Teaching Introductory Economics With a Collaborative Learning Lab Component

Robert L. Moore

For three years, I have taught my introductory economics classes with a collaborative learning lab component (CLL).[1] In this article, I answer the *what, why, how,* and *for whom* questions concerning the CLL at Occidental College and briefly report on the program's effectiveness as indicated by answers to a student questionnaire.

THE *WHAT* QUESTION—BASIC DESCRIPTION OF THE CLL

The collaborative learning lab is where students, usually working in groups of three or four, take a series of short, written quizzes (called *unit tests*) that correspond to each of six units in the course.[2] When the class has completed the material in a particular unit, students are urged to attempt one of these unit tests, which are taken outside of class at pre-arranged times. A unit test usually consists of about three or four questions or problems and takes approximately 20–30 minutes to complete (samples are included in Appendix A).

When a group of students goes to the CLL for a unit test, a specially trained CLL student tutor/mentor hands them one of several similar tests. After each student has had time to think about the questions and their answers, the students discuss their answers as a group. Then the group returns to the CLL student tutor. The tutor has a deck of cards, and for each question on the unit test, the tutor deals each student a card, and the student with the highest card must orally explain the group's answers to that particular question. This random element was developed by Bartlett (1995b) to overcome the free-rider problem in group work.[3] During the discussion, the student tutor may ask the reporting student to clarify certain points or extend the answers. This random procedure is repeated for each question on the unit test. If the students in the group answer all the questions correctly, the tutor records a pass for that unit for each member of the group. If the students miss any portion of the unit test, an incomplete is recorded for each student in the group. There is no fail grade on a CLL test. The tutor tries to explain the difficulty that the group was experiencing and encourages the group to take another similar test on that same unit either immediately or at another time after more studying. The group can keep taking different variations

Robert L. Moore *is a professor of economics at Occidental College (e-mail: Moore@oxy.edu).*

of the unit test for a particular unit until it passes. Credit is awarded for passing, independent of the number of attempts.

I graded the CLL component in a manner that could only improve a student's overall course grade. As an incentive to take the unit test, I calculated 3 percent of the students' final grade as A for each unit they passed during prime time (defined below) and 1 percent A for each unit passed after prime time. The following example illustrates this procedure. Suppose a student passes five of the six units of CLL during prime time. Also assume that his or her grade based only on the items in the syllabus is a C (or 2.0 on a 4-point scale). Instead of earning a final grade of C (without any CLL participation), the final grade would now be computed as $(.85 \times 2.0) + (.15 \times 4.0) = 2.3$, that is 85 percent of the grade would be a C from the regular exams, writing assignments, problem sets, and so forth, and 15 percent of the grade would be an A from the CLL. The numerical value of the student's final grade (again on a 4-point scale) now equals 2.3 or a C+.

Prime time for a particular unit consists of the four days immediately following the announcement that the class has completed that unit. A two-hour lab session is held at designated hours each day during this prime time; lab sessions begin again during the prime time for the next unit.[4] Thus, the maximum benefit derived from CLL occurs if a student passes all six units during prime time. The student's grade is computed by averaging the 18 percent of the grade that is A from the CLL with the other 82 percent based on the grade without the CLL component. Students who never pass a unit test get the same grade they would have received without the program. In that sense, participation in CLL was optional, except that every student was required to *attempt* one unit test in a group.

THE *WHY* QUESTION—RATIONALES FOR THE PROGRAM

The experiment took the form that it did for many reasons. Perhaps my most important motivation was provided by Robin Bartlett (1995a). She impressed upon me that different students have different learning styles and that, as teachers, it is incumbent upon us to provide learning and evaluation techniques that offer a variety of ways for students to learn the material and demonstrate that learning. I also was impressed with the well-known work of Uri Treisman (1992). In his study to determine why minority students did so poorly in the first-year calculus course at UC Berkeley, Treisman found that the stereotypical reasons suggested by others were without merit. Instead, minority students (unlike other students in the course) experienced a lack of collaborative work outside of class that seriously affected their learning. Another motivation was the substantial literature on collaborative learning (Maier and Keenan 1994). I also believe that students sometimes learn the material best when they have to explain it to another student and that a student who does not understand a concept sometimes learns better by having a peer (instead of a teacher) help him. Finally, I felt that working in a group is usually more fun, allows students to get to know other students (especially some they would not get to know otherwise), provides some variety, and develops group learning skills.

