

Teaching "Experience" with Simulation Gaming: An Application of "Green Revolution/Exaction"

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Abstract

Green Revolution/Exaction is a role-playing simulation exercise developed to provide students an appreciation for agricultural production in third world countries. In four years of use at Oklahoma State University, the exercise has proven to be an effective means for students to experience various aspects of international agriculture and improve decision making skills. The majority of students rated "Green Revolution/Exaction as more effective than traditional instructional techniques in learning economic concepts and understanding economic behavior. The exercise is particularly useful in providing students a greater understanding of linkages between agriculture and other sectors of the economy as well as the impacts of government policy on agriculture.

Introduction

The globalization of agriculture is having far reaching impacts on all types of private and public institutions serving agriculture. Many institutions of higher learning, including colleges of agriculture, have examined the international dimension of their programs and identified internationalization as a priority (Love and Yoder, Heinze, Porath). Agriculture students must become familiar with the international system of which they will become an integral part. Schuh identified several components of this system that must be understood, including the international economy, world cultures, agricultural production in other countries, and international institutions. Schneider and Suter noted that internationalization will require that agricultural courses be taught within an international context, rather than simply adding an international course or two. In addition, recent curricula evaluation efforts have also pointed to the need for improvement in the problem-solving abilities of agricultural graduates (Love and Yoder, Porath).

Events of the past few decades indeed emphasize the public need for understanding international aspects of the agricultural economy. The impacts of the Carter embargo of the Soviet Union on grain prices, price impacts on farm inputs resulting from oil price shocks, the transition of the European Economic Community from customers to competitors for agricultural products, exchange rate influences on agricultural trade, and the world hunger problem are issues that typify the difficult task of making sense of global factors in an educational setting. The dramatic geopolitical upheavals in Eastern Europe and the Soviet Republic have

further accentuated the importance of globalization in our curricula. Because of their tremendous complexity, issues such as the linkage of American agriculture to the global economy and the influence of macroeconomic factors and government policies on other countries are not easily taught or understood. For example, the case for food aid and economic development has long been argued on moral grounds. Economists can demonstrate the theoretical justification for developing poor countries to improve export markets for the U.S.; however, studies suggesting the economic benefits of actual cases are difficult for students to comprehend. In addition, it is often difficult to change beliefs based on strong feelings. Sometimes, experience is the only challenge to such beliefs. Teaching methods must be used that provide students an experiential base to better understand the international model and its relationship with domestic agriculture. At the same time, these instructional methods must also provide students experience in integrating material learned in courses and applying these concepts in a decision making context.

An instructional technique that offers considerable promise in addressing these concerns is simulation-gaming. Simulation games customarily consist of groups of players (decision makers) placed in a prescribed setting, with constraints in this setting represented by rule systems and methods of procedure (Taylor and Walford). The principal advantage of such exercises is that they take learning out of the area of abstraction and make it a participatory skill. Taylor and Walford identify three important components of the simulation experience:

1. Players take on roles which are representative of the real world and make decisions in response to their assessment of the situation in which they find themselves.
2. Players experience simulated consequences which relate to their decisions.
3. Players monitor the results of their actions, and must reflect upon the relationship between their decisions and the resultant consequences.

Several attributes make simulation-gaming an attractive alternative relative to traditional instructional methods for delivering various components of agricultural curricula. First, the technique is problem based, and thus a useful device for improving decision making skills. Participants are able to observe the consequences of a particular course of action within a much shorter time span than could occur in real life. Thus, simulation provides a laboratory where experience can be gained and mistakes made. Strategies undertaken by participants frequently involve the use of social skills which are directly relevant to the world outside the classroom. Also, simulation-gaming is fundamentally

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dynamic. Participants deal with changing situations which demand flexibility in thinking and responsive adaptation as circumstances occur.

