

An Illustrated Case for Active Learning

Michael K. Salemi

Running Head: Active Learning

Department of Economics
CB 3305, Gardner Hall
University of North Carolina
Chapel Hill, NC 27599-3305
USA
919-966-5391
Michael_Salemi@unc.edu

JEL Codes: A22, A23

Acknowledgment

The author thanks William Becker, W. Lee Hansen, Mark Maier, Ariana Pancaldo, John Siegfried and Michael Watts for helpful comments.

Abstract

Educational psychologists and instructional specialists agree that students should be actively involved in the educational process. Despite evidence that students learn better and are more committed to learning when they work with course material, chalk-and-talk remains the dominant pedagogy in economics instruction. This article provides a rationale for active learning in undergraduate economic courses based on the literature and on the author's experience. It provides examples of active learning exercises, explains why students and teachers benefit from active learning, and concludes that the benefits of active learning outweigh the costs. The exercises in the paper focus on the concept of present value. A companion web site provides exercises useful for teaching other financial-market concepts.

1. Introduction

Educational psychologists and instructional specialists such as Bonwell and Eison (1991) and Johnson, Johnson, and Smith (1991) agree on the importance of involving students actively in the educational process. Active learning should be a particularly important part of economic education where the over-arching goal is to help students "think like economists" (Siegfried et al., 1991, p. 199). Students can think like economists only if they understand economic concepts well enough to use them in problem solving and analysis.

Hansen (1986) argues that economics majors should be able to gain access to existing knowledge, display command of it, draw it out, use it to explore issues, and use it to create new knowledge. Active learning helps students become proficient in the ways that Hansen thinks they should. Drawing out knowledge, exploring issues, and creating new knowledge requires practice. It requires that students do economics.

Active learning is effective but seldom used. Becker (1997) reports that students learn better, and are more committed to learning, when instructors use active learning. However, chalk-and-talk is still the dominant teaching pedagogy employed in all economics courses at all types of undergraduate institutions (Becker and Watts, 2001). College-level economics instructors seldom use active learning, service learning, cooperative learning or computer-and-Internet-based educational technology.

This article provides a rationale for active learning in undergraduate economic courses based on the literature and on the author's experience as a teacher and teaching-workshop leader. It provides an example of how I use active learning, makes clear why students and instructors benefit from active learning, and concludes that the benefits of active learning outweigh the costs. While the example comes from an undergraduate financial markets course, I believe that instructors can profitably employ active learning throughout the undergraduate economics curriculum. A companion web site, with additional active learning exercises, may be found at www.unc.edu/~salemi.

2. An Example of Active Learning

To clarify the meaning of active learning, I begin with an example from my financial markets course at UNC-Chapel Hill. The course is directed toward junior and senior economics majors who have completed their intermediate theory and statistics courses. It is popular among students who aspire to careers in banking, insurance, and financial markets.

"Present value" is among the most important concepts in a financial markets course. Box 1 summarizes what I want students to learn about present value. Students should not only know

these concepts, but should also be able to apply them in new situations and use them correctly to make decisions and judgements.

While an instructor could cover relevant text-book material in two or three fifty-minute lectures, the importance of present value warrants assignment of active learning exercises. The exercises differ from traditional problem sets because students interact as they prepare and revise answers, critique answers offered by others, and are responsible for correct answers. I do not provide a key -- even at the conclusion of the exercise. The exercises are spread over several weeks because present value appears in several course modules.

Students begin by reading the text and attending a lecture where I introduce present value and explain its importance. They then begin working the exercises. The first exercise (Box 2) asks students to compute the present value of "lifetime" income in two scenarios. In the first, students stick with their decision to attend college with the result that their incomes (net of college expenses) are low at first and then higher as they secure employment. In the second, students repudiate their decision to attend college and begin work immediately. By completing this exercise, students learn to apply present value. They generate income streams for each scenario. They learn how to choose a discount rate. They undertake present-value calculations. They make sense of the numbers they compute, judge whether their calculations are reasonable, and decide how they should be used. I do not believe that most students could achieve these outcomes by listening to a lecture.¹

For the second exercise, I divide the class into groups, choose spokespersons, and assign each a problem like those in Box 3. Each group solves its problem and prepares an oral report. After each report, students ask questions and challenge parts of the report with which they disagree. By completing this exercise, students learn to apply present value in new contexts, practice using the language of present value, and learn to distinguish between correct and incorrect applications.