THE *HOW* QUESTION—SETTING UP THE PROGRAM

To set up this program, an instructor has three basic tasks: (1) preparing tests, (2) hiring and preparing the student mentors, and (3) arranging schedule-compatible student work groups. I prepared three unit tests for each of the course units, which was usually more than sufficient. Most of the questions came from prior problem sets and exams. The unit tests consisted of three or four short-answer problems, and each test in a particular unit was directly parallel to the others in the unit. For example, if a question tested the concept of present value on one test, every other test in that unit had a very similar question. (See the examples in Appendix A.)

I hired junior or senior economics majors (with funding from our Dean of Faculty) to be CLL mentors or tutors—approximately one student tutor for each 50 students in the introductory sections. These tutors received the unit tests ahead of time and met with me for about one hour per unit to review the answers to the tests and to discuss the most effective methods for helping students learn various concepts. We also used these meetings to decide which student mentors were going to work at which lab sessions.

How the groups are formed may be important. I announced during the second week of the course that students were free to form their own groups with the constraint that the group must contain at least three students and no more than four. I announced that I was willing to place them in a group on the basis of their schedule compatibility, and I indicated that I would allow changes in the groups at any time after the first attempt. Although I envisioned that students would answer the unit tests in groups and in the process teach each other the material, I also realized that it is difficult for students to coordinate schedules for this purpose. Moreover, some students may feel more comfortable working alone, so I allowed students to take the units individually but strongly encouraged them to take them in groups. A vast majority of students ended up taking most of the tests in groups of three or four; a handful of students (mainly those who ended up receiving an A in the course) chose to go it alone. Very few groups changed over the course of the semester.

The out-of-pocket cost of the program per semester per student enrolled came to approximately $3.[5] This cost did not include the photocopy expenses for the unit tests or the value of the time it took me to create the unit tests or meet with the CLL student tutors.[6]

THE *FOR WHOM* QUESTION—STUDENT PARTICIPATION AND REPORTED BENEFITS

Over the three years when the program was run in my classes, 82 percent of the students in the seven sections (210 students) passed four or more unit tests during the semester. Another 6 percent passed three units, and 12 percent passed two or fewer unit tests.

To determine which, if any, students benefit from the program and how, I originally had considered performing a controlled experiment similar to the one by

Allison (1976), where one section of the principles class would randomly have the CLL component and a control section would not. Admissions file information would be used for background information on student ethnicity, gender, SAT scores, and so forth. Everything else about the sections (instructor, syllabus, exams, problem sets, paper assignments) would be identical. However, I decided that it was not appropriate to deprive some students of this perhaps positive pedagogical innovation solely for the sake of research in economic education. I also was concerned that readers would consider me a less-than-objective investigator of this new pedagogy. As a result, I abandoned the idea of an experiment before it really got off the ground. Instead, I simply distributed a student questionnaire on the CLL at the end of each course, a copy of which is included as Appendix B, and some key results are recorded in Table 1.

I received 176 questionnaires from the 210 students. The most important question from my point of view was number 9: "Overall, how worthwhile was the CLL program?" Using a 7-point scale, with 1 being *not at all worthwhile* and 7 being *very worthwhile*,[7] approximately 53 percent of the students rated CLL a 7, 30 percent rated it a 6, and 10 percent rated it a 5. This response was only marginally different by gender, with women slightly higher than men.[8] When student responses were broken down by final grade in the course, no strong pattern seemed to emerge (Table 1). Those receiving a higher final grade favored CLL only slightly more.