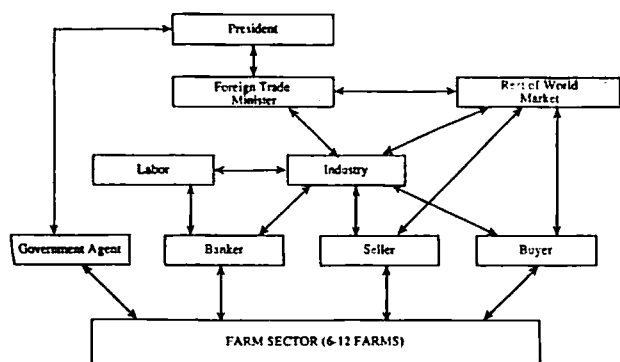
This paper reports four years of experience in the use of simulation-gaming in the agricultural curricula at Oklahoma State University. The specific simulation game, known as "Green Revolution/Exaction", has proven to be an effective classroom tool for providing students a better understanding of international and domestic economic linkages, agricultural policy development, and economic development in third world countries, as well as experience in applying decision making tools. While the experience may not change beliefs, it typically challenges the student and focuses him/her to think critically about those beliefs. At stake is the historically supported proposition that the international market holds the greatest hope for profit opportunities for US agriculture. Such development also holds the opportunities for the US to play a part in the growth process of less developed countries (LDCs), possibly improving their opportunity for enhanced quality of life and political stability.

The "Green Revolution/Exaction"

The "Green Revolution/Exaction Workshop", developed by a Cambridge (England) University geographer who had spent years in LDCs (less developed countries), is a role-playing simulation exercise. The basic version of the exercise, "Green Revolution", simulates an Indian farm village, with each team consisting of 2-4 players acting as a farm unit. There are 6-12 of these farms, each with a random distribution of initial resources. In addition to roles as farmers, some participants are given the role of banker, seller, or buyer. These individuals service the farm sector by purchasing farm products and selling farmers operating inputs. Interactions between participants in the village economy are represented in the lower portion of the schematic in Figure 1. The role-playing workshop is administered by the game manager whose function is to introduce the mechanics of the game and lead the group through the simulation exercise, and enforce the minimal rules.

The exercise progresses through a series of annual time steps, each taking approximately thirty minutes to complete. The exercise centers around the production of a staple

Figure 1. Schematic of Information Flow Among Participants of Green Revolution/Exaction Workshop.



food -- rice. Each farm's primary objective is to feed its members; surplus rice may be sold to purchase operating inputs and capital items. To simulate the uncertain environment in which farmers operate, several events occurring through the year are drawn at random. At the beginning of each growing season, producers must decide upon an annual production plan, including input usage (e.g.: seed, fertilizer, pesticide, and irrigation water), as well as the acreage under production. The growing season is divided into three stages -- germination, middle growth, and flowering. At the beginning of each stage, the game manager randomly selects the weather condition and the incidence of pest attacks on each farm. Annual yield is determined by the interaction of weather, pest attacks, and input usage. For example, if fertilizer were applied and high precipitation occurred, the resulting yield would be higher than average.

At the conclusion of the growing season, participants are free to interact with other players to prepare their farms for the following growing season. Rice production in excess of consumption requirements may be stored, used for seed, or sold and used for the purchase of inputs. Operating inputs employed during the year must be purchased prior to the growing season. Farmers may also purchase assets, including on-farm storage, irrigation wells, and land. Little structure is provided to participants to direct this interaction. Rules of behavior and institutions for obtaining resources and conducting transactions are developed spontaneously during the course of play.

The more sophisticated version, called "Exaction", adds an urban sector and an export market with currency differentials to the "Green Revolution" model. The urban sector includes industry, labor and government, all role-played by participants (see Figure 1). The role of the government, consisting of a President and Foreign Trade Minister, is to develop and administer policies aimed at directing the country to meet determined objectives. Typically, these decisions address such issues as international trade, monetary and fiscal policy, farm assistance, and labor policy. The industrialists may manufacture various items for export or domestic consumption, employing labor and domestic and imported factors of production. Input and output prices are determined by the interaction of supply and demand forces within the economy. Interest rates, inflation, and currency differentials are determined based upon the government's decisions concerning the amount of currency to print, trade policies, and other macroeconomic variables.

Participants playing the role of farmers living in a traditional village setting obtain a unique perspective of the choices and uncertainties facing individuals actually in such a situation. An important lesson learned by participants is that the relationship between short-run and long-run strategies is sometimes extremely complex. Many players get so involved with their family's survival that they abandon strategies that their own academic training and background would suggest. Insight is also provided concerning the consequences of chance events on economic success. Participants experience first hand the fact that even the most well thought out plans can result in failure due to random envi-

ronmental or economic events beyond their control. As a result, many players react in a manner similar to traditional farmers, adopting relatively conservative management strategies. It is hoped students come away with a better appreciation of why many farmers behave as they do, particularly with respect to investment and technology adoption.

