

CHAPTER 3

DEVELOPING PROBLEM-BASED LEARNING MATERIALS

ABSTRACT

A key issue for instructors revolves around the selection and development of suitable PBL materials. This chapter orients the reader to fundamental choices concerning these issues. These include defining alternative varieties of PBL as well as identifying potential sources of PBL projects. The bulk of the chapter is devoted to presentation of a template for the design of PBL projects. We highlight distinctive features of the project components that foreshadow the examples of PBL projects that comprise Part II of this volume.

INTRODUCTION

Whenever we discuss PBL with potential users, the conversation at some point turns to the issue of instructional materials. Common questions include:

- Are projects available in my area of teaching?
- Do projects take a long time to develop?
- Are they difficult to develop?
- Where should I begin?

These practical questions frame the concerns of potential users concerning adoption of PBL for use in their own classrooms. Although there are increasing numbers of management instructors using PBL around the world, we are unaware of any centrally-organized “PBL project banks” that management instructors can access.¹ To date, most sharing of PBL projects has occurred through informal networks.

In this chapter, we share what we have learned about the design of successful PBL projects. While our perspective on the design of PBL materials is informed by cognitive theory and trends in other disciplines that have been using PBL, we draw primarily on our experience. This included the following:

- Designing our own PBL materials from scratch;
- Converting existing “case problems” into PBL projects;
- Constructing PBL projects out of problems arising from consulting and research projects in which we or our colleagues were engaged;
- Guiding master and doctoral students in the design of PBL materials within the scope of thesis projects and graduate courses;
- Assisting colleagues in the design of PBL materials;
- Reviewing and evaluating PBL projects for publication.

We hope the chapter will assist readers by reducing the time and effort needed to design their own successful PBL projects.²

MAJOR CHOICES IN PROJECT DEVELOPMENT

We have discovered that three major choices determine the amount of time and effort that the instructor must expend when crafting PBL projects:

1. Who develops the project?
2. Should one start from scratch or adapt existing materials?
3. What version of PBL should be used?

Who Develops the Project?

We have used two different approaches to creating PBL projects. In the beginning, we developed all of our own PBL materials. We discovered that one project might take three or more weeks to create, field-test, and revise. As our familiarity with the process increased, we found that the required time and effort decreased.

Later we used several formats that involved students in developing PBL projects. Graduate students with a reasonable base of working experience have the capacity to develop excellent PBL projects. Some of our students have created and field-tested projects to fulfill dissertation project requirements for master or professional doctorate degrees.³ Other students, working individually or cooperatively, have developed projects as part of a course. In some instances, the resulting PBL materials have been of sufficient quality to disseminate and use internationally. Given this fruitful but largely untapped resource for project development, we would like to make some additional comments here concerning how we have worked with graduate students on this task.

Student-Designed Projects

To facilitate project development by students, we provide them with a set of learning resources. Students first develop an understanding of PBL by reading material about the nature, process, and effects of PBL. In addition, students receive a copy of the template discussed in the next section, an example of a completed project, and a set of guidelines for using the template. These guidelines resemble the ones we will introduce following initial presentation of the template.

Prior to commencing the development of a project, we encourage students to submit a project prospectus. This prospectus requires students to describe their focal problem and its significance, the resources they anticipate needing to develop the project, a calendar for completing the various parts of their project, their preliminary thoughts about pilot-testing their work, and the biggest concerns or questions they have about their PBL project.

Our role during the development of the project takes several forms. First, we provide feedback on the project prospectus by commenting on the suitability of the problem, scope of the project, potential obstacles, and additional directions they might wish to explore in relation to the proposed project. Then we facilitate its

completion by providing feedback, raising questions, suggesting possible resources, and commenting on the various components of their project as they proceed.

Irrespective of the context, our students have found the challenge of developing a PBL project to be a satisfying, rewarding, and profoundly educational experience. Moreover, when the students designing the PBL projects are themselves practicing managers, the resulting project materials often have an air of reality about them that university instructors can match only with difficulty. Thus, we are enthusiastic about the potential this method could have for the development of PBL materials in the future.

Moreover, although we have observed a global proliferation of professional doctoral programs, there remains a dearth of suitable research models for conducting the associated dissertation projects. The result is often a watered down academic dissertation of poor quality that neither contributes to new knowledge nor management practice. We assert that the development of PBL project materials represents one potential model that achieves some of the key outcomes of professional doctorates: deep knowledge of selected knowledge domains, ability to apply this knowledge to problems of the profession, and knowledge-rich products that contribute to management practice.

