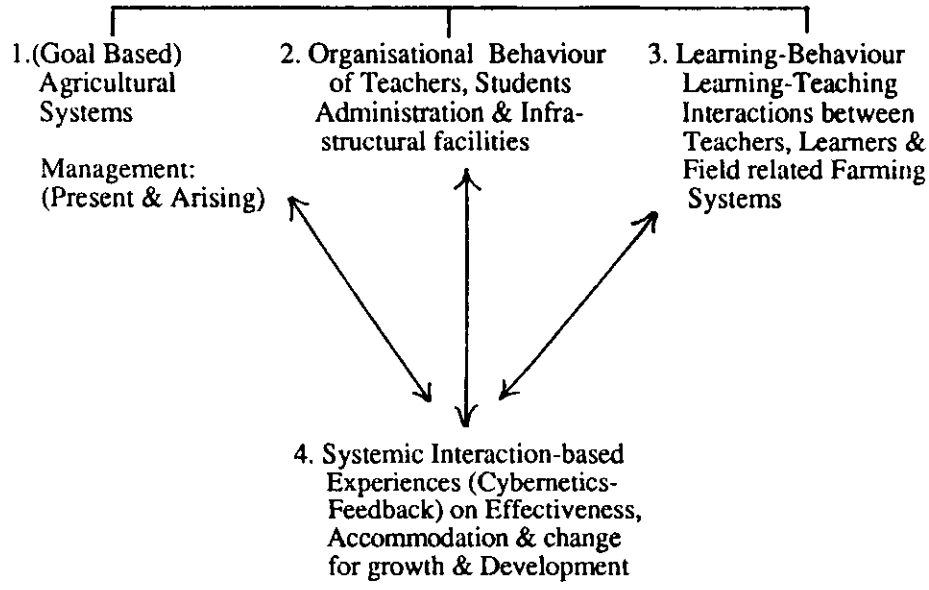

Fig 3. THE INTERACTING SYSTEM FOR CURRICULUM IMPLIMENTATION:

Systems-based Education Process:

Since the advent of Newtonian concept of looking for one-to-one correspondence between cause/condition and effect (i.e. reductionist approach), educational theories have been built around the same form of reasoning and empirically-based research leading to a belief that 'education was a means of transmitting existing knowledge and skills'. This orientation - called 'positive position', gave rise to continuous differentiation of experiences artificially into discrete units of 'subjects'/disciplines. 20th Century discoveries in cosmology, theory of relativity, quantum energy, ecology, molecular biology, farming systems have replaced the 'reductionist' approach with *a holistic systems approach* along with consequent new inter-disciplinary developments. In tune with these new *Perceptions*, higher educational system has developed orientation in terms of 'Constructivist' curriculum with its focus on developing learner-centred perceptions, competencies, etc. Thus, the systems-based education shares the insights and practices of a number of interacting disciplines like (A) 'Management' (B) 'Cybernetics' (C) 'Organisational Behaviour' and (D) 'Learning-behaviour'.