The third exercise (Box 4) asks students to apply present value to predict the price of a share of a company. By completing this exercise, students extend their understanding of present value to the case where payments are uncertain and agents form expectations of their value. Students decide whether the discount rate should be equal to or greater than the Treasury Bond rate. They determine how the share price should change when news about the company's productivity becomes available and when changes in the discount rate occur. Finally, they discuss why share prices might diverge from the present value of expected future dividends.

The fourth exercise (Box 5) is a set of questions that guide class discussion² of Richard Kopcke's 1997 article, "Are Stocks Overvalued?" With this exercise, students move from working with material prepared for novices to working with material prepared for professionals. Through discussion, they deepen their understanding by interpreting how Kopcke uses present value to answer an interesting and important question.

What can my students do with present value at the end of the course? Box 6 provides sample questions from my final examinations. These questions are part of a pool that I distribute to students one week before the examination. I encourage students to study in groups but assess them individually with a closed-book examination. I do not provide model answers.

What course topics are appropriate for active learning? I suggest two principles. First, the topic must be relatively important because active learning uses more class time than alternative pedagogies. Second, the topic should involve concepts that are difficult to master.

For example, definition and computation of required reserves would not be as good a candidate as, say, the impact of a change in Federal Reserve policy on the term structure.

The exercises presented in the boxes are meant to suggest the possibilities. The companion web site provides exercises for several other topics including how financial markets improve economic welfare, tradeoffs associated with insuring commercial bank deposits, decision making in the face of uncertainty, using derivative securities to hedge risk, the treasury yield curve, and whether or not it matters that U. S. saving (as measured by the national income and product accounts) is very low by historical standards.

3. The Case for Active Learning

Over the years, I have asked many teachers about the benefits of active learning. This section recounts what I have learned from them and through my own experience.

Students reach a deeper understanding of course concepts.

The higher levels of Benjamin Bloom's (1956) cognition taxonomy are application, analysis, synthesis, and evaluation. Active learning provides students with opportunities to work with concepts at higher cognitive levels. Students master at the applications level when they can use a concept in a new, concrete situation. To complete the Box 3 exercise, students must apply present value to problems that are different from those presented earlier in the course. Students master at the analysis level when they can break down material into its component parts and understand its organizational structure. To complete the Box 2 exercise, students must figure out what payment streams are, choose a discount rate, decide which present-value formula to use, and make sense of the resulting calculation. Students master at the synthesis level when they can put parts together to form a new whole and explain their synthesis in a communication. To complete the stock-price exercise in Box 4, students must calculate expected earnings, capitalize an income stream, and discuss the effect of "news" on their calculations. Most exercises require students to communicate their findings to others. Students master at the evaluation level when they can judge the value of material. In the discussion exercise, students not only interpret Kopcke's arguments but also decide for themselves whether stocks are overvalued.

Active learning practitioners report that students think harder during class because they spend time trying to make ideas work rather than trying to understand what the teacher is saying. Many point to the power of "learning by doing," arguing that students will be better able to use important concepts if they have opportunities to practice using them in a controlled environment. Others point out that students benefit from seeing and participating in problem solving that goes on during active learning. Practitioners also believe that students benefit from being pushed beyond their initial answers to revisions that are more complete, precise, and correct.

Students and instructors both benefit from feedback.

Students often confuse recognizing a well-formed argument with being able to produce one. Kurfiss (1988, p. 34) argues that students correct misconceptions about course concepts when they make predictions based on those concepts and then put them to the test. In active learning, students frequently use concepts in spoken and written communication. By monitoring student communications, instructors can tell students whether or not they use these concepts correctly. In active learning, students listen to and comment on the arguments of fellow students

which helps them figure out when they need to improve their understanding and provides them opportunities to learn from one another.