The questionnaire also asked students about the experience of taking the tests in groups versus individually.[9] Except for the first unit test, students had a choice of continuing in a group or taking the unit tests by themselves. A large majority continued to take the tests in groups. Question 3 asked, "How enjoyable did (they) find working in a group compared to working alone?" Students used a 7-point scale with 4 being *about the same*, 7 being *much more enjoyable* (in a

TABLE 1
Selected Questionnaire Results (in Percentage, Using a Scale of 1–7)

Question	Scale			
	7	6	5	4, 3, 2, or 1
Question 3:How enjoyable did you find working as a group versus alone?	56	24	8	12
Question 4: How helpful did you find working as a group versus alone?	55	20	10	14
Question 9: Overall, how worthwhile was the CLL program?				
All respondents[a]	53	30	10	7
Male	52	30	14	4
Female	57	30	7	6
By final grade in course				
A	61	25	12	2
B	56	32	9	3
C and lower	44	28	11	17

Notes: The scale used was 7 = *very worthwhile* to 1 = *not at all worthwhile*.
[a]Including unidentified students.

group), and 1 was *much less enjoyable* (in a group). A vast majority of students felt that the working in groups was *much more enjoyable*, with 80 percent rating the enjoyment of group work a 7 or 6 (over half a 7). Only 12 percent rated enjoyment of group work 4 or less (only 4 percent rated it less than a 4). Of the few students who rated enjoyment less than 4, most were students who scored an A in the class. These may well be students with the same learning style as most professors! However, far more of the students who received an A in the course still enjoyed group versus individual work in the lab. The response to question 4, "How *helpful* did you find working in a group compared to working alone?" were almost identical to the responses for question 3.

CONCLUSION

Students overwhelmingly reported that the CLL was very worthwhile and reported that working in groups (vs. individually) in the lab was not only more enjoyable but also more helpful. Very little difference in the responses was related to gender or final grade in the course.

An important question for further research is whether this educational innovation actually contributed to overall student learning, as opposed to simply encouraging students to substitute one factor of production, CLL lab hours, for another factor, individual study hours. Alternatively, the CLL component could have simply constituted an elaborate study hall that encouraged students to spend more time on the course. However, I hope that some readers will be encouraged by the positive student responses reported here to experiment with CLL programs.[10] A few might even try to put my claims to a statistical test by conducting a formal evaluation of the student learning gained, if any, from such CLL programs.

APPENDIX A
Samples of Actual Unit Tests

Unit II, Test 1

Names_____
Group # _____

1. Suppose an economist studying the market for peanut butter has collected the following data for three different months:

	July	August	September
Price of peanut butter	4	3	2
Quantity of peanut butter sold	100	75	150
Price of Jelly	3	4	3
Wage per hour of workers who help produce peanut butter	6	6	4

(Assume that everything else is the same for all three months and that the peanut butter market is in equilibrium each month.)

Draw in supply and demand curves *consistent with the above information.* Carefully describe any shifts of these curves over the three month period using the information above. For example, between July and August, which curve(s) shift(s) and in which direction(s). Do the same between August and September.

2. In the mid-1970s,a very severe frost destroyed a large proportion of Brazil's coffee crop. Suppose this event was responsible for the following changes in the U.S. market for coffee.

a. Use the information in the table below to show what has happened to total expenditure (also referred to as total spending or total revenue) between 1976 and 1977. That is,has total expenditure increased, decreased, or remained the same?

Year	Retail Price of Coffee ($ per pound)	Per-Capita Consumption of Coffee (pounds per year)
1976	1.87	32.4
1977	3.47	24.2

b. Based on the change in total expenditure between 1976 and 1977, would you expect the elasticity of demand for coffee to be "elastic" or "inelastic"? Explain your answer.

c. One commentator claimed that the frost caused two things to occur in the standard supply and demand for coffee:(1) the supply curve shifted left (or up) because of the frost; and (2) the resulting higher price caused the demand curve for coffee to shift left (or down). Do you agree?

3. There are two potential sources of light in the country of Economia: domestically-produced candlelight and foreign-produced sunlight (of which an unlimited amount can be imported at no charge). Suppose that without any imports of sunlight, the market for light in Economia can be depicted as below:

(diagram omitted—standard (linear) demand and supply curve diagram with the demand curve extended all the way until it intersects the Q axis.)

a. On your own graph,depict the consumer surplus and producer surplus that results if imports of foreign-produced sunlight are banned.

b. Now depict the effects on the Economia light market if there are no restictions on imports of sunlight. For this part show the foreign supply curve, and new equilibrium price and quantity.

c. Is Economia better off due to imports? If so, by how much? To answer, show the effects of imports on consumer surplus, producer surplus, and the combined surplus (net social benefits).

