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Discussion: Systems Approach to Agricultural Problems

J. Elterich

Since I have no quarrels with Dr. Koch's excellent and vivid synoptic view, my comments will address the workshop that Bob and I attended at Colorado State University from my vantage point and I will attempt to show parallelisms to Glenn Johnson's views on research methodology as presented in his 1986 book on "Research Methodology for Economists."

Let me immediately state my *biases* in our urgently needed reorientation of teaching and research. The urgent redirection is partly dictated by our blissful ignorance of world affairs in general, the need a) to decompartmentalize our thoughts, b) to awaken students' independent thinking, and c) perhaps to justify the occupation of a central interfacing role between scientists in multidisciplinary efforts by agricultural economists.

I, too, support the union between the research and teaching/learning process advocated by the workshop and Johnson. Learning is a very active form of problem-solving, with new knowledge as the outcome (Figure 1).

Learning can be simply summarized as efficiently acquiring knowledge, critically validating the results, and using the knowledge beneficially. Specifically both the workshop and Johnson stress that teaching should be designed to develop, modify, and improve the student's view about research methodology.

On the one hand, anyone interested in innovative and integrating, holistic teaching approaches—i.e. interaction between social, and physical sciences—has to welcome efforts that are designed to excite the curiosity and imagination of our students and to modify the well trodden path of following standard theoretical and analytical approaches of our profession.

Ag economists have often tried to break the confines of "hard" systems and attempted to include nonquantifiable soft system elements, using simulation to capture the real world. But we have put first the rigors of mastering economic theory, thereby

perhaps, somewhat stifling the imagination of our students. So I am definitely disposed towards the workshop's proposed thrust, since it promises to further independent thinking in combination with the necessary exposure to the economic analysis basis.

On the other hand, detractors of the workshop's recommendations may ask, so what is new? We have required students individually, or in groups, to hand in class projects solving real problems innovatively, to brainstorm, and to go beyond what theory prescribes. But I believe we have to go much further. Kathy Wilson [in her "*Blueprint for Action Proposed Changes in General Agriculture Degree Programs*, (University of Hawaii, 1986)] summarizes it very well, and I paraphrase:

The content of education must not only ground the student broadly in biological, physical and social sciences but also convey the *interrelationships* among the sciences as they may contribute to the management of agricultural problem situations. (Emphasis added.)

Furthermore, students should be able to apply their knowledge competently to these holistic system scenarios. What I believe is needed in today's job market is to educate critically and innovatively thinking students tolerant of other disciplines' contributions. They must thus cooperate productively in teams and efficient networks. This needs to be coupled with good communicative and quantitative skills; invaluable traits for the requirements of our times.

Agricultural economists traditionally were looked upon as integrators between the physical sciences (plant, animal, soil sciences and engineering) and the social sciences, bringing our economic tools to bear on the former's input-output relationships. Now, with a continuing and spreading international and interdisciplinary integration, we need to understand and clarify relationships and come forth with policy alternatives for decision makers, interphasing values that are held by participants impacted by the decision process.

Therefore, consideration should probably be given to revolutionize our course sequence by offering

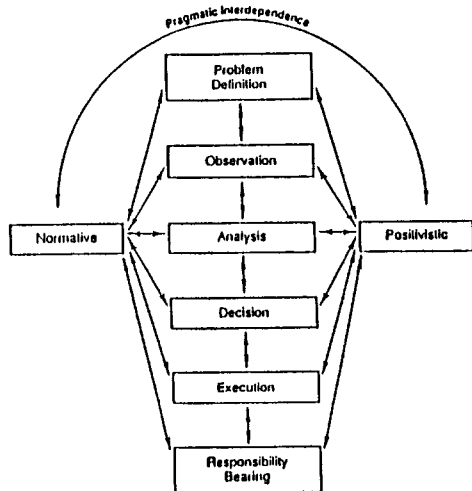
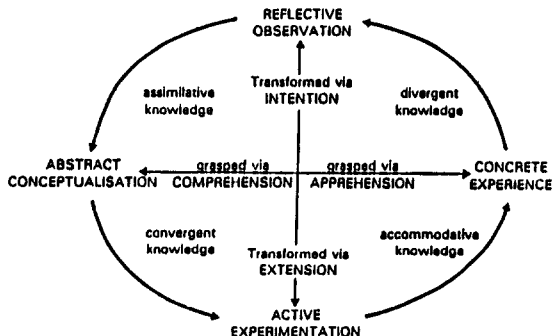


Figure 1. Comparison of Lewin/Kolb Model of Experiential Learning with Johnson's Problem-Solving Steps

Source: Johnson, p. 15.



Source: National Agricultural and Natural Resources Curriculum Project, p. 56, 2.

early an introduction to system thinking and problem-solving and follow this with "traditional" courses, but integrating them into a holistic picture. Specifically, most courses should incorporate two complementary infusions—a multidisciplinary system and an international dimension.

Self directed learning contracts, colloquia, and seminars should give the students some experiences in the system based learning. In the senior year the experimental learning and system based curriculum

should be put to the acid test of real problem-solving research via internship or senior thesis by the students under the joint tutelage of practitioners in industry or government and faculty. As already stressed, creative and independent thinking should be rewarded, requiring some of us to abandon highly held ideals with respect to theory first and last.

In what follows I draw heavily on Johnson's challenging ideas which I believe to be of utmost relevance in this context. In Bolding's foreword to Johnson's book, he warns of the dangers of specialization

It is . . . true that the discipline that is involved in the subculture of those who study a narrow field can also become oppressive and lead to the strangling of new knowledge through the imposition of powerful orthodox-ics. (Johnson, p. xv.)

Obviously, this would be inappropriate for soft systems studies of multidisciplinary scope.