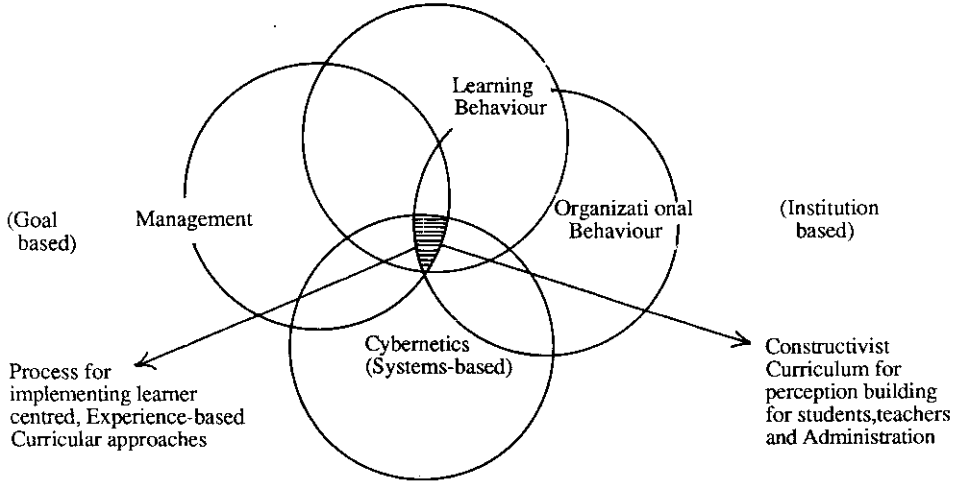

Fig 4. EMERGING CURRICULUM FOR PERCEPTION BUILDING

As a result, along with the existing process of discrete differentiation into new sub-categories of 'disciplines', there is a parallel process of emerging interdisciplinary subjects like bio-technology, ecological and environmental sensitivity, multi-disciplinary technologies for Conservation, Restoration and Sustainability, to name a few. Incident ally, it will be clear as to why perception-building exercises/discussion for all the persons involved in curriculum planning and implementation is incumbent and necessary.

The Process of Learning:

The Experiential Learning Cycle

Learning is an active and continuous process by which every living organism interacts with 'environment', makes generalizations and develops action-system necessary for its survival, growth and development. This built-in dynamism to learn, hypothesise, experiment, adopt/adapt a response-mechanism, or develop suitable strategies in relation to 'in-coming feedback', may be called the 'experiential' learning capacity of every living organism. This is evident much more in humans as they have a language by which to reflect, communicate, negotiate, accommodate and build upon.

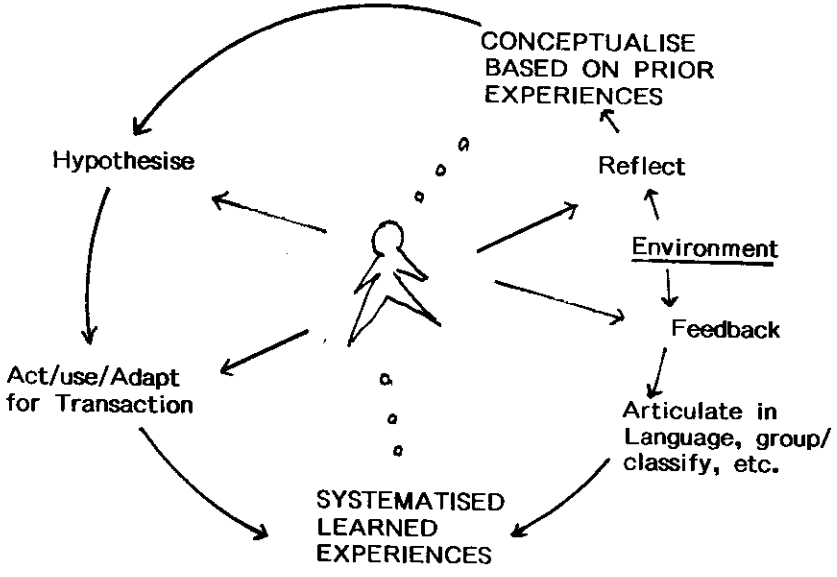

Fig. 5 HUMAN (SYSTEMS-BASED) LEARNING FOR SURVIVAL, GROWTH AND DEVELOPMENT

The 'learning process' is, thus, a continuous on-going 'spiralling' process carrying the learner from one level of 'learning/experience' to higher levels of learning' (: knowledge, skills, values, attitudes, etc.) from several varying experiences.