Should I Adapt Existing Materials or Start Anew?

PBL requires considerable time and effort to implement, especially when the instructor decides to develop new materials from scratch. The novice PBL instructor is especially handicapped by a lack of in-depth understanding of the PBL process. This suggests the advisability of using existing PBL projects or adapting existing PBL or case materials. If one is considering the use of PBL on a *trial basis*, one can reduce the front-loading of time and effort substantially by choosing a project that is already available.

In the Mahidol University management curriculum we have designed or adapted PBL projects that address problems in leadership, organizational behavior, strategic management, marketing, project management, MIS, and human resource management. Bridges has designed a similar range of materials focused on educational management that were developed for use in Stanford's Prospective Principals Program. We have included sample PBL projects in Part II of this volume, along with detailed discussions of their use in management education. These represent a variety of different project types in terms of design characteristics, problem focus, and disciplines represented in the learning resources.

What Version of PBL Should I Use?

As we noted in Chapter Two, the basic unit of instruction in a problem-based learning curriculum is a *project*. PBL projects come in two forms: *problem-stimulated and student-centered*.⁴ We list the components of each project type in Table 1. In the next section, we discuss and illustrate each of these parts, while providing a template for their development.

The major differences between the two types of PBL projects concern who identifies the learning objectives, the resources, and the guiding questions. In problem stimulated projects, the instructor assumes primary responsibility for this task. In a student-centered project, the student assumes primary responsibility for these three components.

In terms of the *front-loading* of time and effort involved, student-centered learning projects require less instructor time and effort. Since the students identify their own learning objectives, locate the relevant resources, and generate the guiding questions, the instructor does not need to spend time developing these three components of a PBL project. Additional time is saved in future use of the project since the instructor does not need to update these components as new issues and literature emerges. The students will set their own learning objectives and seek out their own learning resources as part of the problem-based learning process.

Chapter Fifteen provides an example of a student-centered PBL project that has been used at Mahidol University in our *Organizational Behavior* course. In this project, even the problem is left for the students to define. This student-centered project provides a template that others could use to design student-centered projects for any number of different courses or topics.

Although less front-loading is required in creating a student-centered project, there are also some costs. When given the opportunity to choose their own learning objectives, students may identify ones that only partially overlap with those considered important to the faculty. Since students are generally less knowledgeable than faculty about the subject content, they may fail to locate high-quality resources in the time available to them. Moreover, in student-centered projects, students may cover less of the content deemed desirable by the instructor than is possible in problem-stimulated projects. Although we have been impressed with some of the outcomes achieved from student-centered projects, our experience suggests that this form of project is less consistent in terms of results.

Table 1. *Components of Problem-Stimulated and Student-Centered PBL Projects*

Features	Problem-Stimulated Projects	Student-Centered Projects
<i>Introduction</i>	X	X
<i>Problem</i>	X	X
<i>Learning objectives</i>	X	
<i>Resources</i>	X	
<i>Product specifications</i>	X	X
<i>Guiding questions</i>	X	
<i>Assessment exercises</i>	X	X
<i>Time constraints</i>	X	X

Most of the projects included in the succeeding sections of this volume represent *problem-stimulated projects*. We have chosen to focus primarily on this variant of PBL due to several characteristics and goals of management education. Foremost among these is that we expect students to conduct their projects as *self-managing teams*. Unlike most of the medical schools that employ PBL, we do not provide a faculty tutor to facilitate the group's deliberations. Students fulfill this facilitation role themselves.

Our rationale is twofold. First, we have resource constraints. Second, we wish for our management students to gain the experience of learning how to manage their own teams. Indeed, as we asserted in Chapter Two, a management curriculum should offer students structured opportunities to develop and refine their management skills as well as to experience the emotional consequences of managing others. The use of self-managing learning teams in a PBL context offers this opportunity.

The use of self-managing teams does, however, increase the ambiguity of the learning process for students. In Asia, for example, the vast majority of students enter graduate programs accustomed to conventional learning methods. We find that the additional structure of problem-stimulated projects aids students in making the transition to PBL.

Indeed, at Mahidol University, we believe that the predominant use of *problem-stimulated projects* facilitated our relatively rapid implementation of PBL, even in a "traditional" Asian context. Problem-stimulated projects represent a somewhat less radical departure for students. As suggested above, they are also more efficient in the sense that we have greater certainty that students will be working with quality learning resources.