Students participating in the government sector gain an appreciation for the complexities inherent in policy formation. Typically, well-intentioned policies directed at resolving a particular problem lead to a sequence of unanticipated events in other sectors of the economy. For example, a policy to restrict the export of rice may avert starvation in the short-run, but may also lead to a collapse in the price of rice, decreased farmer incomes, and trade deficit problems. Participants playing roles throughout the economy gain an appreciation for how various government policies both directly and indirectly influence their own livelihood. Such experiences provide students invaluable insight into how agriculture is linked with other sectors of the economy as well as the world market.

Following the conclusion of the simulation exercise (typically 6-7 annual periods are simulated), a debriefing session is conducted. At this time, game managers and participants interact to share their impressions of the experience. This debriefing session is an important component of the "Green Revolution/Exaction" workshop, since it allows participants to step out of their roles and evaluate their own as well as other's actions. As a basis for discussion, statistics are presented summarizing both individual performance and the entire economy's evolution over the game. Observations are made relating participant's initial resource situation to economic success, and the effect of various policies and chance events on each sector is analyzed.

Classroom Use

Several opportunities exist for integrating the "Green Revolution/Exaction" exercise into agricultural classroom instruction. The workshop can be conducted at the beginning of a course to introduce students to various issues to be addressed throughout the semester, or alternatively, at the conclusion of the course to apply various learned concepts. The exercise's versatility also makes it applicable to a variety of courses, ranging from more general production-related course to those addressing specific topics such as agricultural policy or international trade.

Students enrolled in the senior-level agricultural policy course at Oklahoma State University are given a choice of writing a term paper or attending a weekend or evening "Green Revolution/Exaction" workshop. Not surprisingly, most students select the latter alternative. Prior to the workshop, roles are assigned and directives are provided to assist students in developing objectives and strategies to be employed in the exercise. These materials have been found to be effective in getting students in the right frame of mind to play the game and improve the quality of the role-playing experience. During the workshop, students receive an as-

signment guide that lists questions that must be answered in a required summary report. The summary report provides the student an opportunity to contemplate his/her experience and relate the workshop to course material.

In the junior-level farm management class, students are provided an opportunity to attend a "Green Revolution/Exaction" workshop for extra credit. Students are assigned roles as farmers, and hence, are provided an opportunity to apply decision making principles learned in the course. Following their participation, students are required to submit a written summary of their experience, including a description of how they employed farm management decision tools in the exercise. Over the past three years, participation rates for the optional assignment have ranged between 50 and 68 percent of student enrollment in the farm management course.

Green Revolution/Exaction exercises have been conducted more than 30 times in the past five years at OSU and other Oklahoma sites for students in a variety of traditional and nontraditional classroom settings. In addition to the undergraduate classes mentioned above, the exercise has been used for:

- (1) Classes of the Oklahoma Agricultural Leadership Program, comprised of selected 25-40 year old agricultural producers and others working in the agribusiness sector;
- (2) 4-H youth age 12-18; and
- (3) Married couples teamed at a farm organization retreat.

Evaluations are always favorable. Despite the length of the program, participants are always reluctant to see the exercise end.

Evaluation

Recently, a survey was conducted of agricultural students who had participated in "Green Revolution/Exaction" workshops. Students who completed the survey had participated in workshops from one to four semesters earlier; thus, their responses reflect long-run perceptions of the "Green Revolution/Exaction" experience. Responses of 111 students to several key questions are summarized in Table 1.

The students' overall reaction to the "Green Revolution/Exaction" exercise was quite favorable. Over 77 percent of those students surveyed rated "Green Revolution/Exaction" as more effective than traditional teaching techniques (lectures, labs, etc.) in learning economic concepts. Nine out of every ten students recommended that undergraduate students in agricultural economics and other agriculture majors participate in the exercise. The students not only found the exercise productive, but also enjoyable! Over 75 percent of the respondents stated that they had fun while participating in the workshops.

