"HANDS-ON" MODELS: INNOVATIONS FOR

TEACHING ECONOMIC THEORY TO UNDERGRADUATES

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ABSTRACT

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The abstract nature of economic theory creates challenges for
introductory agricultural economics courses. Current techniques designed
to teach theory tend to be labor intensive or porhibit active partici-
pation in learning theory.

This paper discusses recent experiences of designing, constructing
and presenting multiple dimensional and mechanical models in classroom
learning.

"HANDS-ON" MODELS: INNOVATIONS FOR
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The abstract nature of economic theory creates many challenges for instructing introductory agricultural economics courses. Maintaining student interest in economic theory is especially difficult in large classes where student-teacher dialogue is prohibitive and where projects and problem exercises requiring instructional resources are not possible. These difficulties manifest themselves in College and Departmental orientation sessions which are characterized by a conspicious absence of projects or booths designed to recruit new students into the study of agricultural economics. The abstract nature of theory and the absence of hands-on models illustrating economic concepts discourages and bores many underclassmen during their introductory exposure to agricultural economics. This manuscript discusses innovations in modeling economic relationships along with preliminary results in using these innovations in teaching introductory agricultural economic courses.

The use of innovative teaching aids discussed by French included computer applications, programmed learning, case studies, special problems, field trips, class visitation, tele-lecture, slides and films. [p. 1168] Boehlje and Eidman evaluated simulation and gaming (bank and farm management) as an educational tool, with reference to educational objectives and learning styles of individual students. [p. 987] Nelson and Harris emphasized the estimation and use of personal probabilities in the decision-making process. [p. 993] Mandercheid and Ferres have highlighted the use of field experience in Michigan State University's public affairs management program. [p. 998] While these

innovations have made many contributions to teaching their application tends to be demanding of instructional resources and perhaps better suited for advanced courses and programs. Their application to survey and introductory courses are constrained by resource limitations associated with such courses and by an absence of a foundation in economic theory on which these programs rely.

O'Connor and Osterman define innovation in teaching such that the particular approach need not be different, unique or new to all teachers [rather] they are innovative for those who have not tried them or are inexperienced with their use. [p. 985] In this light, the models discussed in this paper may not be new discoveries, yet their innovative potential lies in their development as a technique in teaching theory. The important features of the models discussed in this paper stem from their "hands-on" nature which allows students to either participate in their construction or in their manipulation. The participatory quality of these models is difficult to illustrate verbally given their multi-dimensional and dynamic characteristics-hence their full impact can't be appreciated on two dimensional paper. Photographs have been included to aid in visualizing the potential of these models.

The major limitations of teaching economic theory from textbooks include the two-dimensional and static nature of its pages. Students are often asked to visualize third dimensions while instructors stand in corners waving their arms furiously. On the other occasions students are asked to intuitively visualize movements of curves in comparative statics without actually seeing any movements. Where graphs fail, mathematics is sometimes introduced which (in the eyes of some beginning students) adds abstraction upon abstraction.

Out of these frustrations the following series of economic models were constructed. Many of these were jointly designed and constructed by students and the instructor as individual projects for make-up or extra credit. The student is required to assist in model design, construction and presentation to fellow class members.[1] These presentations involve the writing of a users manual which students use in teaching one another.the implications of these models.

PARTICIPATORY MODELS

Simpliest of these models are those designed on a two dimensional setting and permit the student-participant to manipulate interrelated parts of the model. Ramifications of these models include the use of magnetic boards, clear plastic over-lays and movable interconnected graphs. Magnetic boards are particularily useful in showing relationships between areas of related graphs such as between elasticity of demand and total revenue or between total physical product and marginal physical product. The triangular pieces shown on the model in Figure 1 are transferrable between graphs.

Figure 2 depicts a model which utilizes clear over lays to illustrate similarities between indifference curve and factor-factor analysis and movable elastic budget lines to illustrate the ramifications of price and income changes. Another variant of these two dimensional models (not shown herein) involves the use of movable interconnecting curves. A rotation of a total cost or total value product curve is followed by a corresponding change

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[1]Credit is due to the following students and faculty for their contributions in designing or constructing these models: Prof. Jack Thompson, Prof. Glenn Johnson, Lynn Leverett, Ricky Maddox, Patrick Crews, Larry Hacker and Andy Norman.