Teachers also benefit from feedback during active learning. When asked whether a class went well, lecturers can comment only on their own behavior. They must wait until exam time to learn how well their students understood material. In active learning, instructors receive constant feedback about what students do and do not understand. It helps them focus on what their students are learning and adjust their teaching to meet student needs (Cross and Angelo, 1993).

Students benefit from variety in teaching styles.

Educational psychologists argue that undergraduates are characterized by a variety of learning styles. For example, Kolb (1981) argues that students are either abstract or concrete learners and either active or reflective learners.³ With a mixture of active learning and lecture, instructors can reach more learners than they could by exclusive use of either approach.

Practitioners argue that active learning works well in classes with fast and slow learners. During exercises, fast learners can be used as teachers. When instructors realize that some group members understand a problem, they can ask them to explain their understanding to others. Helpers learn different ways to get their point across and deepen their understanding by verbalizing it. Those being helped receive more attention than the instructor alone can give and pay lower emotional costs because they are helped by a peer.

Active Learning promotes a positive attitude toward learning.

For a number of reasons, participation in active learning improves student attitudes toward learning even in large-enrollment classes (MacGregor, 2000). First, students gain satisfaction from using course material in exercises. Second, through real-world exercises and assignments, students come to appreciate that economics is relevant and important and try harder to master concepts that they can use in their assignments. Third, students take greater responsibility for learning because they value being part of a joint effort and because they respond positively to the expectation that they are responsible. Fourth, students prepare better for active learning classes because they know they will be asked to contribute. Fifth, students like to talk about class material with their peers using familiar language.

Students benefit from classroom interaction with their peers.

Students gain by interacting with their peers in the controlled setting provided by active learning (Johnson and Smith, 1998). They learn to listen critically, to question what they do not understand, and to challenge when they disagree. Critical skills are important because student answers are often incomplete and incorrect. The practitioner has many opportunities to model critical listening, questioning, and critiquing skills and should encourage students to practice these skills. In active learning, students also come to appreciate that different people approach tasks in different ways and from different perspectives. Through peer interaction, students learn how to function in the post-college world where they will regularly encounter diversity of opinion and arguments with which they do not agree.

Active learning conveys benefits to practitioners.

Managing an active learning class is challenging in ways that lecturing is not. The instructor must be ready to react in a productive way to whatever sort of answer, question, or

contribution students come up with. I find this challenge stimulating and enjoyable. I particularly enjoy it when students come up with exercise answers and strategies that never occurred to me. On such occasions, I learn from my students. For me, the most important benefit of active learning is the way my students take to it. I like it when my students say: “We learn economics in all our classes here; in your class, we do economics.”

3. Conclusions

What are the costs of active learning? In my mind, three deserve serious attention. First, it takes more class time to teach a concept with active learning than by lecturing which means that

fewer topics can be covered. This cost can be ameliorated by using active learning to teach only the most important concepts and by communicating clearly to students that they must master some concepts on their own. Even so, an active learning course covers less material than a lecture course. This is fine with me. What matters is what students know and can do years after the course is concluded. It’s not what teachers cover, but what students learn.

Second, active learning is not the best strategy for all learners. Some students become confused by the amount of information that is presented during active learning. They have difficulty separating arguments that make sense from those that do not. They would be better off hearing clear arguments from the instructor, studying those arguments, and then applying them. That active learning is not best for all students is an argument for a diversified teaching strategy rather than an argument for lecture. My approach is diversified. With topics like present value, I lecture to introduce the topic and to help students organize information they will encounter. Students then work on exercises. With lesser topics, I lecture more and limit active learning to interactions resulting from examples and questions.