In order to understand Johnson's framework let us look quickly at his three dimensional "cube" that distinguishes between kinds of research and kinds of knowledge generated. I will short change the third dimension, philosophical orientation.

The framework of the national workshop was mainly concerned with the problem-solving layer and involved both positivistic as well as normative knowledge, but tolerating any *Weltanschauung* (defined as worldview; philosophical underpinnings, subject matter knowledge and objective function of scientist.) As an aside, the workshop

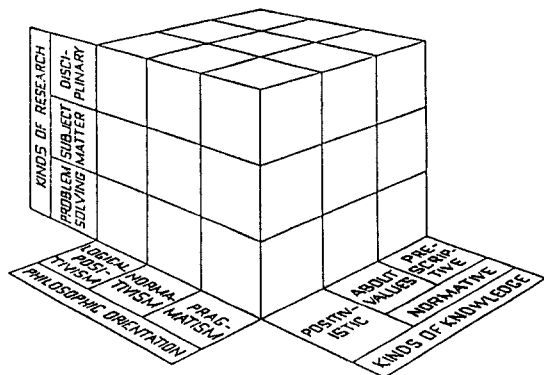


Figure 2. Interrelationships among kinds of research done, philosophies used, and kinds of knowledge generated by economic researchers. [1, p. vii]

(Source: Johnson, p. vii)

activists welcomed opposing *Weltanschauungen*, since conflict and tensions may help in clarifying the issues and lead ultimately to a problem resolution.

In Johnson's spectrum of kinds of research arching from the usually highly regarded disciplinary research with long lasting impact over subject matter research to complex problem-solving research, the workshop addressed principally the latter, less spectacular, short lived classification. But it—

. . . requires acquisition and utilization of value free positivistic knowledge and knowledge about values to produce prescriptive knowledge based on complex decision rules. (Johnson, p. 20)

Johnson advocates building selectively upon the respective strength of philosophical schools (positive and normative) that requires relaxation of some of their restrictive confines.

What is stated easily but definitely needs to be accomplished in painstaking work, is a synthesis of the methodological pluralism from physical, biological, and social sciences, i.e., a successful crossing of disciplinary boundaries in integrative enquiry. To be a facilitator in this undertaking should be one of our principal efforts in years to come.

Economists pride themselves not only in dealing in monetary but also non-monetary values, yielding either economic or efficient solutions.

This makes economics an inherent part of many multidisciplinary subject matter studies and an essential part of all problem-solving studies . . . As the scope of economists' work includes potential contributions to all problem-solving research . . . their research methodology must be attuned to all kinds of research. (Johnson, p. 239)

For brevity's sake I ignore three important aspects raised by Johnson: the difficulties (1) to fund, and (2) to administer such multidisciplinary endeavors, and (3) the more easily overcome handicap of communication across disciplinary areas. I am afraid both funding agencies as well as most administrators—especially those with hard science backgrounds—will experience difficulties in adjusting to research efforts of such a scope.

Some holistic applied systems science research has become very pragmatic—despite the positivistic origins of systems science in cybernetics—by modeling different subjects and problems that forced interactive interaction among decision-makers (actors or owners of systems in the CATWOE lingo) and affected people (clients) (Johnson, p. 115). This resembles the up or downward spiraling of Bawden's model discussed by Koch. We should evaluate different scenarios (states of nature) with

behavioral and criterion variables involving humans and institutions. On the other hand,

. . . non-pragmatic, disciplinary research makes it easy to subdivide one's discipline into small, narrow axiomatized simple components. Holistic, multidisciplinary, and possibly optimizing domains of human activity are much more difficult to axiomatize, . . . (Johnson, p. 237)

and almost impossible to deal with, when pragmatic interdependence occurs. Dynamic systems may grow so complex that they yield unstable results due to either over-simplification, too much complexity for our minds or computers to handle, or lack of data.

This brief discourse will remain incomplete. However, one point I wish to emphasize: advances in disciplinary (or basic) research complement and benefit problem-solving (applied) research and vice versa, hence a "good" mixture of both is needed to extend our frontiers of knowledge. Neither kind of research should receive priority over the other, since each is dependent upon the vitality of the other for impulses of more complex work to be accomplished.

In summary, my tenets can be stated: we need

1. To strengthen interdisciplinary aspects of university education by broadening our teaching and research efforts embracing the international dimension including, of course, world agricultural markets, but also other ecological, economic, political, strategic, and social aspects involving our clientele as well as trading partners and competitors.
2. To position agricultural economists as pivotal unifying brokers between our colleagues from the hard and soft sciences assuming that large multidisciplinary projects with prescriptive outcomes grow out of point 1.
3. To conduct a good blend of disciplinary, subject matter, and problem-solving research in order to better manage our limited resources in a shrinking and more interdependent world that poses larger and more complex problems for mankind to tackle.
4. To foster our student's independent, innovative thinking in a systems context so they can successfully occupy leading positions in public institutions and private enterprises.

In the time permitted we could only scratch the surface of these two interrelated set of impulses—from the workshop and Glenn Johnson's thinking—but we should embrace both as coming to us at the right time for general holistic reorientation in the teaching and research process. Perhaps, if events

on the increasingly integrating world force governments to critically review their policies and this and the next generation of our colleagues of diverse disciplines recognize the challenges and priorities awaiting us, the job should be tackled *now* for the benefit of generations to come. So, let us not procrastinate, rather get on with the urgently needed reorientation in teaching and research methodologies.

References

- Johnson, Glenn L. *Research Methodology for Economists*. McMillan, 1986.
- National Agricultural and Natural Resources Curriculum Project, Food and Agricultural Systems Task Group, *System Approaches to Food and Agricultural Problems*, 1986, various workshop papers.