

THE GREEN REVOLUTION AS A TOOL FOR PARTICIPATIVE INTERDISCIPLINARY LEARNING

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ABSTRACT

The development of human resources in the agronomic sciences, having the ability to solve situations of different complexity level and hierarchy, requires a demanding curriculum with knowledge in several disciplines. Moreover, it demands the ability to apply such knowledge in a systemic and interdisciplinary way. Through the 1999's Curriculum Reform, the School of Agronomy of the University of Buenos Aires (FAUBA) decided to implement systemic approaches and participatory methodologies from the initial steps of the agronomic studies. The Green Revolution was used as a controversial case which encouraged an interdisciplinary learning approach. This study shows the positive response given by students to this learning experience.

Key words: Case Method, interdisciplinary approach, participatory methodologies

FOURTH EUROPEAN SYMPOSIUM ON EUROPEAN FARMING AND RURAL SYSTEMS RESEARCH AND EXTENSION INTO THE NEXT MILLENNIUM

WORKSHOP 5: EDUCATION AND TRAINING FOR FARMING SYSTEMS RESEARCH AND EXTENSION.

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INTRODUCTION

To solve agronomic situations students need to integrate knowledge from different disciplines, either from the so-called “hard sciences (physics, biology, etc.) or the “soft” ones (sociology, etc.). In the same way, it implies to participate in team work with professionals and specialists from different areas and disciplines.

However, not all the knowledge required to solve agronomic problems is part of the agronomy curriculum. This means that students should not only have a solid knowledge, but the ability to analyse real situations in a systemic and interdisciplinary way through team or individual work.

Although the School of Agronomy of the University of Buenos Aires (FAUBA), has had a long experience in implementing the systemic approach (Senge 1992, Wilson et al. 1990) in the different levels of the curriculum, the 1999 Curriculum Reform intensified these systemic approaches, adding an interdisciplinary view (Morin 1998) from the initial steps of the agronomic studies. To achieve these objectives, four courses were established using a participatory methodology: Workshop I, II, III and IV (FAUBA 1999). Workshop I was conducted using the “Case Method” as a participatory methodology.

Workshop I (first year) confronted students having no previous agronomic knowledge with increasingly complex situations. It tried to simulate their future professional work. The methodological tool used was the “Case Method”. This method has been frequently used in postgraduate studies and has been modified by Plencovich – Ayala Torales and Bocchicchio (Plencovich et al. 1998) to be used in grade studies.

Different activities, such as lectures, group work and individual assignments (oral and written) and plenary sessions, were developed, and each activity was evaluated. A profile of the students was developed (Bocchicchio 1999). Workshop I had a participatory nature. Students learnt by doing and the teaching team only guided and oriented their activities. It had a student-centred approach

In order to achieve the goals of Workshop I, the Green Revolution was selected as a subject to work with the students (Banchemo et al. 1999). This event brought about a change of paradigm in the agronomic sciences in the '70s, and was selected because it can be analysed interdisciplinarily and has a controversial nature.

The objective of this paper was to analyse a systemic and interdisciplinary approach implemented through the use of a controversial case (the Green Revolution), as it was perceived by the students attending the first year of the Agronomy programme.

MATERIALS AND METHODS

The target population was the first year students of the FAUBA who attended and got through Workshop I (227 students). The profile of the population was characterised by a self-administered questionnaire with open questions. This questionnaire collected information about:

- A) Student's origin (urban – rural)
- B) Motivation to choose this programme of studies
- C) Prior knowledge about agronomic work
- D) Students' perception about professional skills
- E) Expectations about the workshop.

The profile worked as a general background to analyse the students performance and perception.

The methodology used in Workshop I was a Case Method adaptation (Plencovich et al. 1998) for undergraduate university students. The Workshop focused on a historic and controversial event: the Green Revolution.

The Workshop was developed along twelve weeks, on a weekly -session –basis, which lasted four hours. The activities were programmed and ordered in increasing difficulty. Figure N° 1 shows the activities carried out along the Workshop.

