Problem-Based Learning: Modifying the Medical School Model for Teaching High School Economics

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Many students enroll in high school economics thinking they will face a semester of dry, uninspiring information about vague principles that fall under the rubric of “the dismal science.” As late as 1960, “economics in the (high) schools simply was not accepted by college and university economists as a respectable area of professional concern.” Instruction in the course, if such a course existed, was “descriptive, dry and rarely included economic analysis.” The profession took note and, thirty years later, claimed dramatic improvements. More high school students took economics, and the high school course contained more analytic rigor and less description and often covered basic economic concepts. Furthermore, high school teachers were better prepared as a result of taking credit course work and attending non-credit programs in economics (Walstad 1992).

Active learning materials for teaching high school economics have become more widely used in the last thirty years. In fact, since the 1970s, the National Council on Economic Education (NCEE) has produced and distributed a wide variety of curriculum materials (www.nationalcouncil.org and www.economicsamerica.org) that promote active learning in the high school classroom. In many of the activities, students participate in a process designed to further their understanding of economic principles and concepts, with their teachers using fairly standard teaching pedagogies (e.g., lecture/discussion, textbook reading, group work). With some activities, students examine a series of supply-and-demand diagrams and use them to explain production (Schag, et al. 1995, 17). In many of the activities, students participate in active learning but are not necessarily expected to make independent, critical, evaluative judgments and reasoned choices.

In this article, we present an innovative approach to integrating active learning into high school economics by using problem-based learning (PBL). Within this pedagogy, students construct knowledge about economic principles and concepts, following a curriculum that stimulates learning through independent research, critical, evaluative judgments, and reasoned choices. They learn the principles of demand and supply by researching solutions to projections of revenue and cost for twelve businesses.

In adopting a PBL approach to the teaching and learning of economics in high school, educators must deviate from more conventional instructional strategies along a number of lines (e.g., Torp and Sage 1998; Duffy and Savery 1994; Stepien, Gallagher, and Workman 1993; Birch 1986). PBL restructures traditional teacher/student interaction to emphasize active, self-directed learning by the student, rather than didactic, teacher-directed instruction. Students formulate and pursue their own learning objectives and select learning resources that are most appropriate to the problem they are seeking to resolve. Teachers coach with suggestions for further study or inquiry but do not assign predetermined learning activities. Instead, stu-
dents research a situation, develop appropriate questions, and produce their own solution to a problem.

The traditional PBL model, which was developed for medical schools, must be modified for the high school learning environment (e.g., Aspy 1993). In this article, we look at necessary adaptations, develop a PBL model for teaching and learning in high school, and describe a PBL curriculum for high school economics, using the example of a unit focusing on the principles of demand and costs.

The Problem-Based Learning Approach

Conventional medical education contained a course sequence that began with basic science courses and proceeded to clinical experience. However, as the conditions of medical practice changed during the 1960s and 1970s, medical educators debated the ability of traditional medical education to prepare students. Many denounced medical education as being "too preclinical" and questioned whether its collection of fragmented knowledge and reliance on memorization provided students with the problem-solving skills and motivation necessary for lifelong learning in a rapidly changing environment. In response, faculty at a number of medical schools introduced a tutorial process—Problem-Based Learning—to promote student-centered learning in a multidisciplinary framework, an approach that was believed to promote lifelong learning in professional practice.

With the possible exception of business schools, the PBL approach has been implemented most widely in medical schools. Although medical school models differ in their application (e.g., Bound and Felitti 1997; Schmidt et al. 1989; Barrows 1986a), the stages of a generic model can be described as follows (Barrows and Tamblyn 1980; Delisle 1997; Wilkerson and Gijselaers 1996):

1. A problem situation, which is the basis for stimulating learning, is encountered before any preparation or study has occurred.
2. The problem situation is presented to students in the same manner that it would be in the "real world." Often students encounter the problem within a small group that is guided by a tutor.
3. Students work through the problem in a manner that challenges their ability. The tutor facilitates learning by asking questions and monitoring the learning process.
4. Needed areas of learning are identified during the process and are used as a guide to individualized study.
5. The knowledge and skills that are learned in stages 3 and 4 are applied to the problem to evaluate the effectiveness of learning and to reinforce and contextualize learning.
6. The learning that has occurred through the process is integrated into the student's existing knowledge base.

Obviously, the PBL approach differs from the traditional lecture-discussion and activities pedagogy most often used in high school.