Fig. 2a: Overlay Board with Adjustable Budget Lines, Illustrating Factor-Factor Analysis

Fig. 1: Magnetic Board Illustrating Relationship Between Total Product and Marginal Product
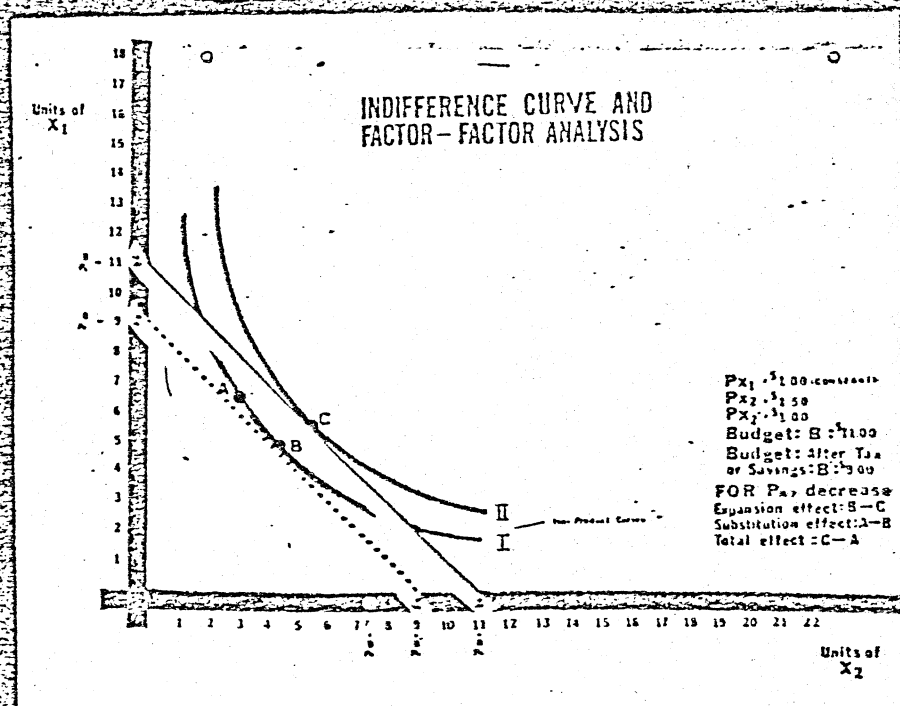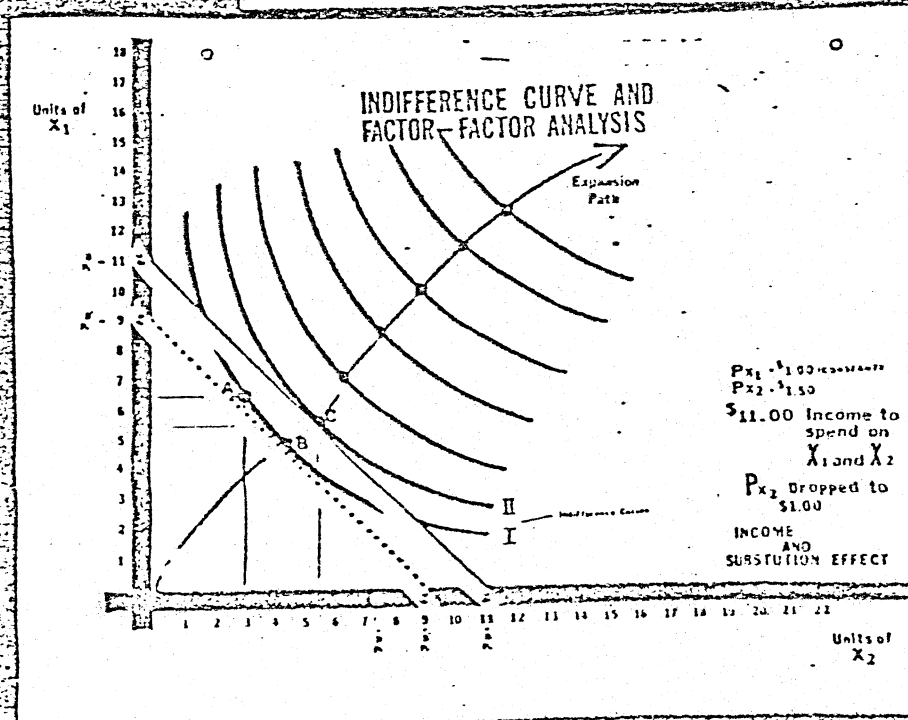
Fig. 2b: Overlay Board with Adjustable Budget Lines, Illustrating Indifference Curve Analysis

in a marginal curve corrected by strings and positioned on a lower graph. In

general these models are inexpensive, durable and require a minimum of

maintainence.