4. Draw a graph showing a perfectly competitive housing market. Assume that supply and demand are neither perfectly elastic nor perfectly inelastic. Show the equilibrium price and quantity, as well as producer surplus and consumer surplus.

b. Now suppose that Congress decides to help middle-income families become homeowners by adopting a national program of price controls on housing. Draw a graph showing the effect of the price control program compared to the free market. Show the new equilibrium price and quantity. Carefully analyze the changes in consumer and producer surplus and then determine if the price control program will increase or decrease overall social welfare. Indicate any deadweight loss, i.e. inefficiency on your diagram.

Unit II, Test 2

Name _____
Group # _____

1. Suppose that an economist studying the market for film has collected the following data for three different months:

	July	August	September
Price of film	2	3	4
Quantity of film sold	100	150	75
Price of "Film Development" (Note: "film development is a complement good to "film")	3	2	3
Wages of workers who make film	5	5	8

(Assume everything else is the same for all three months and that the film market is in equilibrium each month. That is, the demand curve and supply curve must intersect at the P's and Q's shown above in each month.)

Draw in supply and demand curves consistent with the above information. [Note: this is basically asking you to explain which curve(s) shift(s) between July and August and similarly between between August and September, given the information above.]

2. Health Care Reform

a. Use the supply and demand diagram below to depict the unregulated, free market price and quantity of "health care services". (This is meant to be very straightforward. For the purposes of this question, ignore any knowledge you may have about Clinton's reform proposals or any other information about health care. Just assume that health care services are no different than any other good we have considered, such as "eggs".

[diagram omitted here—standard (linear) supply and demand curve diagram with the demand curve extended all the way until it intersects the Q axis]

b. Label the consumer surplus and producer surplus that results in an unregulated market. Briefly explain why you choose the areas you did so that I know you understand what these concepts are.

c. Now suppose that the U.S. adopts a system of national health insurance in which health care services are financed by general tax revenue, and individual patients are not charged for the health care services they individually consume. Use your diagram to indicate:

(i) the new quantity demanded of health care [Hint: the effective price to buyers is zero]; and

(ii) the price health care providers will have to receive to induce them to supply the new quantity demanded.[Hint: it's the vertical distance up to the suppply curve at the quantity you chose in i]

d. Show how the introduction of national health insurance affects the following:

(i) change in consumer surplus

(ii) change in producer surplus

(iii) the increase in government spending

e. Compared to part a,does national health insurance result in an efficient amount of health care services being produced? If not,show the areas on your graph that correspond to the deadweight loss, and *explain carefully.*

f. Most actual proposals (including President Clinton's) include provisions "limiting payments to providers of health care," in order to control total spending. Suppose the price per unit paid to providers is limited to a price somewhere below the intersection of the supply and demand curves in the diagram above. Briefly describe what problem(s) if any, you might anticipate will result from such constraints. For example, would such limits result in the efficent quantity of health care services behing provided now? Why or why not? (Don't limit your answer to this issue only however.)

3. The questions below refer to the following passages from a newspaper article, titled, "Despite Fare Rise, Taxi Fleets Report New Losses Again":

> The 17.5 percent fare increase that went into effect in November has produced only about a 10 to 11 percent increase in gross revenues rather than the 17.5 percent that the Taxi and Limousine Commission (TLC) had predicted.
>
> The Metropolitan Taxicab Board of Trade (MTBT), representing the city's 60 fleet owners, would probably demand that the Taxi Commission "live up to its commitment to give them the fare increase that will provide the 17.5 percent increase in gross revenue. . . . According to the industry accountants, that can only be done by reshaping the fare upward to the 25 percent schedule they originally submitted.

a. Based on this information, is the demand for taxis elastic or inelastic? Explain your reasoning.

b. What did the TLC expect for the elasticity of demand with respect to price? (Be as specific as you think the information here allows.)

c. Which group assumed the higher elasticity of demand for taxis,the TLC or the MTBT?