An Effective PBL Model for High School Economics

When the social institutions of medical school and high school are compared, striking differences exist. Those include the nature and diversity of the students, the intellectual goals of the institutions, the expectations held for student knowledge acquisition, the classroom environment in which learning occurs, and the definition of the student role. High school curriculum goals are determined by content-driven state testing programs, Advanced Placement exams, and district and state curriculum standards. As a result, high school teachers are often forced to focus on the coverage of specific subject matter rather than developing analytic skills. The pressure put on teachers to bring students up to district and state content-driven standards suggests that PBL curriculum materials must address standards if they are to be used. In economics, NCEE designed and disseminated the Voluntary National Content Standards in Economics in accordance with the Goals 2000: Educate America Act (www.economicsamerica.org) and developed the Test of Economic Literacy to assess students in the high school economics course (Soper and Waldstad 1987).

Using the above-mentioned five differences as a guide, we modified the medical school PBL model. A team that included high school economics teachers, an educational research institution, and economics faculty members at a university designed a PBL economics curriculum that uses features of the medical model but accommodates the differences between high schools and medical schools. The complete curriculum contains six units (www.bie.org) and meets all of the Voluntary National Content Standards in Economics.

The first problem in the curriculum introduces the principles of opportunity cost, scarcity, market economies, and circular flow by asking students to explain and illustrate the relationship between producers and consumers for a new shoe company. The second unit emphasizes trade by showing students that two islands, which have existed in economic isolation, increase total economic output through specialization and trade. The third unit is devoted to macroeconomics and has students discover the monetary and fiscal problems societies face during periods of inflation. The fourth unit introduces students to investment and growth by placing them in positions of economic advisors to a city that faces a fiscal crisis when its treasurer absconds with city monies. The fifth unit has students balance the advantages of the free market and entrepreneurship against those of economic institutions when a school is asked to accept corporate funding of programs. The sixth unit, described in detail below, illustrates demand and costs by having students weigh profit maximizing and political decision making when they, as student council members, must select restaurants to operate in their new food court.

Although the focus is economics, each unit presents students with the opportunity to improve their core skills
in teamwork, communication, time management, decision making, data collection, and research. For most of the problems, students prepare written materials, including charts and graphs, and make an oral presentation. As students progress through the curriculum, the assignments demand higher levels of skills. Each unit was tested repeatedly by economics teachers in high school classrooms, and each was frequently revised to ensure that curriculum goals could be achieved in a wide variety of settings.

In the economics PBL units, students and teachers confront a problem that, through investigation, research, and cooperative input, allows for more than one possible solution. Students discover that economics is essential to understanding and solving the problem. Because students recognize the need to understand economics, they become motivated to learn the material in the curriculum. The problems, although loose enough to allow for student discovery and independent learning, follow a highly structured series of steps or phases.

The phases of the model correspond to the medical PBL model that was outlined in the section “The Problem-Based Learning Approach.” Although the components are similar, the high school economics model contains more structure. The stages of the high school economics PBL are outlined below and illustrated with examples from one of the units, “The High School Food Court.” The stages are numbered in accordance with the medical school model outlined above.

1. Entry point. In the high school food court unit, students play student council members at a fictitious high school. They learn about demand and costs and also about market systems, economic systems, and public policy costs. They tackle the overarching concepts of tradeoffs, opportunity costs, and scarcity, which are at the core of all the units. The students’ task in the unit is to select five restaurants from among twelve bidders who want space in the high school’s new food court. The entry document is a memo from the high school principal explaining to the student council that the school board expects them to pick the restaurants and justify their selection. A percentage of the restaurants’ profits will go to the student council to pay for council-sponsored student activities. The memo makes it clear that this is to be the only revenue the student council has. Included in the memo are the terms revenue and profit as well as the instructions, “The President of our Board is an economist. So remember that, regardless of your decision, the rationale must be grounded in sound economic thinking.” The seeds of economic expectations begin to move students toward the curricular goals.

2A. Framing the Problem. Teachers coach the students through a questioning process that leads to the construction of a problem statement that asks the following generic question: How can we, as—, do—, so that—? In the food court unit, the initial problem statement may evolve to be: How can we, as the Student Council, choose five restaurants based on an established criteria, so that the needs of the students are met, the Student Council gets money, and restaurants maximize profits?

2B. Problem Twist. To maintain student interest and demonstrate the shifts that thinking must take with new information, the problems often take a twist as they unfold. In the food court case, the school principal sends an audiotape of a series of phone messages he has received. One is from the PTA president, who is concerned about the students’ eating fast food; one is from the school counselor who is concerned about low-income students having access to low cost, good food. The Gourmet Club members call to remind the Student Council that some students do not want to eat “cardboard” hamburgers. The council also hears messages from the Vital Vegetarians, the school-to-career counselor, and Ms. Stravinsky, the woman who donated the funds for the new student center and who wants to serve borsch at the food court. The students, in their roles as student council members, must weigh the demands of these competing constituencies against the restaurants’ profits, which pay for their activities.