Third, it takes time to develop and revise good active learning exercises. Although revising our courses is the cost we all bear to keep up to date, it takes more time to introduce a new technique than to revise an old one. For that reason, I suggest that instructors who want to try active learning adopt an incremental approach. They should choose a content area where they believe students would benefit from active learning and create or find exercises for it. If they judge that the benefits outweigh the costs, they can add additional active learning components when they next teach the course.

In my experience, it is possible to use a good active learning exercise for as long as the topic is relevant and important. Some might question whether exercises would stop working well once they found their way into fraternity file systems. I have not found this to be so. Although exercises like those in Boxes 3 and 4 may lead to a single answer, the point is to have students explain how they arrive at the answer. Knowing the answer is not enough. Students should display understanding of the principles that lead to it. With exercises like those in Boxes 2 and 5, the arguments are more important than the final answer. I find that discussions based on the same article and list of questions can differ substantially from semester to semester.

Active learning is neither a panacea nor a free good. In my experience, it is a strategy through which students gain lasting understanding of important economic concepts. Managing an active learning classroom is exciting, fresh, and fun. For me, the benefits far outweigh the costs.

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Endnotes

1. In order to focus effort on present value, I let students guess the income numbers they use in the exercise. Lee Hansen suggests an alternative approach in which students would use labor market data as the basis for estimating income with and without a college degree.
2. For more on writing discussion questions and leading discussions, please see Hansen and Salemi, 1998.
3. Learners are concrete if they learn better through concrete experiences and abstract if they learn better by working with abstractions and theories. Learners are active if they prefer to construct experiments and create results and reflective if they prefer reflective observation of available data and evidence.

Box 1
Present Value Concepts That Students Should Master

1. An asset entitles its owner to receive a stream of payments. Payments for a U.S. Treasury bond (coupons and final payment) are certain. Payments for a stock share (dividends and sale price) are uncertain.
2. Because a dollar received in the future is less valuable than a dollar in hand today, a rule is needed to convert future payments into current dollar equivalents. The conversion is called discounting.
3. Suppose the interest rate is expected to be constant over the M-year life of the asset and suppose the asset promises to pay S_{t+j} dollars in period t+j. Then, present value (PV_t) is defined as:

$$PV_t = \frac{S_{t+1}}{(1 + R)} + \frac{S_{t+2}}{(1 + R)^2} + \frac{S_{t+3}}{(1 + R)^3} + \dots + \frac{S_{t+M}}{(1 + R)^M}$$

4. The present value of a stream of payments is an amount that would permit the asset owner to replicate the payment stream provided the owner can borrow and lend at the discount rate.
5. When the rate of interest is expected to change in the future, the present value formula adjusts the discount rate associated with each future payment. Let R_1 be the discount rate for the first year (t to t+1), R_2 be the rate for the second year (t+1 to t+2) and so forth.

$$PV_t = \frac{S_{t+1}}{(1 + R_1)} + \frac{S_{t+2}}{(1 + R_1)(1 + R_2)} + \dots + \frac{S_{t+M}}{(1 + R_1)\dots(1 + R_M)}$$

6. When the stream of payments entails a fixed payment (C) in each year followed by a final payment (F) in the last (M^{th}) year, there is a more simple formula for present value. It is:

$$PV = \frac{C}{R} + \left(\frac{F + C}{R} \right) \left(\frac{1}{1 + R} \right)^M$$

7. The discount rate that equates the price of an asset (P_t) with the present value of the stream of payments for the asset is called the internal rate of return (IRR) or the yield of the asset.

$$P_t = \frac{S_{t+1}}{(1 + IRR)} + \frac{S_{t+2}}{(1 + IRR)^2} + \dots + \frac{S_{t+M}}{(1 + IRR)^M}$$

8. The fundamental theory of equity prices says that the price of a share of stock equals the present value of expected future dividends to be paid to owners of that share. The discount rate used to compute present value is called the investor's "required rate of return." It exceeds the yield on long term treasury securities by an amount called the risk premium.

Box 2
Present Value Exercise: Is a College Education Worthwhile?