APPENDIX B
Copy of Student Questionnaire

Economics 101
Collaborative Learning Lab (CLL) Evaluation

As you may be aware, we have put quite a bit of effort into the collaborative learning lab (CLL) program. In order to evaluate its effectiveness, we are asking you to complete the questions below. For the evaluation to be useful to us and to future students in Economics 101, it is obviously important that you be honest and candid. We are asking for your student I.D. number so that we can determine in a statistical sense which students found the program most helpful and which students found it less

helpful. In this regard, we may use the computer to match your student I.D. with admissions data that is not confidential. We give you our *personal* promise that we will not see these evaluations until after we have turned in the course grades, and that we will only examine statistical results from all the questionniares and not associate individual respones with particular students. Anyone who is uncomfortable with providing their student I.D. may leave this question blank.

Student I.D. Number _____

1. By the end of the term, how many of the CLL units will you have completed?
   0 1 2 3 4 5 6 7
2. How many of the CLL units will you have tried at least once in a group instead of alone?
   0 1 2 3 4 5 6 7
3. How enjoyable did you find working in a group compared to working alone? (4 = about the same)
   much less enjoyable 0 1 2 3 4 5 6 7 Much more enjoyable
4. How helpful did you find working in a group compared to working alone? (4 = about the same)
   much less helpful 0 1 2 3 4 5 6 7 Much more helpful
5. Has passing a unit test been a good indication of your mastery of the unit?
   no, not at all 0 1 2 3 4 5 6 7 yes, very good
6. How interesting were the unit test questions?
   very dull 0 1 2 3 4 5 6 7 very interesting
7. Did you like the fact that unit test grading provides personal contact with a student?
   no, not at all 0 1 2 3 4 5 6 7 yes, very much
8. How well did the mentors explain your mistakes to you?
   not at all 0 1 2 3 4 5 6 7 very well
9. Overall, how worthwhile was the CLL program?
   not at all worthwhile 0 1 2 3 4 5 6 7 very worthwhile

We'd appreciate any additional comments and suggestions about the CLL program. Please use the back of this page for this purpose.

NOTES

1. This pedagogy resulted from a confluence of two important experiences that I had. From 1973 to 1978, I participated as a graduate teaching assistant and then assistant professor in Professor Elisabeth Allison's experiment in self-paced teaching in Harvard's Economics 10 course (Allison 1976). More recently, I attended each of the three National Science Foundation-sponsored conferences on "incorporating the latest scholarship on race and gender into the introductory economics course" (Bartlett 1995a).
2. For the past three years at Occidental, I have taught a one-semester principles of economics course that covers the basic principles of both micro and macroeconomics. I cover less material than is contained in most one-semester texts, but I also require five short writing assignments and several group projects in addition to the more traditional problem sets and in-class exams. The CLL was first offered in a one-semester principles of microeconomics course in the fall 1993 term. The survey results reported later in this article refer only to the last three years.
3. I thank my colleague Jim Whitney for being the first person to suggest incorporating Bartlett's innovation into the CLL.
4. Students who wanted additional practice were allowed to take additional unit tests in those units that they had already passed.
5. This cost was the result of hiring the student mentors/tutors. I used approximately 35 tutor hours for each 50 students enrolled. If one uses the minimum wage (in 1997) as the hourly wage rate for the student mentors, this cost comes to 35 hours times $4.25 per hour, or about $150 per 50 students.

6. To ensure that the lab sessions are not intimidating, I did not attend the actual lab sessions except to occasionally stick my head in to make sure the student mentors had shown up.
7. Students were asked to voluntarily report their student ID numbers on the questionnaire. They were informed in writing that I might use their admission file in order to determine better who benefits the most from the program. About 30 students chose to omit their student ID number. I also promised not to examine the questionnaires until course grades were turned in.
8. In particular, of the sample of 145 students who identified themselves, 55 percent rated CLL a 7, with another 35 percent rating it a 6. When this response was broken down further by gender, 52 percent of the male respondents gave the CLL a 7 rating, while 57 percent of the female respondents gave it a 7 rating. Approximately half the students in these seven sections were female. (See Table 1 for more details.)
9. The self-paced program at Harvard developed by Allison was similar to the CLL, except that the students never took the unit tests in groups. See Allison (1976) for a detailed formal evaluation of the what,how, and for whom questions of that experiment, where a randomly selected control group was used.
10. Several of my colleagues at Occidental as well as one at Miami University of Ohio have added the CLL as an option but evidently with a smaller grade incentive. Formal evaluations of their versions have not been attempted.

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