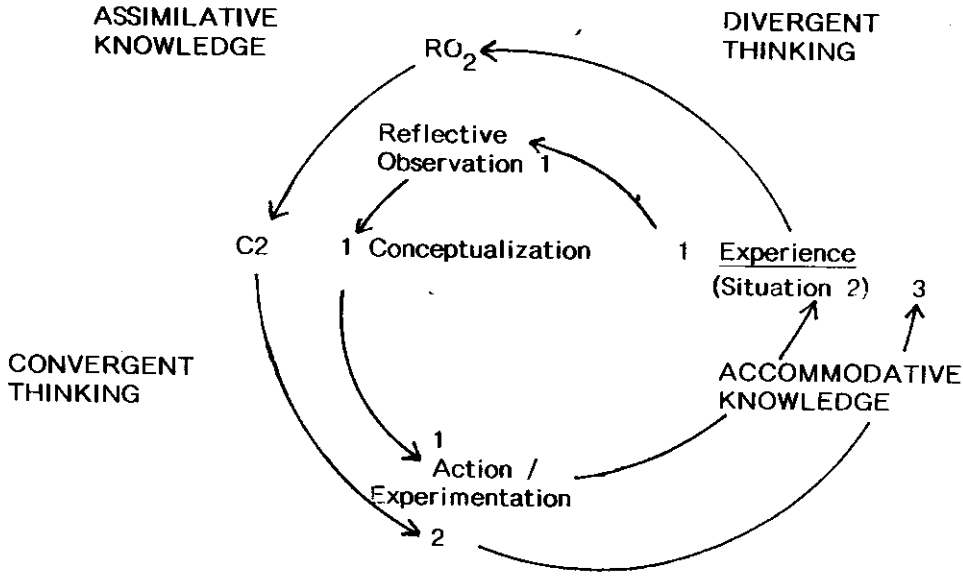

Fig.6. THE PROCESS UNDERLYING EXPERIENTIAL LEARNING

By a series of intra-active (as an individual learner) and inter-active (in group learning) questioning, a learner/group learns through (a) succeeding stages of recalling prior experiences, reflection, tentative conceptualisation, experimental action and reformulation of the Concepts. (b) This process takes place through ever recurring cycles throughout one's life. From one stage to the next, the learner may move through processes of questioning and thinking like (A) Divergent thinking, (B) Internalizing strategies of assimilation and integration with 'prior' knowledge, (C) Convergent thinking and (D) Accommodation and Reformulation of knowledge/skills, etc. according to the 'feedback' one may receive from action/experimentation.

From this model, it may be seen that the learner's natural mechanism need to be strengthened by involving them in four different kinds of abilities: (1) They must be able to involve themselves fully, openly and without bias in concrete experiences (understanding and articulating

abilities). (2) They must be able to reflect on experiences, intentions, needs and other perspectives (reflective observation abilities). (3) They must be able to create concepts that integrate observations into coherent models for analysing and synthesizing concepts (abstract conceptualization). (4) They must be able to use these models to make decisions, solve problems or generally improve complex situations by active experimentation and accommodation.

Emerging Autonomy for 'Learning' for Application :

To grapple with the 'arising' complex problems of agricultural production and other needs, learners should be enabled to cultivate these four abilities and integrate them into a dynamic process for further self-learning (i.e. learning to learn), research and extension education. An experiential learning situation is likely to bring about, not one performance-related learning outcome but several, as it involves integratively all the domains of the learners viz. the knowing, the acting and the feeling and applying domains.

The advantages of an experiential learning approach (in the form of discussions, real work experiences, Case studies, etc.) for a learner are many since the approach is built around the natural 'information processing and learning strategies' of the 'human' as mediated through language, verbal and non-verbal discourse conventions and other cultural artifacts, and, thus, oriented to problem-solving awareness building and improvisation/ innovation/ creativity ..." The language of education, if it is to be an invitation to reflection and culture-creating, cannot be the so-called uncontaminated language of 'fact' and 'objectivity'. It must express stance, and counter-stance, and in the process, leave place for *reflection*, for metacognition. It is this that permits one to reach higher grounds, this process of objectifying in language or image what one has thought and then turning around on it and reconsidering it" (Bruner, 1986) . "The task of a university is to weld together imagination and experience" (Whitehead, 1980). Further, it is likely to develop creative orientations in the learners, as the approach is meant to be developed as open systems thinking, and not 'merely' conditioned by 'existing' reductionist perceptions. This calls for new orientations to teachers, and their 'teaching' approaches.