The thrust of the second set of models is to incorporate a third spatial

dimension characteristing much of economic thoery. Visualizing a third

dimension from a two-dimensional page creates problems for beginning and

advanced students alike. The models shown in Figure 3a, 3b, 3c, 4, 5 and 6,

incorporate the third dimension to illustrate relationships between two and

three dimensional models. Figure 3a, shows the relationship between factor

product and factor-factor analysis. Figure 3b, illustrates profit maximiza-

tion and generalized stages of production in factor-factor analysis. While

Figure 3c illustrates another facet of the model depicting two and three

dimensional utility relationships. Figure 4 depicts a model illustrating

product-product relationships with the iso-cost or production possibilities

curve along with characteristics of enterprise combination (complementary,

supplementary and competitive).

Figures 5 and 6 depicit models illustrating the case of perfect

complements and perfect substitutes in factor-factor analysis respectively.

These three dimensional-models consist of several multi-colored removable

sections which can be disassembled and re-assembled by students. Between each

layer additional theoretical information is available. While the maintenance

and durability of these three-dimensional models is low, their construction

can be time consuming and costly. Innovation and imagination can reduce some

of these constraints.

A third set of models and perhaps the most fasinating to beginning and

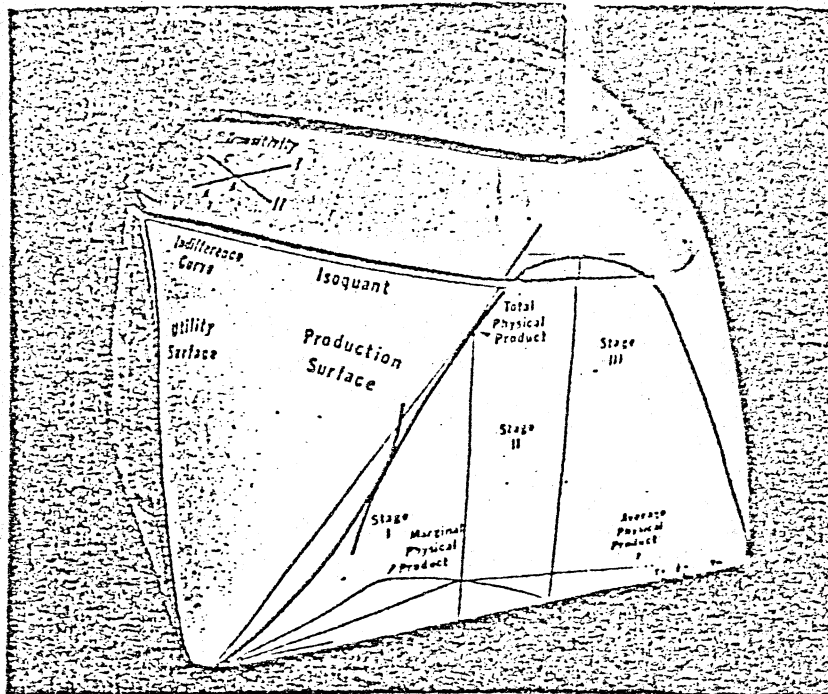advanced students alike are the flow models which incorporate spatial and

