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ROLE-PLAYING, CASE STUDIES AND SIMULATION  
GAMES AS TEACHING AIDS IN APPLIED  
ECONOMICS COURSES\*

by

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Role-Playing, Case Studies and Simulation Games  
as Teaching Aids in Applied Economics Courses

Abstract

This paper assesses the impact of introducing role-playing, case studies and simulation games into undergraduate courses in applied economics. An educational impact model is used in a qualitative evaluation of the teaching aids and to generate hypotheses. Quantitative results of two experiments are used to test the hypotheses. Results indicate that each aid can improve students' performance when used in appropriate situations. However, there is a definite trade-off between student contact time requirements and the effect of these aids.

## ROLE-PLAYING, CASE STUDIES AND SIMULATION GAMES AS TEACHING AIDS IN APPLIED ECONOMICS COURSES

Role-playing, case studies and simulation games are three of the many teaching aids being used by university instructors to supplement the lecture format for teaching (O'Connor and Osterman; Siegfried and Fels; French; Kendrick). All three of these techniques are simulations which can be classified as learning tools (Blank, p. 215). Simulations designed as learning tools are those that provide participants with a new or improved understanding of the system which has been modeled. These techniques cannot compare with the lecture format when the objective is to convey large volumes of information, but they can improve the level of understanding concerning specific points (Kolb). Often techniques such as these are used because the learning process of typical students in some disciplines necessitate using teaching methods that rely less on intuition and reading and more on sensing and factual materials (Robert and Lee). Yet, despite the increased use of these teaching aids, their ability to increase the effectiveness of learning has rarely been evaluated (Siegfried and Fels).

This study was developed to address that need for research. Presentation of the findings is organized into four major sections. First, the objectives and methodology are discussed, emphasizing the experimental designs used. Next, a brief description of the three teaching aids is presented. Third is analysis of experimental results for each aid. Finally, conclusions and limitations of the study are outlined.

### Objectives and Methodology

The purpose of this paper is to assess the impact of introducing role-playing, case studies and simulation games into undergraduate courses in applied economics. The educational impact model developed by Joyce and Showers

will be used in a qualitative evaluation of the contents and expected effectiveness of the teaching aids. In addition, the results of two experiments designed to quantify each technique's actual educational impact will be presented.

#### Educational Impact Model

Joyce and Showers state that when students use what has been learned to solve problems they are demonstrating that their training has had the highest level of impact possible. The level of impact a teaching program will have, in turn, is affected by the following training components:

1. Presentation of theory or description of skill or strategy;
2. Model or demonstration of skills or models of teaching;
3. Practice in simulated and classroom settings;
4. Structured and open-ended feedback;
5. Coaching for application.

Joyce and Showers indicate that components 1 through 5 above have increasingly greater levels of impact on students' abilities to solve problems. When all five components are included in a teaching program up to 75 percent of students are able to apply what has been learned.

The model by Joyce and Showers implies that teaching aids which incorporate more of the five components will have greater impact than aids involving fewer training components. This hypothesis will be considered here by using the results from two experiments conducted over a period of years. Both experiments used average test scores as an indicator of student performance.

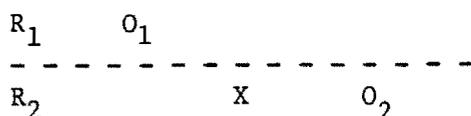
#### Experiments Used

Student test scores were evaluated first during a two-year experiment. During the first year, three different courses were taught by a single instructor using only the standard lecture format. During the year-end review of

each course the instructor decided that the level of performance was not satisfactory. Therefore, the instructor decided to incorporate the teaching aids being discussed into the course presentations. At that time the idea of conducting an experiment was developed.