New-orientations to Teachers and Teaching:

Most senior teachers of the present generation are products of the 'reductionist' era, with orientations built around 'given' knowledge, and on

the notion that "consensually passed on laws of science are facts or truths" (Kuhn, 1986). Great Scientific revolutions and insights have come through open systems thinking, signifying a flux, and also a resultant resolution between apparently opposing 'stances' of the mind namely concrete perception and abstract perceptions, and between reductionistic (discipline-based laws) and 'holistic' (multi-disciplinary) perceptions.

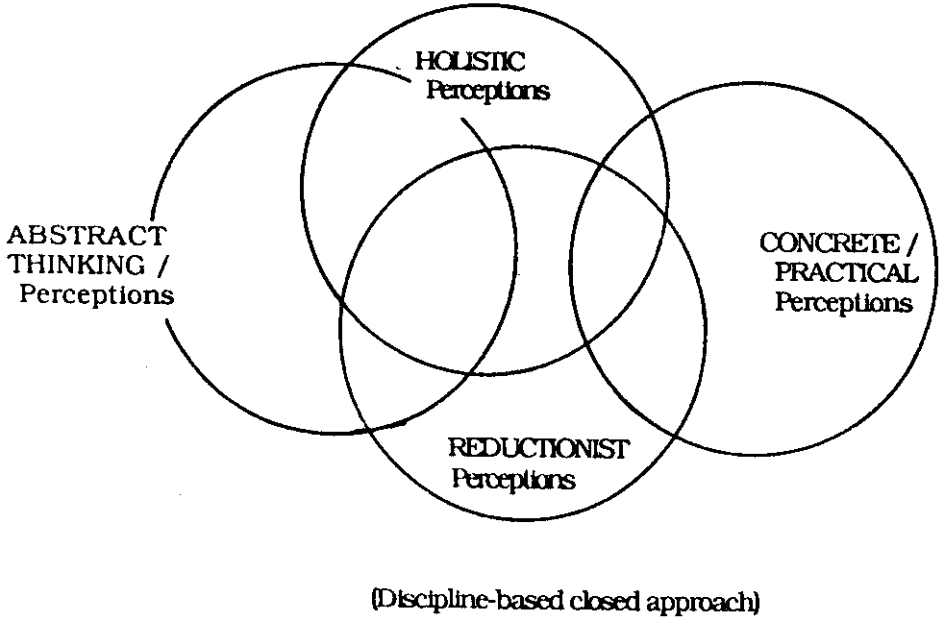

Fig.7 INTER-ACTING COGNITIVE STANCES IN EXPERIENTIAL LEARNING
(Multi-disciplinary and Situation-based)

Holistic perceptions grow with the range of one's experiences of different situations, activities, socio-cultures, and so on, and contribute to activating the use of right-brain for intuitive grasp, insight formation, synthesis, innovation, etc. along with the traditional use of the 'left-brain' which is associated with 'reductionist' approaches.

Experiential approach does not only benefit the learners but also the teachers. When the teachers are confronted with a series of unexplained puzzles and problems in a discipline/ situation, their 'reflective' and 'accommodating' cycle of 'perceptual learning' may suddenly leap to higher level insight of more inclusive theories/principles.

It is only through experiential approach to teaching that higher education in agriculture can help with 'the required shift from an imitative to a creative R & D System '(Swaminathan, 1989). Further, this approach leads to learning-teaching-testing of competencies (Sudarsanam, 1989) instead of getting fossilised with yesterday's 'content' or knowledge. Today's learners would get properly oriented for to-morrow's "On farm Research/Extension in Systems Agriculture" as 'co-learners' with farmers. (Sriskandan Raja et al, 1989).