Fig. 3a: Three-Dimensional Model Illustrating Relationship Between Factor Product and Factor-Factor Analysis
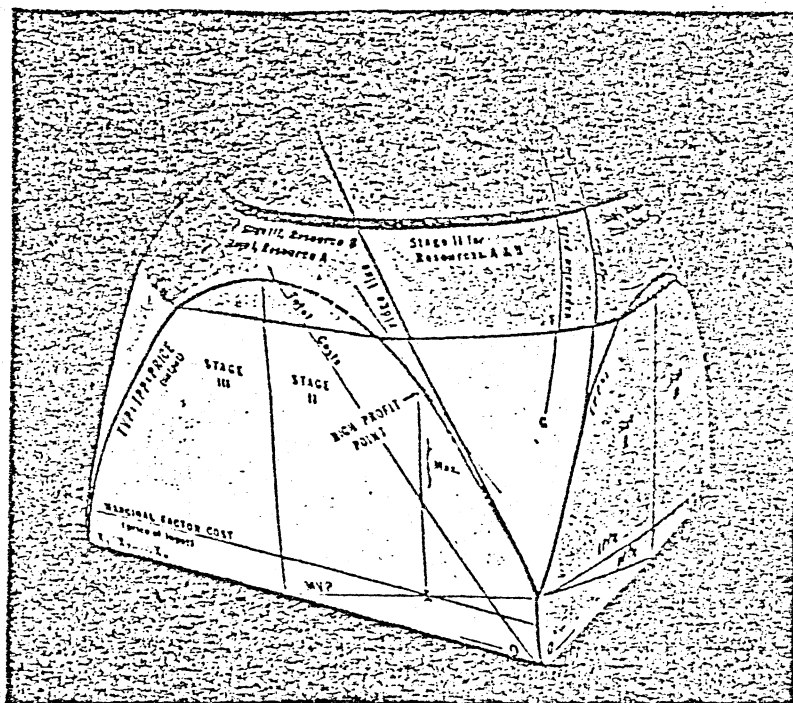

Fig. 3b: Three-Dimensional Model Illustrating Profit Maximization and Stages of Production
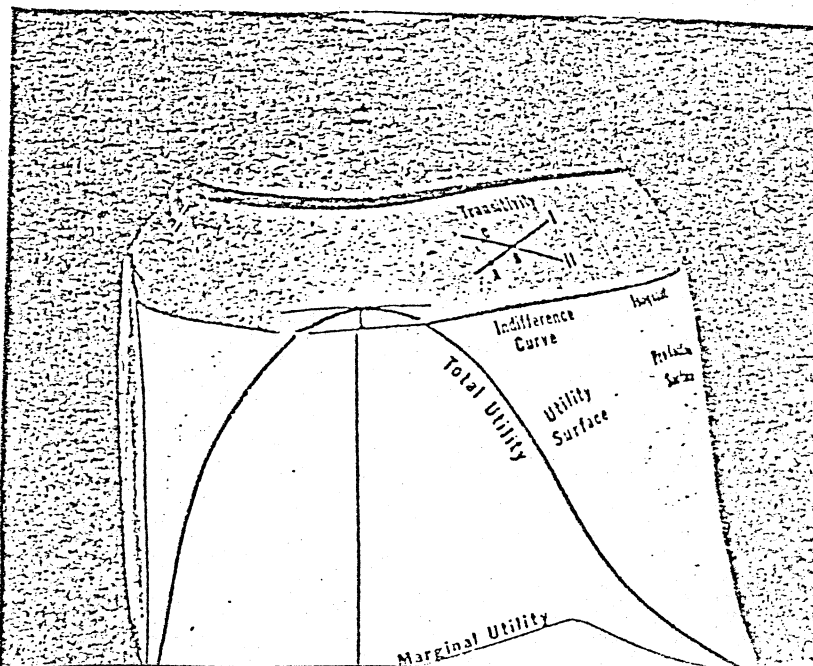

Fig. 3c: Three-Dimensional Model Illustrating Utility and Indifference Curve Relationships