Some indication of the relative strength of "Green Revolution/Exaction" in teaching different aspects of economic behavior can be inferred from responses to questions 4 through 8 in Table 1. Respondents felt the exercise was best suited for gaining an appreciation of macroeconomic be-

havior, such as sectoral linkages and policy impacts. Over 55 percent of the respondents gave the exercise a high rating in terms of usefulness for obtaining a better understanding of the influence of macroeconomic variables on the farm sector, rural-urban sectoral linkages, and government policy impacts. This result is particularly encouraging, given the difficulty of providing students insights into these areas using traditional instruction methods.

Students were somewhat less convinced of the usefulness of the exercise in learning how to apply farm management tools and concepts. The agricultural sector of the current version of the game is somewhat abstract since farms can only produce one crop and input decisions are limited to those related to fertilization, pesticide use, irrigation, and seed variety. Considerable sophistication could be added to this component of the game by expanding the array of decisions concerning crop mix and level of input use. Some experimentation has also been conducted requiring participants to complete financial statements in order to obtain capital or conduct budgeting analyses to justify resource use.

Students were also requested to provide recommendations for improving the effectiveness of the "Green Revolution/Exaction" workshops. Several past participants felt that the experience could be enhanced by providing a more detailed introduction to the game. Most of these respondents had roles within the farm sector and spent the initial portion of the game adjusting to their new situation and developing lines of communication with other players. Apparently, some students were somewhat uncomfortable with the lack of structure and well-defined objectives that characterizes the game. The game manager must be cognizant of this concern, but must resist the temptation to provide a level of detail that stifles participants' creativity in dealing with their unfamiliar role.

Since the workshop usually requires from 4 to 5 hours to complete and is held on week nights and weekends, it is not surprising that several respondents felt the exercise should be shortened. Determining a game length short enough to maintain participants' interest, but of sufficient length to gain an appreciation of the dynamics of economic behavior is a challenge facing users of the game.

Summary and Conclusions

"Green Revolution/Exaction" is a simulation-gaming exercise developed to provide students an appreciation for agricultural production in third world countries. This paper reports the results of four years experience in applying the exercise in course instruction at Oklahoma State University. The workshop has proven to be an effective means for students to experience various aspects of international agriculture as well as improve decision-making skills. The exercise has been particularly useful in providing students a better understanding of the influence of macroeconomic variables on the farms sector, rural-urban linkages, and the direct and indirect effects of government policies.

In taking on roles of agents within a third world economy, students are able to experience first hand the choices

Table 1. Selected Responses from Survey of "Green Revolution/Exaction" Participants

1. Overall, compare Green Revolution/Exaction to traditional learning experiences (lectures, labs, etc.) as a way to learn economic concepts?	
a. Much more effective	34%
b. Somewhat more effective	42%
c. About the same	13%
d. Somewhat less effective	10%
e. Much less effective	1%
2. Would you recommend that other agricultural students play the game?	
a. Yes, definitely	50%
b. Yes, given a convenient time	39%
c. Maybe	6%
d. Probably not	5%
e. No	0%
3. How would you rate your experience playing Green Revolution/Exaction in terms of personal enjoyment?	
a. Extremely fun	18%
b. Fun	59%
c. Average	15%
d. Boring	5%
e. Extremely boring	3%
Based on your experiences playing "Green Revolution/Exaction", rate the usefulness of the exercise in the following areas.	
4. Learning how to apply farm management tools and decision criteria.	
a. Very High	5%
b. High	44%
c. Average	37%
d. Low	12%
e. Very Low	2%
5. Obtaining a better understanding of the influence of macroeconomic variables (e.g., interest rates, exchange rates, etc.) on the farm sector.	
a. Very High	14%
b. High	44%
c. Average	30%
d. Low	10%
e. Very Low	0%
6. Obtaining a better understanding of economic linkages between rural and urban sectors.	
a. Very High	14%
b. High	46%
c. Average	31%
d. Low	9%
e. Very Low	0%
7. Obtaining a better understanding of government policy and its effect on the rural sector.	
a. Very High	19%
b. High	36%
c. Average	32%
d. Low	13%
e. Very Low	0%
8. Obtaining a better understanding of economic development in third world countries.	
a. Very High	16%
b. High	41%
c. Average	33%
d. Low	9%
e. Very Low	1%

and uncertainties facing individuals in such a situation. The game also demonstrates the complexity of decision making in even a relatively simple model of agricultural society. The exercise provides students a decision making laboratory, where strategies can be implemented, consequences