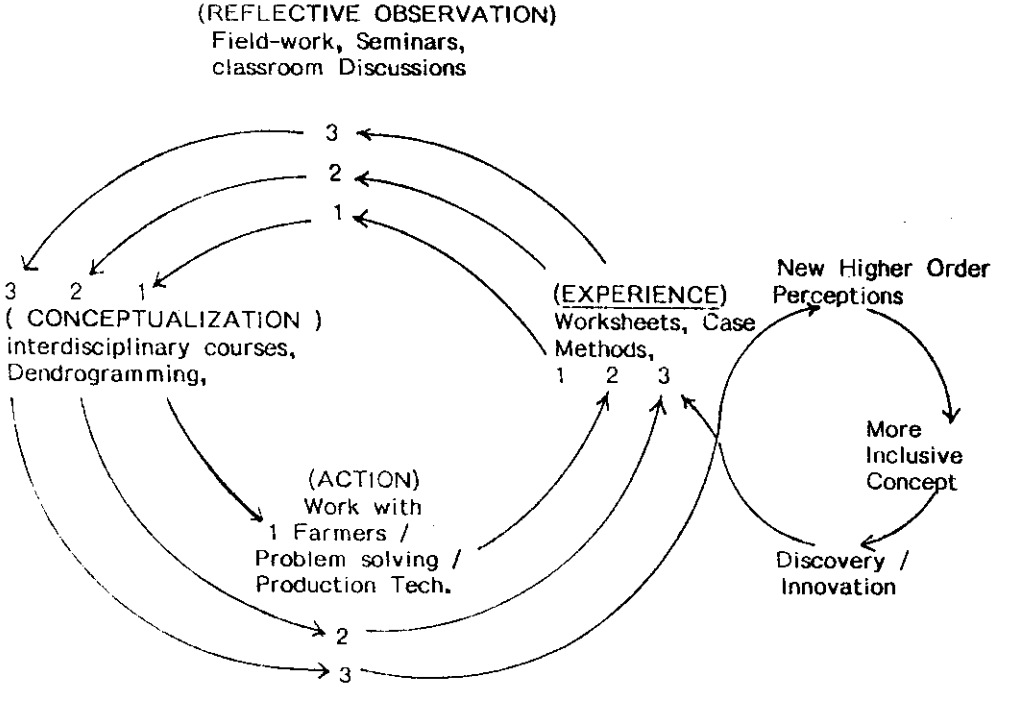

Fig. 8. EXPERIENTIAL APPROACH AND ORIENTATIONS TO CREATIVITY

It may be seen that experiential perceptions are likely to lead to higher level and more inclusive perceptions and creative insights, innovations and discoveries for the teachers.

Curricular Pattern in Agricultural University System

The Pattern in SAU's in our country

Having touched upon the issues relating to curriculum planning and implementation in terms of required orientation to new forms of learning-teaching interactions, we may examine our current approach with others experimented elsewhere . It will be useful in recognising ways and means of upgrading our curriculum in relation to the 'socio-technological ethos and needs of our country .

The agricultural universities, faced with the task of orienting our educational pattern to the varying challenges discussed earlier, and to meet the needs of a development-oriented society, adopted a professional educational model that telescoped with the existing feeder channels of secondary education. A framework adopted by them is given in Fig.9.

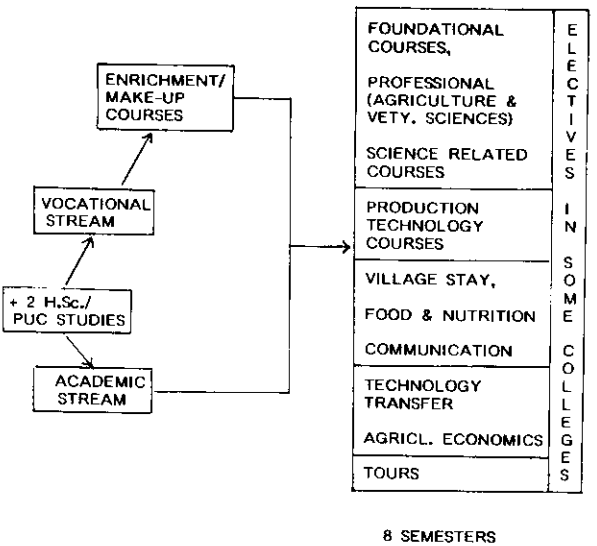

Fig. 9 EXISTING (GENERAL) PATTERN IN SAU's IN OUR COUNTRY

There are variations in this model between universities; many do not offer optional electives. The focus is on teaching more of the 'same' content-oriented teaching. Even 'Village Stay' Programme is not organized as 'experiential learning-situation'; it is organised in terms of reductionism-based questionnaires, survey-based guided learning and data-filling tasks. The existing discipline-based structural approach to Curriculum Development may not allow us to completely switch over to the forms developed elsewhere, for example Hawkesbury Agricultural College, Australia.