During the second academic year (three quarters) the teaching aids were used (as described in the next section). To measure the effects of the aids, the same examinations used during the previous year were used again. In the fall quarter the tests given were identical to those given in the previous fall quarter. The tests given in the winter quarter of the second year were the same as those given the winter before, and the same process was used during the spring quarter. For each of the three courses the scores from questions concerning the relevant topics were tabulated to compare the average results from each year. All other aspects of the courses remained the same - lecture content, homework assignments, etc.<sup>1</sup>

The experiment described above has a Separate Sample Pretest-Posttest (SSPP) design (Blank, p. 200), diagrammed below:



where an "X" represents the introduction of an experimental stimulus to a group, an "O" identifies a measurement or observation event, and an "R" indicates that the group members have been selected randomly. The Xs and Os are read time-wise from left to right and symbols which are vertical to each other take place simultaneously. In this case, the rows have been separated by a dashed line because the comparison groups were selected in two random processes (one each year), rather than one. The SSPP design is a "quasiexperiment"<sup>2</sup> (Blank, p. 200) with some threats to its internal validity. However, this design is considered to be superior in external validity to true experiments because it is a field experiment using samples from the population to which the results are to be

generalized. The impact of each aid (X) is measured by the difference  $O_2 - O_1$  in each of the three respective experimental iterations.

At the end of the second year the instructor decided to eliminate doubts concerning the results of the first experiment by conducting a second experiment with a stronger design. During one term of the third year, each of the three aids were tested again using a Posttest-Only Control Group (POCG) design.<sup>3</sup> This design, considered a "true experiment" (Blank, p. 198), is diagrammed

R	X	$O_1$
R		$O_2$

using the same notation as above. Threats to both internal and external validity are handled adequately by this design. The effect of each aid is measured by the difference  $O_1 - O_2$  in separate experimental iterations.

The POCG experiments involved comparing the performance of two separate sections of the same course. During the same academic term, the instructor had two sections of the course, one which was taught using only the lecture style, the other using the relevant teaching aid in addition to the lecture. The sections were taught on the same days and the control groups were the second (later) section so as to benefit from any improvements in instructor performance and to downward-bias the observed improvement of the experimental groups. Once again, student performance was measured using scores from the relevant course examinations. Each section was given the same exam on the same day. The tests given were completely new versions, not the same exams used in the first experiment.

#### The Aids as Teaching Devices

The three aids, role-playing, case studies and simulation games are all used by the Agricultural Management (AM) department of California Polytechnic State University, San Luis Obispo (CPSU). That department will serve as the source for all examples to be presented here. A brief description of how each aid was used follows.

## Role-Playing

Role-playing, as most often used in a classroom, requires physical involvement on the part of students. Two or more people "act out" the part of individuals in a hypothetical situation (Black). One example comes from an introductory agricultural economics course. While presenting the subject of price determination, a role-playing exercise patterned around the open-outcry market typical of commodity futures markets was used. Sixteen students participated in three successive auctions, some acting as farmers and others acting as wholesalers. Information concerning quantities to be bought or sold and profit/cost levels per pound was provided on index cards given to each participant by the instructor. During each three-minute auction the students had to negotiate transaction prices with one another. After the third auction, the three sets of resulting prices were analyzed by the entire class. After the instructor told the class which set of prices were generated in an equilibrium, surplus and shortage situation the students could see for themselves that the theory presented in their textbooks did, in fact, describe what happened in their exercise. That small example gave the participants and observers a memorable illustration of the market processes which influence prices.

Using role-playing ensures that students will be exposed to training components 1 through 3 of Joyce and Showers' impact model. Whereas lecturing leaves off with the second component, role-playing is designed to give students classroom practice in solving particular types of problems. Since the purpose of most role-playing exercises is to illustrate some point made during lectures, the feedback given tends to be aimed at highlighting the point of interest rather than at the performance of the students involved. There, component 4 is often excluded from being part of this teaching aid.

## Case Studies

Case studies are used in many AM courses. In particular, an undergraduate research methods course used cases analyzed by small teams of students in an effort to tie together the skills learned in a number of other courses. The research course, taken at the end of the undergraduate program, was designed to give students an opportunity to apply the management skills learned during the entire four-year period. Case studies of real business situations give students the chance to see how all functional areas of a business interrelate, whereas most courses in a college program must deal with just one aspect of business at a time -- marketing, production, etc.