Fig. 4: Three-Dimensional Model
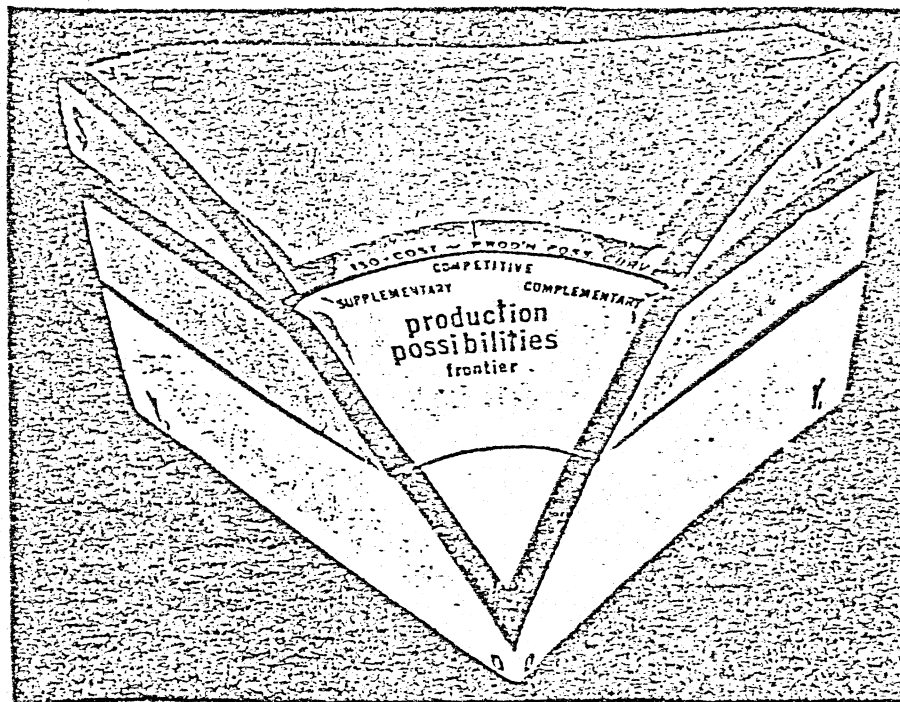Illustrating Product-Product
Relationships

Fig. 5: Three-Dimensional Model
Illustrating Perfect Complements
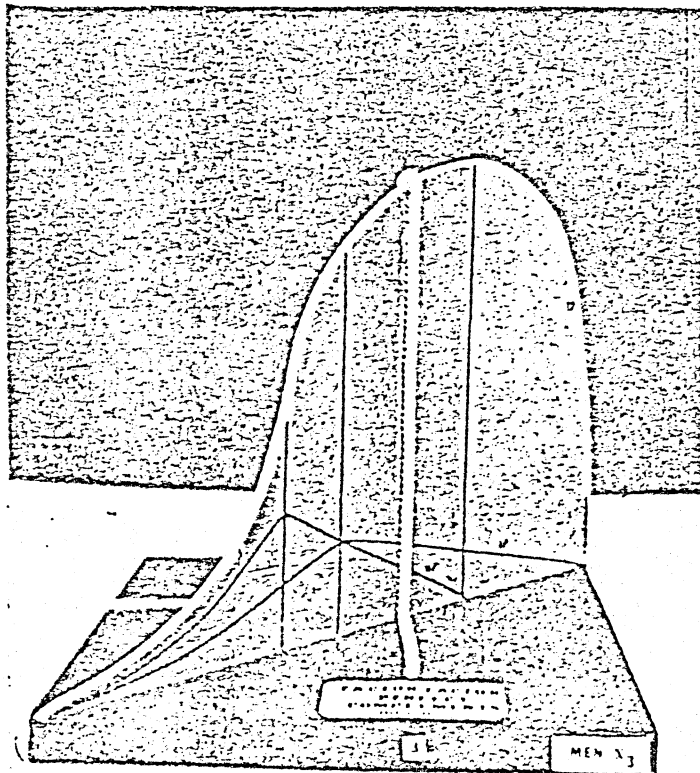in Factor-Factor Analysis

Fig. 6: Three-Dimensional Model
Illustrating Perfect Substitutes
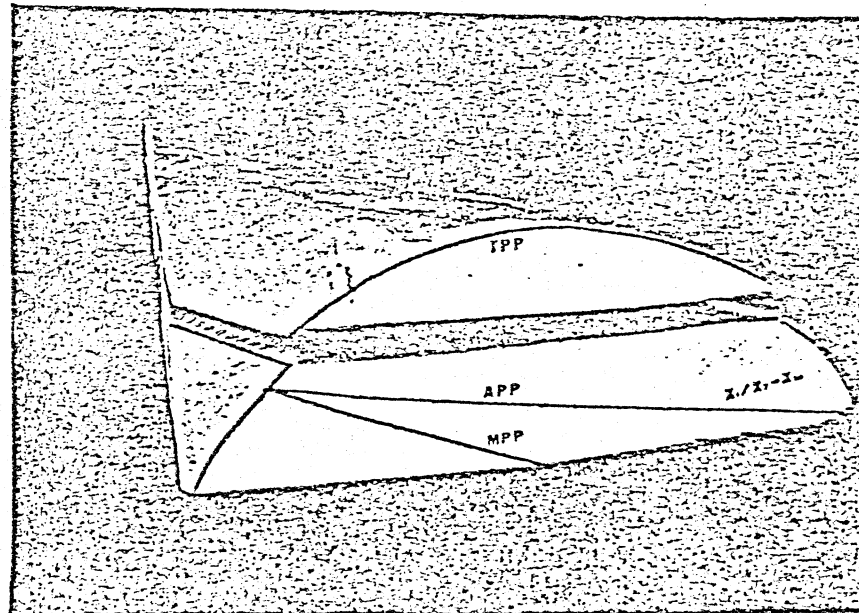in Factor-Factor Analysis