GUIDELINES FOR DEVELOPING A PBL PROJECT

When developing the following guidelines, we assumed that the instructor will already have decided to use the problem-stimulated variant of PBL. These guidelines would apply regardless of whether the instructor or a student was designing the project. They are also similarly applicable regardless of whether the instructor is adapting a case for use in a PBL mode or starting from scratch.

The Template

As we indicated in the preceding section, each problem-stimulated project has eight major components: introduction, problem, learning objectives, resources, product specifications, guiding questions, assessment exercises, and time constraints. In the paragraphs that follow, we discuss each component in terms of purposes it serves. We then illustrate each project component using excerpts from a PBL project.

The illustrative project is one that we used at Vanderbilt University as well as at Mahidol University, *Systems Thinking/Systems Changing*. The project is organized around a problem-based computer simulation that focuses on the challenge of developing an organization's capacity for learning and change. The reader may refer

to any of the chapters in Part II in order to get a more in-depth feel for the range of information included in these components in other PBL projects.

An Introduction

This component introduces the student to the focal problem for the project and provides a rationale for including the problem in the curriculum. The introduction states how and why the project is relevant to the work of the manager and connects the problem and the learning objectives to the reality of the workplace. The introduction should serve to motivate the student by answering the questions: “Why would I want to participate in this project, and what will I gain from it?”

Sample: Introduction

Many organizations today find themselves undertaking a number of projects as part of their change effort. An organization may simultaneously be working on TQM, process reengineering, employee empowerment, and several other programs to improve performance. But the key to the change effort is not attending to each party in isolation; it's connecting and balancing all the pieces. In managing change, the critical task lies in understanding how pieces balance one another, how changing one element changes the rest, how sequencing and pace affect the whole structure. (Duck, 1993)⁵

In the post-modern era, the capacity of organizations to adapt and to respond rapidly and effectively to changes in their environments can spell the difference between becoming an industry leader or a dinosaur. In the past, the success of an organizational change was often attributed to the efforts of an individual or perhaps a team. Today, we increasingly view the capacity to change as an attribute of an organization. The best example of this perspective is illustrated in the efforts of companies to become *learning organizations*.

In the words of Peter Senge, a learning organization is able first to envision its desired future, and then to develop its internal capacity to create that future.⁶ The term, *learning organization*, highlights the relationship between successful change and the collaborative learning of people throughout the organization. Learning organizations have developed structures, processes, and cultures that support the ongoing learning of individuals, teams, and business units. These characteristics of the learning organization enable individual leaders and project teams across the company to bring about changes continuously and with a higher rate of success.

Despite the attractiveness of this concept, transforming the concept of a learning organization from the abstract into practice is more difficult. This project is organized around *Systems Thinking/Systems Changing*, a problem-based, computer simulation. Its purpose is to help develop your ability to lead continuous improvement in organizations.

By engaging in the *Systems Thinking/Systems Changing* simulation, you will refine your ability to understand how to develop the capacity of organizations to become learning organizations and, more generally, to think strategically about organizational change. The simulation draws on three decades of research on change efforts in organizations. Through the project, you will learn to apply change principles drawn from several research-based models: Systems Thinking, TQM (Total Quality Management),

CBAM (Concerns Based Adoption Model of Change), Learning Organizations, Change Adopter Types, Diffusion of Innovations, and Knowledge Management.

In this simulation, you will assume the role of a project team charged with helping develop the long-term capacity of your company to adapt to change. The overall goal of the project is to help transform the company into a *learning organization*. During the simulation, you will work with staff from Head Office as well as several branches. Your goal is to reorganize management processes to increase the company's capacities for:

- Thinking systemically,
- Learning individually and collectively,
- Adapting to change,
- Improving stakeholder satisfaction,
- Improving productivity.

Systems Thinking/Systems Changing simulates an organization that is learning to use these tools to make positive changes. Enjoy the challenge of bringing about change!

Problem

Each PBL project is structured around a high-impact problem that the administrator is apt to face in the future. A high-impact problem is one that has the potential to *affect large numbers of people for an extended period of time*. Some of these problems are highly structured, while others are complex, messy, and ill-defined.