The purpose of studying business cases in the research methods course is not always to learn specific answers to specific problems, but to become familiar with analysis and decision making, with the process of arriving at answers rather than with answers themselves (Ladd). In this case students analyzed each case in teams of 3-5 with the entire group being responsible for submitting a single written report. This method forced each student to come in contact with others in the class. During the academic term the composition of the teams was continually changed so that each student worked with a different group on each case. That approach assured that students would be exposed to the thinking of many others, which could improve each students' awareness of their own abilities and shortcomings. It also facilitated the exchange of ideas. The teams worked together both in and out of class to prepare the written report. That forced them to deal with the real problems of allocating their scarce time and resources to completing the case assignment while working with people that they did not select themselves.

Using case studies, like the example above, incorporates components 1 through 4 of the impact model. Components 1 and 2 are included by using lectures to present the material which will be applied during the case studies.

Components 3 and 4 are included by the case studies themselves. The students practice applying their new problem-solving skills both inside and outside the classroom. They receive structured feedback from the instructor as well as open-ended feedback from other students while the teams are working together.

#### Simulation Games

Simulation games in economics and management tend to be computerized (Litzenberg). One of the most comprehensive games used in the AM department of CPSU was part of an advanced marketing course. In that course students were divided into three-person teams, each team to perform as the management of a separate company in a computerized simulation game. All of the teams were part of a single industry, therefore each team was competing with all the others. Decisions concerning all aspects of company operations are submitted by each team on a regular basis and the results of those actions were calculated by the computer program. The decisions made by students were similar to those made by real managers, as explained in the lecture portion of the course. Having to make the decisions themselves gives students valuable insight into how various aspects of a company are interrelated (Boehlje and Eidman). This perspective could not be given to students using only a lecture format (Baker and Babb).

Computerized simulation games, such as the one described above, combine the contents of case studies and role-playing exercises (White). As a result, simulation games expose students to training components 1 through 4 and provide more depth of exposure than either of the other techniques. This is due principally to the relatively long period of time that simulation games require to complete - games often continue throughout an academic term while case studies usually last a few days and role-playing concludes within one class session. Therefore, simulation games provide students with many more

opportunities to practice problem-solving and to receive feedback from both instructors and other students.

#### Hypotheses Implied by the Model

Implied by the qualitative assessment of the aids above are the hypotheses that (1) each of the three teaching devices will improve student performance over that observed when a lecture-only approach is used and (2) that the level of impact varies between aids. All three aids are expected to improve on the lecture-only (L) approach because lecturing involves just the first two training components of Joyce and Showers' model while role-playing (R), case studies (C) and simulation games (S) each include at least three components. (The first hypothesis:  $R, C, S > L$ .) The second hypothesis comes from the determination that role-playing involves only the first three components of the model while the other two aids each include four components. Also, simulation is expected to have slightly more impact than case studies due to the length of student exposure. ( $H_{02}: S > C > R$ ) Quantitative assessments of these hypotheses are presented below.

#### Analysis of the Aids

The effects role-playing, case studies and simulation games had on the performance of students in the AM courses described above are presented in Table 1-3, respectively. Average test scores improved in all cases, as did student evaluations of the courses after the teaching aids were introduced.

The results for the experiments concerning use of a role-playing exercise provide some insight into the impact of that teaching aid and possibly others. It was noted that although role-playing had a small direct effect on test scores covering only the relevant topic (a 3-4 percent increase on scores concerning price determination), course total scores from the two experiments improved over five percent, on average. An analysis of variance (ANOVA) of the scores from the control and experimental groups found a statistical

TABLE 1. Impact of Role-Playing on Introductory Agricultural Economics Course

Experiment	Average Test Score <sup>a</sup>		% Change		% $\Delta$ /hr <sup>d</sup>
	Control Group	Test Group	Subject	Total	
SSPP <sup>b</sup>	64	68	4	6.3	6.3
POCG <sup>c</sup>	65	68	3	4.6	4.6

<sup>a</sup>Score is from a maximum possible of 100.