TABLE 1: Student Evaluations of Techniques Used to Teach Economic Theory
in Introductory Agricultural Economics Course

Student Evaluations

Techniques	usefulness*			Recommendation**		
	N	mean	std. dev.	N	mean	std. dev.
1. Textbook***	53	4.17	.98	52	3.01	.69
2. Examinations	53	3.56	1.02	52	3.21	.88
3. Lecture graphs	30	3.7	.89	52	2.37	1.10
4. Mathematics	52	3.12	1.48	51	2.92	.55
5. 3-D models	53	3.32	1.6	52	3.38	1.18
6. Flow models	51	3.80	1.24	52	3.52	1.35

	Mean	N
Credit hours taken prior to course	107	51
Previous courses taken in Ag Economics	.42	53
Previous courses taken in Mathematics	3	52
Current grade point average	2.8	47

* Score based on scale of 1 to 5 with 1 = not useful and 5 = very useful

** Score based on scale of 1 to 5 with 1 = use less of technique, 3 = use same
amount of technique and 5 = use more of technique

*** Sjo, John. Economics for Agriculturalists: A Beginning Text in Agricultural
Economics (Approximately 14 of 18 chapters were covered during the 10 week
period)

temporal dimensions. While popular in early economic theory texts these models have been forgotton by all but a few elderly economists. The mechanics which characterized these models has since been replaced by mathematics and comparative statics. The construction of a simplified version of a flow model offered by Boulding [p. 108] proved to be the most challenging (see Figure 7a). This model shown in Figure 7b and 7c consists on a series of self regulating valves, manual valves, floats and indicators which simulate the perfectly competitive market. A series of electrical of pump assisted reserviors supplies the model with water while gravity flow permits the student to intervene in the self adjusting system. The interventions or policy changes available include holding market price artifically high (Figure 7c), artifically low, and introducing changes which shift supply and demand. A broad range of economic policies can be simulated by this model from rent control schemes to the oil embargo. Each intervention is accompanied by a series of changes in flow rates, available stocks and price levels. When left alone, the model will automatically return to equilibrium (Figure 7b).

The complexity of these flow models suggests that the bulk of student participation should be in the actual minipulation of the model itself. Flow models do require periodic maintenance, are more costly to construct and are less portable than previous models. However, the benefits of participation and observing the free market in action is well worth the investment.

EVALUATION

Preliminary evaluations of the usefulness of these models in teaching economic theory are positive. Evaluative data is limited due to their recent introduction. The results of student reactions to these models is shown in Table 1. At the end of the quarter students were asked to assess the usefulness

Fig. 7a: Bouldings Original Model: How Price Regulates Production and Consumption
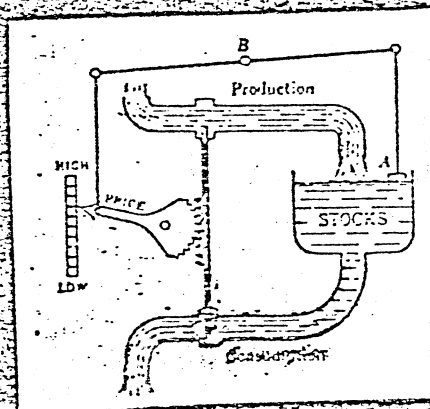