In this exercise, students will use present value. Imagine you are again seniors in high school but imagine, too, that you know then what you know now about your job prospects. As part of your decision to attend or not attend college, you compute the present value of your expected labor income in two cases. In case one, you attend college for four years, graduate, and take a job. In case two, you begin working immediately after high school. Suppose a twelve year planning horizon beginning with your freshman year at college: year 1 in the table is your freshman year, year 2 is your sophomore year, year 5 is the first year after you graduate, and so forth.

1. Fill in the following table.

Year	Decision 1: Attend College			Decision 2: Do not Attend College
	a. Expected Income	b. Cost of College	c. Expected Net Income ($c = a - b$)	d. Expected Income
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

2. What rate should you use to discount future costs and income? Why?
3. What is the present value of expected net income if you attend college? What is the present value of expected income if you decide not to attend college.
4. Based on your present value calculations, is it “worthwhile” to attend college? Why or why not?
5. Is it likely that using only a 12 year horizon in the above calculations biased your conclusions about the relative present value of attending and not attending college? Why or why not?
6. What considerations, beside present value of income, affect a decision to attend college?
7. How would you apply the above analysis to a decision to pursue a Masters Degree?

Box 3
Present Value, Yield to Maturity, and Bond Prices
Class Exercises

Your objective in this exercise is to learn how to apply the concepts of present value, internal rate of return, and yield to maturity to practical financial questions and problems. Students will work in groups and each group will work on one question. Group leaders should make sure that every group member agrees with the group answer. Groups will report their answers to the class.

1. Suppose that you are considering subscribing to *The Economist*. The cost of a one-year subscription is \$90.00 payable in advance. You expect the cost of a one-year subscription to remain unchanged. The cost of a two-year subscription is \$170.00 also payable in advance. You don't have the cash now so you plan to pay for your subscription by charging it to your credit card. Are you better off subscribing for two years or subscribing for one with the intention of renewing your one-year subscription next year? Explain. How would your answer change if you are paying for the subscription with money you currently hold in a saving account?
2. You have received a gift of \$1000 from Uncle Buck and wish to save it to use as the down payment on a car that you intend to buy in three years. Which of the following financial strategies is best. Do the strategies imply any trade offs?
 - a. Buy for \$1000 a U.S. Saving Bond (discount bond) that matures in three years and pays \$1200 at maturity.
 - b. Buy a three-year U.S. Treasury Bond with a face value of \$1000, a coupon rate of 6.5% and a current market price of \$1000.
 - c. Buy a five-year U.S. Treasury Bond with a face value of \$1000, a coupon rate of 6.7% and a current market price of \$1000.
3. You buy a ticket for a lottery with an advertised first prize of a million dollars. YOU WIN!!! Later, you find out that the prize is actually \$50,000 per year for the next 20 years. What is your prize really worth?

Box 4
Stock Pricing Exercise

In this exercise students will determine price for the stock of a fictional company using the fundamental theory of stock prices. They will also study how news will change the price of the fictional stock.

Green Genes is a bio-technical products company. The current dividend paid by the company is zero. The consensus view of investment analysts is that the prospects for future earnings of Green Genes are well described by the following table of scenarios.

Scenario	A	B	C	D	E	F
Probability of Scenario	1/6	1/6	1/6	1/6	1/6	1/6
Permanent Level of Green Gene Profits per share	\$0.00	\$2.00	\$2.00	\$5.00	\$5.00	\$15.00

To clarify, in scenario A, Green Genes never makes profits and in scenario C, profits are expected to be \$2.00 per share each year forever. The yield to maturity of 30 year treasury bonds is assumed to be 8.00%.

1. What price will the fundamental theory of stock prices predict for the shares of Green Genes? How did you arrive at your answer.
2. What would be the effect on the current price of Green Genes shares if Green Genes suddenly announced that current earnings had risen from zero to \$5.00 per share as the result of the sale of a patent for a process owned by the company? Your answer should depend on whether this announcement affects the table of scenarios.
 - a. Suppose the table of scenarios remains unchanged. How should the share price change?
 - b. Suppose analysts interpret the announcement to mean that the probability of scenario D has risen to 1/3 while the probability of scenario A has fallen to zero. How should the share price change?