Realising that the current Curriculum Development process was bogged down by persistant discipline-based collective bargaining for more teaching hours to teach more 'content', a reorganized pattern of education in terms of holistic perspectives of agriculture was introduced in Hawkesbury Agricultural College in 1978. A system of learning strategies which comprise a) staff sequenced workshops on Farming Systems (: for discovery learning), b) a few problem-based (: learning inducing) workshops in the institution, c) non-sequenced staff workshops on topics like Farming Systems, Regional eco-system, Future-job/work related Social groups, etc. (: for providing 'conceptualising competencies'), d) experiential work, self-directed learning and unsequenced exercises (like project work in work-situations, student-centred discussions, reports and Seminars in the institution, etc.), has been organized roughly in the order in which these are listed here. Thus the students are moved back and forth between a) institution-based 'directed' learning and b) work-situation-based experiential learning, between c) library-centred and self-directed learning and d) group-centred learning built around worksheets, problem-based workshops and Case Studies (Bawden & Valentine, 1986). Such curricular orientations were introduced after several perception-building exercises like Workshops, Seminars and small-group discussions thus developing a Constructivist Curriculum over a period of six/seven years. This provided them with time for reorientation and development of selfconfidence among the teachers, and of resource materials for learning-teaching situations.

Implications:

To sustain Curriculum Development which is a dynamic process undergoing evolutionary changes, on an even keel, a group of educationists should continuously study curricular issues, organize suitable perception-building exercises and develop implementation

procedures in a holistic way. Though immediate changes in structural approach to Curriculum Design are difficult to conceive, some of the learner-centred instructional methods can be put to use in our educational institutions.

Syllabus for a course may be expressed in terms of a) significant issues for self-study, b) behavioural objectives in respect of skills to be learnt from practicals, c) problem areas to be discussed and worked out in the form of worksheets/ assignments, d) case-study related workshops on certain topics and e) one group seminar on any one topic out of four or five. Though structural change may not be immediately possible, these changes may be brought about so that one can remove our teachers' preoccupation with coverage of topic-based syllabus, and reorient them to teaching competencies. Competency-based test papers, if introduced, may provide the necessary impetus for conviction and change (Sudarsanam, 1989).

Learning Centred Instructional Strategies:

In the context of our arising needs and 'existing' socio-technical ethos, the most vital need of Curriculum Development is the need for the introduction of learner-centred Instructional strategies and methods like discussions, problem/puzzle-based worksheets/assignments, case studies and Farm related unstructured experiential learning exercises during the 'village-stay' programme, etc.

Skill Sessions for recalling pertinent experiences, setting up expectations and reflective thinking may provide for an integrated learning of the four abilities mentioned earlier. Participation of students as observers in situations like "variety-release discussions / meetings, real-life situations-based information processing models, simulated activities, problem-posing/solving worksheets and puzzles may be built into our system. These may be selected and organized in a systematic way such that the learners learnt to move from one level of complexity to increasing levels, through processes of personal reflection, peer-group interaction and interactive discussion with the teachers, and self-reading. This approach will carry all the learners (i.e. the slows and the gifted) forward and backward between reductionism and holism, and between technology-related problem-solving (: hard system) systems and concept-related issues (: soft-system), and contribute to transforming them into effective and creatively-oriented systems agriculturalists.