Fig. 7b: Perfectly Competitive Flow Model Illustrating Market Equilibrium Price and Quantity
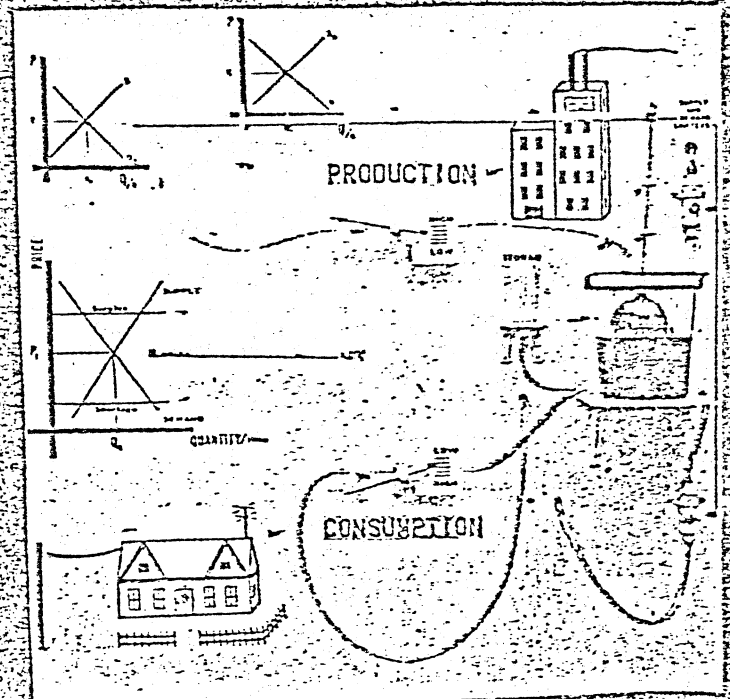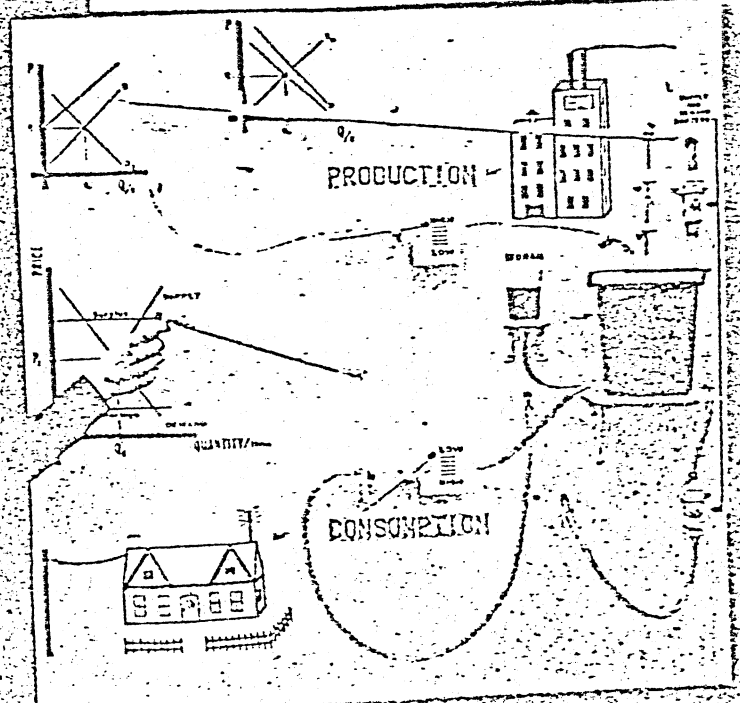

Fig. 7c: Perfectly Competitive Flow Model Illustrating Consequenses of Government Support Price Above Market Equilibrium Price

of and make recommended changes in the level of alternative techniques used to teach theory. In general, students either found these models useful to their learning economic theory or felt that greater emphasis should be placed on the use of these models. To the extent that a cummulative ranking can be inferred, students felt the usefulness or potential of these models exceeded the use of lecture graphs, examinations and mathematics as techniques for teaching theory.

CONCLUSIONS

This paper summarized teaching innovations incorporating "hands-on" or participatory type models into programs teaching economic theory. Greater participation is accomplished either by student construction of a particular "show and tell" model or by direct manipulation of the model itself. These models are not intended to replace existing teaching techniques, rather they are designed to supplement these techniques where teaching resources are limited and where no foundation in theory is present. The durability and timelessness of these models enables students to make useful contributions to teaching programs which can be used for future generations.

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