Figure N° 1: Gantt Diagram, Workshop I 1999 FAUBA

ACTIVITIES	Weeks											
	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°
Workshop I Rationale	■											
Pre-test and students' profile	■											
Case: The fruits of the Green Revolution		■	■	■	■	■	■	■	■	■	■	■
Note taking. How to work with reference books		■										
Lectures			■	■	■	■						
Questions to experts			■	■	■	■						
Progress report submission					■							
Some diagnosis instruments						■	■					
Hypothesis							■					
Limiting Factor							■					
How to make effective presentations								■				
Individual assignment is handed in								■				
Flexible, effective and divergent thinking								■				
Review									■			
Opinion Paper										■		
Tutorial guide							■					
Individual work		■	■	■	■	■	■	■	■	■	■	■
Small group work								■				
Group assignment									■	■	■	■
Plenary			■	■	■	■	■	■	■	■	■	■
Autonomous work	■	■	■	■	■	■	■	■	■	■	■	■
Personal and Workshop Evaluation											■	■
Post-Test												■

References: Activity development ■ Students' presentations ▨

All the activities were directed to achieve the Workshop I objectives:

- ❑ Get an interdisciplinary view using a historic process crucial for the evolution of the agronomic sciences.
- ❑ Analyse the agronomic reality from a systemic and sustainable perspective.
- ❑ Build up an outline for a professional intervention proposal in a participative way.

Activities were mainly based on three modules:

- a) Lectures: There were 4 lectures with experts from different disciplines: i) Breeding, ii) Ecophysiology iii) Social and Economic impact of the Green Revolution, iv) Environmental impact. Lectures were designed to help students develop a theoretical and suitable frame for an interdisciplinary and systemic approach.
- b) Individual assignment: the following figures show some of the instruments devised to appraise the students' performance in this module.

Figure N° 2: Individual assignment. Workshop I 1999 FAUBA

After reading the case and its annexes, please answer the following questions:

- 1-What was the contribution of the Green Revolution for the world? What was its importance?
- 2- Is it possible to obtain the same yields without increasing the dependence on fertilizers, chemicals, water and the risk of pollution and erosion? Yes –No-. Why?
- 3) a) State briefly Malthus' Law. b) Establish its relationship with the Green Revolution c) Comment on its predictive value.
- 4) Within the context of the Case, give a definition of the following terms: a) Sustainability b) Biodiversity c) Genetically Modified Organism d) Technological package e) Phenotypic Expression.
- 5) a) What special characteristics make wheat suitable for Borlaug's selection program?
B) Why was the program based on the dwarf wheat gene? c) What was the peasants' hypothesis about the dwarf gene? Explain. d) Why did Borlaug have to fight against nature when he selected the dwarf wheat gene? Explain
- 6) What was the limiting factor that prevented Borlaug from using organic fertilizers in India?
- 7) What are the characteristics of the subsistence agriculture?
- 8) Build up an agronomic diagnosis about Africa situation in the '80s.
- 9) Is the Genetic Engineering the new Green Revolution? Yes - No. Explain.
- 10) Productivism vs. Environmentalism. State your position in about 10 lines.

Figure N° 3: Progress Report submitted by students before handing in the individual assignment.

Item	Level of Performance			Observations	
	Solved	Partially Solved	Incomplete	Difficulties	Bibl. Search
The Importance of the Green Revolution					
Yield components					
Malthus Law					
Terminology					
Dwarf wheat gene (Hypothesis)					
Limiting factor					
Subsistence Agriculture					
Agronomic diagnosis					
Genetic Engineering: continuity or rupture?					
Productivism vs. Environmentalism					

Figure N° 4: Paper specification table

ABSTRACT	Concise
	Consistent
	Key words
PAPER	Introduction, Development, Conclusion
	Cohesion
	Importance

- c) Group Assignment (small groups -5/6 persons-): Students carried out several group assignments i) after the lectures, guided with specific questions. ii) with photographs and a video of a rural development program in a marginal area of Argentina iii) with specific instructions to build up a simulated professional intervention (See Figure N° 5)

Figure N° 5: Instructions for Final Group assignment. Workshop I, 1999 FAUBA

<p>In a small group, read the following instructions and organize activities for items a), b) and c).</p> <p>The authorities of a rural co-op have hired you as agronomists to help in a development project that would increase the profitability of a small farmers' group. The only condition imposed is that the project should not pollute the underground water with toxic residues.</p> <p>a) Make a list of the questions you would ask the different actors involved (small farmers, authorities, professionals, etc).</p> <p>b) Justify the list of questions</p>

c) Based on a) and b) items, organise an oral presentation to discuss in the plenary session.

The group has 20 minutes. You may use any materials (transparencies, flip-chart, etc.)