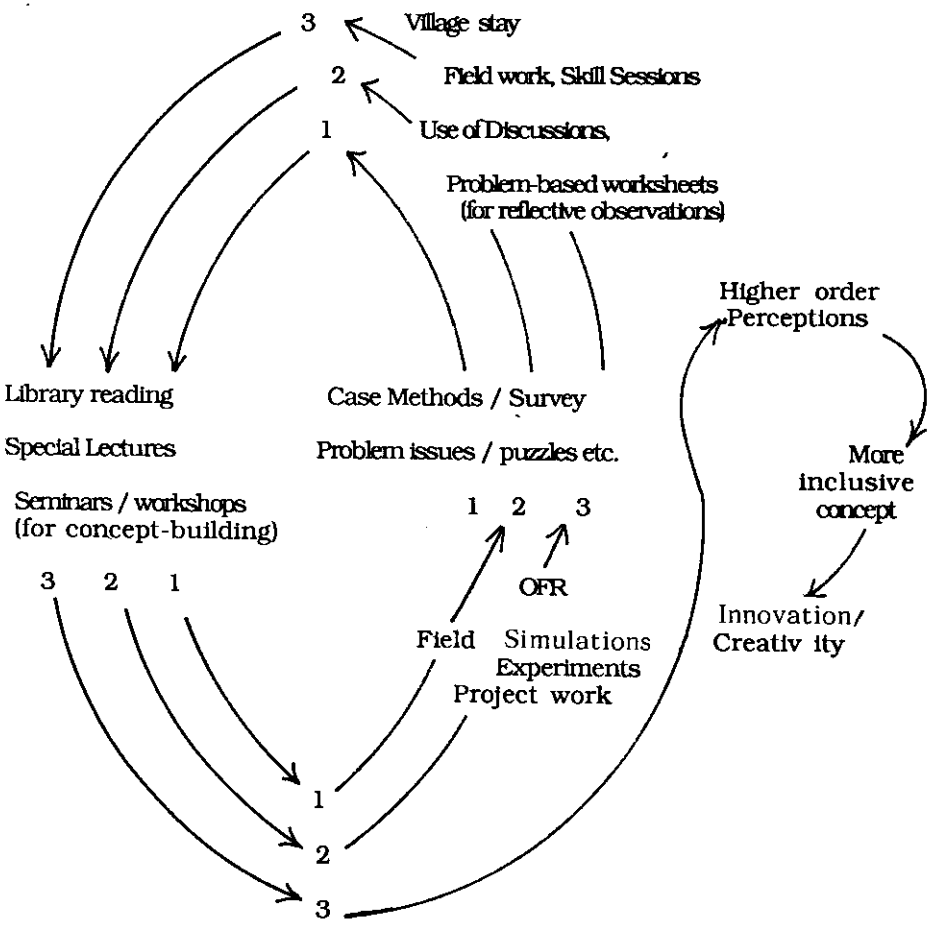

Fig. 10. INSTRUCTIONAL CYCLES AND CREATIVITY

CONCLUSION

Relevant curriculum planning to meet emerging challenges call for holistic perceptions, imagination, innovativeness and bold initiatives.

Many new ideas and issues (e.g. sustainability issues) could be easily incorporated in certain existing courses.

New integrated interdisciplinary courses (e.g. Integrated Production Technologies, Animal Management, Nutrition Management, Water Management, etc.) and special i.e. Optional courses for women students need to be included.

Redundant discipline-based courses may be replaced with new Courses like FSR/E, Farm Management, Development Education, etc.

Instructional approaches need to be structured around learning-centred problem-identification, problem-solving, situation optimizing/ improving experience/assignments

The faculty need to be oriented towards adopting experience-centred learning-teaching strategies and methods. Workshops and In-service Programmes with this focus will assist in this orientation. Each Agricultural University may establish an Educational Technology Cell to study these issues, organize the necessary In-service Workshops and develop suitable implementation procedures.

Education is now considered not as a means of transmitting knowledge or skills but as a means of establishing a 'desirable future' and hence Curriculum Development should have orientations to the 'Future', and to the inculcation of 'competencies' with which today's learners could tackle the problems of 'tomorrow'.

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