3A. Knowledge Inventory (know /need to know). Teachers lead the class through a discussion and record knowledge that the students already have (know) and information that they still need (need to know) to arrive at a solution. The knowledge inventory process is repeated periodically throughout the unit. In the food court problem, students would include in the initial list of knows such statements as, “We get 20 percent profits from the restaurants,” and “School Board will vote on our proposal.” That is information gleaned from the principal’s memo (entry document). The initial need to know would include such questions as, “Which restaurants make a profit?” and “What foods do the restaurants serve?” (Note: Individual assessment of this inventory is undertaken in the problem log, 3B.)

3B. Problem Log. Students keep a to-do list, time line, questions, observations, outline for their group or individual project, and a list of resources. The problem log reflects students’ lines of inquiry, new questions that arise during the process of investigation, and their thoughts on the problem. Teachers can ask students to answer specific questions in the problem log. That helps the teachers track student progress toward solving the problem. Questions for students are provided in the teacher manual, so teachers can determine whether the construction of knowledge is leading toward the curriculum goals. In the high school food court unit, after the initial problem statement is developed, students are asked as a problem log exercise, “What do you think are the most important issues that the Student Council must consider?” After a list is distributed describing the twelve restaurants bidding for food court space, students are asked, “What are the positive and negative features of each restaurant?” After the revenue, cost, and profit tables are completed, students are asked, “What problems, if any, did you have with the computations and concepts presented in the tables? How can you use the information contained in the tables to help
choose the restaurants that will operate in the food court?" After the students listen to an audiotape of various groups lobbying for particular kinds of food, the students are asked, "What are the various constituency groups asking for? How will this information influence your selection of restaurants? How does this information alter your economic

redefinition of the problem statement. During the process, students recognize the need to know more about the principles of economics to solve the problem. They often ask the teacher at this point for instruction or coaching. If the problem log reveals that the students are not grasping key concepts, theories, or principles, the teacher can provide a mini-lecture to expand the student’s knowledge of the problem.

Each economics PBL unit contains the materials necessary to understand the topic: background information for teachers, specific PBL process information, and a complete set of materials for undertaking the problem and assessing the outcome.

reasoning about restaurants that should operate in the food court?"

4. Research and Resources. Teachers seed the investigation process with resources in the form of additional simulated correspondence, text, tables, and benchmark lessons. Students gather information to answer the questions: What do we know? What more do we need to know? What are potential solutions to the problem? The students must prepare tables for total revenue, daily costs, and daily profits. The blank tables are included in the teacher’s curriculum manual along with completed versions of each table. Although it is essential that the students understand total revenue or daily profits in order to solve the problem, it is at the teacher’s discretion how the tables will be completed. Some teachers ask that students complete tables using spreadsheet programs that they have learned to use in computer training courses. Others have students work in groups to complete the tables, and still others divide up the work by having individual students complete several lines of the tables and others complete them.

5. Teachable Moments. Students, with the teacher as coach, continually engage in a dialogue about what they have discovered and what they know/need to know, resulting in frequent reconsideration and possible

ed. After grappling with the problem, students will be receptive to the information because they will be able to recognize their need to know it. Detailed background information for the benchmark lessons is included in the manual for teachers. In the high school food court unit, mini-lectures are included for the topics of demand, costs and supply, profit, graphs, and computation of tables.

6B. Wrap-up and Debriefing. The teacher leads a discussion with the whole class encouraging students to consider the thinking that went into their problem solving, including analysis of both content and process (e.g., the adequacy of competing solutions as well as the difficulty of having to make choices).

Each economics PBL unit contains all of the materials necessary to undertake the unit. It includes background information to provide teachers with the necessary economics knowledge, PBL process information that is specific to each unit, and a complete set of materials to undertake the problem and assess its outcomes. All the elements are incorporated into a curriculum guide for teachers that includes:

* an example of a problem statement. In working through the unit, students develop the problem statement, which is often restructured as the unit unfolds. The curriculum guide provides examples of various problem statements throughout each iteration;
* a one-sentence introduction to the problem;
* a description of where the problem would best fit into the curriculum (i.e., which concepts students should know before undertaking the unit);
* a list of economic concepts that students should learn with the lesson. The concepts listed are layered. All students should learn the primary concepts, and the remaining ones will be learned as the students go deeper into the problem;
* a list of objectives for students to meet through the unit;
* a table illustrating which Voluntary National Content Standards in Economics are met in the unit;
* the approximate amount of class time required to undertake the unit;
* a one-paragraph description of the lesson;
* a description of the resource materials
needed to undertake the unit and where they can be found in the manual;
• an example of a sequence of the unit;
• a detailed procedure guide for using the problem. This includes a discussion of how students enter the problem, examples of coaching students toward a problem statement and through the “know” and “need to know.” It also contains a discussion of how the problem log can be used to focus students on economics, how the resources can be used as research materials, and how the benchmark lessons can be used to stimulate midpoint dialogues. Finally, the procedure section includes a discussion of the student product to be evaluated and aspects of the problem to be emphasized during the debriefing;
• a discussion of ideas to try and ideas not to try. Each problem is highly structured so students can be coached into learning the underlying economic concepts. During the field testing of each unit, we uncovered some disasters and some ideas for potential change. Each is highlighted;
• the document that introduces students to the problem (the entry document);
• background information for teachers to use in benchmark lessons (The benchmark lessons discuss many of the primary concepts in a traditional manner and provide the teacher with information for introduction at the appropriate teachable moment);
• a definition of each of the primary and secondary concepts around which the unit was designed. These definitions are written at a level for the teacher and not for the student;
• a copy of all the resource materials necessary for the problem;
• (if appropriate) a listing of questions that can be used during the students’ oral presentations;
• rubrics that can be used for evaluating students’ products;
• a multiple choice test. The questions can be used not only as a content assessment at the end of the unit but also to coach curricular focus while the problem is being unraveled.

Design Considerations for High School versus Medical School Problem-Based Learning

The first design consideration addressed in the PBL model for high school economics was the difference between the typical medical school student and the typical high school student. Because not all high school students are highly motivated in economics, the units were structured so that students would find the problems relevant and entertaining. Motivation comes from the ownership of the role the student must play in the scenario. If the problem does not provide such motivation, students may lose interest in the problem, devote little energy to learning, or stray from the curriculum.

PBL units were subtly structured to direct students to appropriate resources so they take ownership of their budding research skills. That structure means that there is less risk of conducting ineffective library research. Although it could be argued that this is a lost opportunity for learning, few high schools have the library or technological resources to accommodate intensive library searches for all students and all projects.

The second design consideration addressed was the institutional differences between medical schools and high schools. Because curriculum goals in high school are content driven, the economics units were structured to ensure that students learned specific concepts and principles. Although students can actively construct meaning through internal dialogue and thinking processes or through interaction with others, they generally cannot independently direct the course of the inquiry without wandering off the curriculum goals. Each of the units is tightly constructed to keep students from wandering off the curriculum goals. In the high school food court unit, students cannot change the restaurants’ menus or conduct a campuswide marketing campaign to increase demand for Ms. Stravinsky’s Borscht Palace. Students must use sound economic reasoning to justify their choices by operating under constraints and with the goal of maintaining profit for the student council. The expectations keep them focused on the curriculum goals of demand and costs, economic incentives, market economies, and public policy costs.

The third design consideration addressed was the different role of the instructor in teaching and learning. The typical high school economics teacher has only general subject matter knowledge. The high school economics PBL, therefore, provides a highly structured curriculum guide for teachers containing background information that is necessary to keep students focused on the curriculum goals. Although the PBL units are described fully in the curriculum manual it is essential that the teacher complete workshop training prior to using the units. Without training, teachers often place too much emphasis on the problem-based learning method and lose sight of the economics curriculum goals.

Finally, because PBL in high schools is often adopted by a single teacher (and not as part of whole-school curriculum reform), a support network for high school economics teachers undertaking PBL was developed. Workshops for teacher development in the PBL process helped establish a network of teachers using PBL in high school economics courses. The networks build the critical support needed to initiate new projects (e.g., Richardson and Placier in press; McLaughlin 1987; Shaver 1987) and to discuss problems that may arise during implementation.

In short, the medical PBL model was redesigned to meet content standards, structure a “real-world” problem, and provide a detailed, structured curriculum manual and training for high school economics teachers. The units are entertaining and engaging for students and lead to highly participatory, lively class work. Preliminary evaluation of the learning of economics in the high school PBL, compared to more traditional methods, can be found in Mergendoller, Maxwell, and Bellissimo (in press). The differences in execution of PBL in medical school and in high school economics show us that further
study of appropriate PBL models at other educational levels and in other subject areas must also be undertaken.

NOTE

1. In California, where one semester of high school economics is required to graduate, less than 2 percent of teachers teaching economics have an economics degree. Instead, teachers who are credited in the social sciences teach courses in economics, government, history, psychology, and sociology. Although the level of knowledge necessary for the "tutor" is actively debated in medical PBL (e.g., Barrows, 1988), the discussion is within the context of whether or not the tutor has specific knowledge within the field. There is no discussion of the impact of the tutor's general level of knowledge.

REFERENCES