The students' general performance was evaluated through the following instruments:

- a) Pre-test (first class) and post-test (last class).
- b) Students evaluation by teachers
- c) Self-evaluation
- d) Peer Evaluation

RESULTS AND DISCUSSION

From the students' profile we were able to characterise the student population in Workshop I (Table N° 1). 66.5% of the students are from the urban area (Federal District, Buenos Aires, and surrounding areas) and 33.5% come from the rest of the country and from abroad.

Table N° 1: Workshop I - Students origin, 1999 FAUBA (1)

	Federal District and sur.	Bs. As. Province	Rest of the Pampean Region	NOA Region	NEA Region	Patagonia Region	Other nations	TOTAL
%	66,5	18,5	6,6	1,3	0,4	3,5	1,3	100,0

When students were asked why they had chosen Agronomy, 45.4% of the students pointed out their interest in country-life or in environmental issues. Only 26.6% referred to family or personal antecedents linked to the profession. The rest pointed out other different reasons.

As regards having prior knowledge about the work of agronomists, almost 50% stated not having any.

Almost half of the population does not know the skills that an agronomist must have.

Finally, 32% expected that the Workshop would help them "integrate disciplines and knowledge".

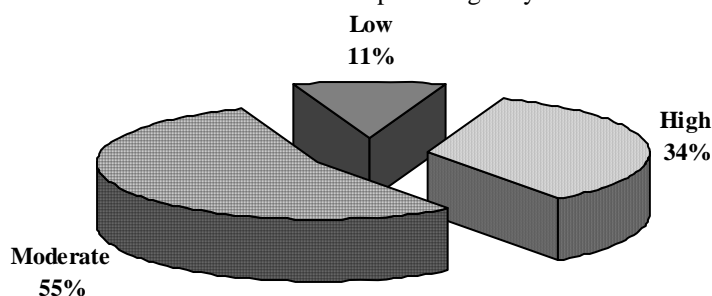
In the following paragraphs we present the students level of performance in the assignment work and their evaluation of the workshop

We put together the average marks of the individual assignment and the Opinion Paper in three groups. Table N° 2 shows the scale used, and Table N° 3, the corresponding percent distribution.

Table N° 2: Achievement categories by marks.

Achievement level	Marks(1 to 10 scale)
High	8 a 10 points
Moderate	6 a 7 points
Low	1 a 5 points

Table N° 3: Case percentages by marks



These percentages are in correspondence with those shown in Table N° 4

Table N° 4: Questionnaire Results: items a) and b) “What level did you reach in the following objectives of the workshop”.

	High		Moderate		Low		TOTAL	
	Number	%	Number	%	Number	%	Number	%
To get an Interdisciplinary view of an agronomic situation	102	44,93	122	53,74	3	1,32	227	100,00
To get a systemic and sustainable approach	76	33,48	140	61,67	11	4,85	227	100,00

Besides, in an open question about positive and negative aspects of the Workshop I (carried out in the 10th week), 18% of the students pointed out the interdisciplinary approach as a positive aspect.

In the Pre-test only 35% of the students answered about the Green revolution and its importance, whereas in the Post-test 100% were able to answer the same question.

From the results obtained through the instruments used, we may state that it is possible to get a systemic and interdisciplinary approach through the use of a controversial case, even in the first courses of an agronomy programme.

This is supported by the results presented. Thirty to forty percent of the students recognised that they had reached an interdisciplinary and systemic approach; if we add those who could reach the same objectives in a moderate way, we have more than 90% of the population (see Table N° 4). Our own quantitative evaluations arrived at similar conclusions (see table N° 3).

CONCLUSIONS

a) The use of participatory learning methodologies seems to be the right way in the development of professional resources required for solving agronomic situations. If these methodologies are used from the very beginning of the program, it is possible to develop active and critical skills in students, responsibility for their own professional growth, with creativity to solve problems within an interdisciplinary and systemic vision.

b) We believe that a workshop methodology based on the Case Method is the proper tool for introducing students to the agronomic problems, no matter if they have only scarce prior knowledge.

c) We believe that if we add sociological, economic or environmental approaches to the usual analysis (genetic, crop production and fertilizer perspective) of the Green Revolution, we give the students a good opportunity to make an interdisciplinary approach.

d) The choice of a controversial case (the Green Revolution), and the interdisciplinary and systemic approach (through lectures, bibliography search, etc) represent an introduction to the agronomy curriculum and to contents that students are going to work with across the different disciplines of the program.

It could be strongly recommended to implement other participatory methodologies along the different courses of the programme in order to deepen the interdisciplinary approach and make students face the real profession.

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