Writing to Learn in Agriculture And Natural Resources Courses

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While college faculty in scientific and technical disciplines feel a growing responsibility to help students write well in their subject areas, faculty in disciplines other than English often express qualms about including writing in their courses. The reasons for these reservations are not difficult to discern: they expect that responding to student papers is necessarily labor intensive, and--since they believe that responding means correcting grammar, punctuation, and mechanics--they also believe that using writing in their courses requires "English" expertise which they do not possess. They may also question whether or not time devoted to "writing" will interfere with students' subject matter learning.

In our experience, a writing program which helps faculty to identify and use their pre-existing strengths and talents as writers and teachers in their subject areas can lead to positive and lasting changes both in faculty attitudes toward student writing and in the amount and type of writing they incorporate into their courses. This is a lesson well-illustrated in our experience as writing specialists with the College of Agriculture and Natural Resources (CANR) at Michigan State University.

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Between December 1989 and March 1992, Project Write--a writing across the curriculum project initiated by the faculty of the College of Agriculture and Natural Resources and developed jointly with the Department of American Thought and Language (ATL)--reached over 4,500 students enrolled in CANR courses. CANR is one of the largest colleges at MSU and includes departments as diverse as Animal Science, Biochemistry, Fisheries and Wildlife, Packaging, and Parks and Recreation. The ATL department, where we normally teach, is largely responsible for freshman writing courses. Project Write (Writing Restored In Technical Education) grew out of a CANR self-study which identified the improvement of writing as a high priority for the College particularly in keeping with the land-grant mission of the university. As a result of this study, CANR contracted with two of us, Leonora Smith and Jeffrey Charnley, to coordinate an effort to improve the teaching of writing in their undergraduate and graduate courses through faculty development. With strong support from CANR Associate Dean Taylor Johnston and Assistant Dean Richard Brandenburg, a faculty task force made up of Professors Robert Deans (Animal Science), Clifford Jump (Agricultural Technology), Jeffrey Vincent (Forestry), and Frank Fear (Resource Development), initiated Project Write, which supported the development and implementa-

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assessed, and new courses of actions formulated. The survey results are being used to strengthen perceived weaknesses in the exercise. A domestic (US) version is also under consideration by instructors using the exercise.

A key to the successful implementation of "Green Revolution/Exaction" in agricultural economics courses at Oklahoma State University has been its integration with course material. Participants comprising the farm sector are drawn from the junior-level farm management course, while students from the agricultural policy course make up the urban and government sectors. Thus, students are able to draw from course material when reacting to their new roles. The debriefing session conducted at the conclusion of the game is also an important step in integrating the experience with course content. By writing a written report on various aspects of the "Green Revolution/Exaction" workshop, students are given a final opportunity to make the connection between course material and their role-playing experience.

References

- Chapman, G.P. and E.A. Dowler. *The Green Revolution Game: Manager's Handbook*. Marginal Context Ltd., Cambridge, United Kingdom, 1982.
- Heinze, K.L. *Shaping Agriculture and Natural Resources Undergraduate Education for the Future: A Land-Grant Imperative*. Michigan State University, East Lansing, Michigan, 1989.
- Love, G.M. and E.P. Yoder. *An Assessment of Undergraduate Education in American Colleges of Agriculture*. Pennsylvania State University, State College, Pennsylvania, 1988.
- Porath, E. *Curriculum Innovation for 2005*. Higher Education Programs, United States Department of Agriculture, Washington D.C., 1987.
- Schneider, V.E. and D.A. Suter. "Alternative Curricular Patterns for Globalization of the Agricultural and Life Sciences," p 35 - 58 in *Educating for a Global Perspective: International Agricultural Curricula for 2005*, North Central Curricular Committee Project, 1989.
- Schuh, G.E. "The Rationale for International Education in the 21st Century," p 1 - 10 in *Educating for a Global Perspective: International Agricultural Curricula for 2005*, North Central Curricular Committee Project, 1989.
- Taylor, J.L. and R. Walford. *Simulation in the Classroom*. Penguin Education Publishing Co., United Kingdom, 1978.