<sup>b</sup>Sample size for each group: 150 (approximate)

<sup>c</sup>Sample size for each group: 45

<sup>d</sup>The average student contact time for this aid was one hour per term.

difference at the 90% significance level. Written comments made by students evaluating the course during the second year of the SSPP experiment indicate that role-playing may have raised student enjoyment enough to have had a significant indirect effect on course grades. Seventy-three percent mentioned the exercise in their answer to the open-ended question, "what were the most favorable attributes of the course?" Only three percent listed the exercise as one of the "least favorable" attributes in response to the next question on the course evaluation form.

There was approximately a 10 per cent increase in the average test score in the research methods course after case studies were introduced. An ANOVA found this difference between control and experimental groups to be significant at the 95% level. In general, there was improvement across the range of students: more "A" and fewer "F" course grades were given.

In the marketing course there was a 13-15 per cent increase in exam scores when the computer simulation game was used. As a result, the average course grade issued rose from a "C" to a "B". The difference in scores was found to be significant at the 95% level using an ANOVA.

It is likely that some of the improvements made in the research and marketing courses were due to the indirect effects of the teaching aids, as was the case in the introductory course. Students evaluating each of the two courses often noted that the cases and the game presented them with an interesting challenge which they enjoyed.<sup>4</sup>

Care must be taken when interpreting the results of these experiments. Although the total percent change in test scores reported in Tables 1-3 support both hypotheses posed, it must be kept in mind that the level of impact noted here for each teaching aid is not necessarily indicative of the level of impact that the technique would have if used in other courses. Also, the results for the three teaching aids are not directly comparable because they came from three different courses. The changes in test scores were

TABLE 2. Impact of Case Studies on Research Methods Course

Experiment	Average Test Score <sup>a</sup>		% Change	% Δ/hr <sup>d</sup>
	Control Group	Test Group		
SSPP <sup>b</sup>	71	78	9.9	2.0
POCG <sup>c</sup>	70	78	11.4	2.3

<sup>a</sup>Score is from a maximum possible of 100.

<sup>b</sup>Sample size for each group: 180 (approximate)

<sup>c</sup>Sample size for each group: 30

<sup>d</sup>The average student contact time for this aid was five hours per term.

TABLE 3. Impact of Simulation Game on Marketing Course

Experiment	Average Test Score <sup>a</sup>		% Change	% $\Delta$ /hr <sup>d</sup>
	Control Group	Test Groups		
SSPP <sup>b</sup>	74	84	13.5	1.5
POCG <sup>c</sup>	72	83	15.3	1.7

<sup>a</sup>Score is from a maximum possible of 100.

<sup>b</sup>Sample size for each group: 100 (approximate)

<sup>c</sup>Sample size for each group: 32

<sup>d</sup>The average student contact time for this aid was nine hours per term.

used here simply to indicate whether the teaching aids had any impact on the effectiveness of learning, not to assess which technique is "best".

To make the results between aids more comparable, the impacts must be modified to allow for differences in student contact time. Each teaching aid required a different amount of students' time per academic term (1, 5, and 9 hours, respectively, for role-playing, case studies and the computer game).<sup>5</sup> As a result, it is not surprising that the aid requiring the most time, the computer game, had the highest absolute level of impact on students' performance. A better measure of the relative impact a teaching aid had on learning would be one which reflected the "return on investment" received from student contact time. This modification led to the last column in Tables 1-3, which reports the percent change in test scores per hour of average student contact time.

Such a modification still does not make the results from the three aids directly comparable, but it does give a different impression of the impacts generated. To be comparable the results would have to all come from applications in the same course (not three different courses). Nevertheless, by shifting the focus of a quantitative assessment of the aids from the absolute level of impact to a return on time invested framework, the modified results of this study raise some questions for future research.

For example, the relationship between inputs (time) required of students/faculty and resulting outputs (educational impacts) for particular teaching aids may be an important factor in determining which learning devices are most appropriate in specific circumstances. Equally important might be the choice of how outputs are to be measured -- on a total or marginal basis. Plotting the experimental results reported here for all three aids on a graph with total student contact hours on the horizontal axis and total percent change in test scores on the vertical axis illustrates a positive

relationship (nearly a straight line sloping upward to the right). However, placing percent change in test scores per hour of contact time on the vertical axis transforms the relationship into a negatively sloped curvilinear figure. In other words, it appears that use of the marginal physical product concept may be appropriate in selecting teaching aids. First it will be necessary to test an assortment of devices requiring varying amounts of student contact time to provide a representative sample. From such a sample, an input-output relationship for teaching aids might be estimated to allow relative educational impacts to be measured.