What conclusions do you reach about the effect of news about the company on the market price of its shares?

3. What would be the effect on the current price of Green Genes shares if the treasury bond rate falls to 7.50%? Explain your reasoning.
4. Why might the actual price of shares of Green Genes be different than the share price you concluded in part A?

Box 5
Discussion Questions
for

Kopcke, Richard, Are Stocks Overvalued? *New England Economic Review*, Sept/Oct 1997, 21-40

Next class, we will discuss Kopcke's article on the level reached by stock prices in the late 1990's. Students are expected to read the article in advance and to frame preliminary answers to the following questions. A quiz is possible. During class, students will put forward their answers and discuss them.

1. What is the evidence that leads Kopcke to suspect that share prices may be overvalued (at the time the article was written in 1997)?
 - a. What does figure one show? Does it support the view that share prices may be overvalued?
 - b. What is Tobin's q ? How do estimates of Tobin's q support the view that share prices may be overvalued?
 - c. Why is it reasonable to look at data on the price-earnings ratio of stocks to determine whether share prices may be overvalued? What do these data show?
 - d. Do figures 4 through 7 reinforce the conclusion that share prices may be overvalued? Why or why not?
2. According to the model presented in Section II of the paper, what factors **could** (in principle) account for the increases in stock prices observed in the past 15 years?
3. What, according to Kopcke, **does** account for the increase in share prices that have been observed in the past 15 years?
 - a. Which of the factors discussed in question 2 does Kopcke think can account for the increase in share prices? What relevant evidence does Kopcke present?
 - b. Does Kopcke think that share prices are overvalued?
4. Do you think share prices are currently overvalued? Why or why not? What do you mean by overvalued?

Box 6
Examination Questions Assessing Mastery of Present Value

The following questions test mastery of present value. I distribute a pool of questions to my students one week before the exam. I encourage students to study in groups but assess them individually with a closed-book examination comprising four questions from the pool.

1. Kopcke explains why the fundamentals model of stock prices implies that the price-earnings ratio for a stock is given by the following formula

$$P/E = \frac{(1 + \alpha)}{(\delta + \alpha r)}$$

- a. Provide detailed definitions of α , δ , and r .
 - b. Explain in a way that shows your understanding of the fundamental model why the P/E ratio rises with an increase in r and falls with an increase in d , *ceteris paribus*.
 - c. How would Kopcke use the formula to account for the high level of the S&P 500 Index at the time of the writing of the article “Are Stocks Overvalued?”
2. You begin life with no tangible wealth. You will work for three periods and be retired for one period before you die. You plan to leave nothing for your heirs. You expect your working income to be \$20,000, \$60,000, and 80,000 in years one, two, and three. You can borrow and lend at 8% per period. You prefer to consume the same amount every year. You will be paid and will consume at the end of each period.
- a. What is the present value of your lifetime income at the beginning of your life? Show the formula and evaluate it.
 - b. What is the largest, constant consumption stream that you can afford?
 - c. What borrowing-lending strategy will you use to realize your part-b consumption plan.
 - d. What will be your wealth at the start of each period? Recall that wealth is a stock.
3. Consider a bond with a face value of \$1000.00 and a coupon rate of 5% which matures in 4 years.
- a. Assume that the market rate of interest is 6% and is expected to remain constant for at least four years. Give an expression for the present value of this bond. You need not evaluate this expression. You must say whether the market price of the bond is greater or less than \$1000.00 and explain.
 - b. Instead, suppose the price of the bond is \$950.00. Give an exact expression for the yield to maturity of this bond. Give an approximate expression for the yield-to-maturity of this bond and evaluate it arithmetically.
 - c. Suppose again that the market rate of interest is 6% and expected to remain there. Then testimony by the Chairman of the Federal Reserve Board about future monetary policy leads people to believe that the market interest rate will rise to 7% in two years time. **How and when** will the price of the bond change? Explain.