### Conclusions

The general conclusion reached in this brief analysis is that role-playing, case studies and simulation games can all improve the effectiveness of learning when used as teaching aids. The results of the experiments reported here indicate that these techniques improve students' understanding of complicated material when combined with lecture presentations. However, the amount of impact each technique has on students varies directly with the amount of time required, as would be expected.

Role-playing helps in giving students a better understanding of the decision making environment, but does not allow for much detail in the information presented or in the variables being studied. Students are exposed to the stresses of a particular situation of interest, yet the exercise lasts only a short time.

Case studies can present detailed information about situations, but often do not allow students to "feel" the decision maker's position. It is difficult for students to fully understand the nature of the environment being described in a case if those students are analyzing the case data in a relaxed, academic atmosphere while having no personal stake in the outcome of decisions being

made. Therefore, case studies can be useful when an instructor's goals include presenting large amounts of technical data in the form of a problem to be solved, or when placing some emphasis on the mechanics of the management/decision making process itself.

Computer-based simulation games give students both repeated exposure to the decision making environment and the opportunity to deal with a large amount of detailed information. While participating in a simulation game, students must work together to make decisions concerning a wide range of variables over a period of time in a competitive environment. This means that students must analyze detailed information, as in case studies, but they must do so in an environment filled with real stresses, just as in role-playing situations.

The results of this study do not mean that simulation games are considered to be more valuable than either case studies or role-playing as teaching aids. There is a definite trade-off between student contact time requirements and the effect of these teaching aids. The simulation game had the greatest total effect here, but simulations often require previous exposure to certain topics and/or methods of analysis. As a result, games such as the one described here may not be appropriate for use in introductory level courses. It is also noted that the time required to conduct a simulation game may not be justified when attempting to illustrate relatively minor points. Case studies and role-playing, however, require less time and can be used in many different situations with little difficulty, but have less total effect. Yet, the return on time invested was found to be highest for role-playing and lowest for the game. This result is the reverse of the ordering of the impacts for the aids when total effects were measured.<sup>6</sup> Therefore, it is clear that all three teaching aids can be valuable additions to a program of instruction when used in appropriate situations.

The limitations of this study center on the unresolved problems of measuring all outputs and assigning them weights. Also, different teaching aids have different impacts on different students, so the distribution of outputs needs to be measured. As suggested in the analysis section, research efforts need to be focused on the input-output relationship for teaching aids so that guidelines can be developed to assist in choosing effective devices for particular situations. In this way improved educational impact models will become available to teachers as tools for use in improving the quality of the learning environment.

Footnotes

1. Of course, some changes are unavoidable. In this case, experimental error from the source called maturation (Blank, p. 194) is likely. Although the same lecture materials were used each term, instructors tend to eliminate poor examples and improve the presentation in subsequent attempts. Experimental error from instrumentation was reduced by not allowing students to keep their examination papers. After discussing the test results in class, the instructor collected all papers in each class to avoid the creation of a "test file". Also, the form of the exams (each about 2/3 multiple choice and 1/3 short answer questions) lent itself well to objective grading.
2. Quasiexperiments are used when some of the variables can be controlled, but not enough to use a true experiment. In this case the design is used because equivalent experimental and control groups could not be established in a single random process; two processes took place -- one each year.
3. Each aid was tested during a different term in the three-quarter academic year.
4. The percentage of "most favorable" and "least favorable" comments for case studies were, respectively, 61 and 6. The responses for the computer game were 80% favorable, 2% unfavorable.
5. These are the average amounts of student contact time reported by students in a written report on the relevant aids, for case studies and the computer game, and from observation by the instructor for the role-playing exercise.
6. The implication here is that the second hypothesis ( $S > C > R$ ) would be accepted if total impacts are of concern, but it would be rejected if marginal impacts (percent change per hour of contact time) are considered most important.

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