Both structured and ill-defined problems may take one of the following forms:

- *The swamp*, consisting of a complex problem that contains numerous sub-problems.
- *The dilemma*, in which the manager knows what is wrong but must choose among alternatives involving a sacrifice or trade-off of important personal and/or organizational values or objectives.
- *The routine problem*, one that most managers encounter regularly in their work.
- *The implementation problem*, in which the manager must figure out how to ensure the successful implementation of a new policy or program.

In our view, students need opportunities to confront a variety of types of problems in order to gain an understanding of the different challenges that accompany them. Empirical studies of expertise in managerial problem solving support this approach. These studies find that expert managers are better able to identify the key issues in managerial problems.⁷ Their approach enables them to develop *routines* for finding and solving problems.⁸ Educational programs can contribute to the development of managerial expertise by providing guided practice in understanding and solving problems similar to those that students will encounter in the workplace.

The sample problem shared below is only an excerpt from the computer simulation. At the start of the project, the problem scenario is left intentionally vague. As is the case with many organizational problems, it is only through trying to solve them that you actually discover the sub-problems. Thus, in this project, the

problem scenario unfolds gradually. As the project team engages in the simulation, members gain access to additional information about the organization's history, the perspectives of individuals, the corporate culture of different branches, value conflicts, political issues, and social cliques and relationships.

Sample: The Problem

You are members of a project team appointed by the Managing Director of the *Best Company*. Your team just met for the first time and you don't know whether to feel shocked, confused, angry, or pleased. At the meeting, the MD gave the charge to your project team to spearhead a new company-wide initiative to become a *Learning Organization*. Your confusion comes from the fact that not very much about the initiative seems very clear. Thus far, about all that you know can be summed up in the following:

- The MD went to a conference and came back excited about the idea of learning organizations. He said that it would solve continuing problems that the company was experiencing in improving product quality, stimulating innovation, breaking down departmental barriers, and adapting to technological changes in the industry.
- However, when queried about what this concept of a learning organization was, he was rather vague. He did share a handout from the conference which stated: "A *learning organization* systematically plans, acts and monitors its progress towards the goal of benefiting all of its stake-holders. In a learning organization people work together to create their desired future. They think and work in innovative ways and are continually learning how to learn together."⁹
- While that sounded good, it provides little guidance to the team.

Nonetheless, you have been assigned to the internal project team responsible for implementing the learning organization approach in the company. Your team will be working with staff in three branches as well as the Head Office to begin the task of creating a learning organization. You will shortly read about each of the staff who you will be trying to influence in the simulation. In the simulation, you will work for three years to accomplish two goals:

- To move most members of the company through the stages of becoming a learning organization from lack of awareness to consistent skillful use of relevant practices.
 - To produce as many *stakeholder benefits* as possible through making improvements in the workplace. *Stakeholder benefits* include improved staff morale, higher customer satisfaction, increased productivity, and higher profits.
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Learning Objectives

These objectives, limited in number, signal what knowledge and skills the student is expected to acquire by completing the project. These objectives often emphasize higher order thinking (e.g., analysis, application synthesis, evaluation), as well as basic concept understanding. As we shall elaborate shortly, the learning objectives form a link between the problem and relevant knowledge domains.

Sample: Learning Objectives

1. To understand and be able to apply concepts of organizational change including Total Quality Management, Learning Organization, Knowledge Management, Change Adopter Types, Change Management.
 2. To analyze change problems from a systemic perspective;
 3. To develop and apply strategies for transforming companies into learning organizations.
 4. To work effectively as a team in a problem-solving context under time constraints.
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Resources

For each project, the student receives some combination of the following types of resources: books, articles, videos, website links, and consultants (instructors or practicing managers). The specific nature of the resources depends upon the learning objectives, the problem that is the focal point of the project, and the culminating product or performance. Since students often bring specialized knowledge and skills to a project, they should be encouraged to inventory the resources existing within their own project team and to take advantage of the material and human resources in their own organizations. The resources should also be designed so as to draw upon relevant knowledge that they may have learned in other courses.

Sample: Resources

- Garvin, D. (1993, July-Aug). Building a learning organization. *Harvard Business Review*, 79-91.
- Hallinger, P. (1998). Increasing the organizational IQ: Public sector leadership in Southeast Asia. *The Learning Organization*, 5(4), 176-183.
- Marquardt, M. (2002). *Building the learning organization*. Palo Alto, CA: Davies Black Publishing.
- Rogers, E. (2002). *Diffusion of innovations*. New York, NY: The Free Press.
- Senge, P. M. (1990). *The fifth discipline: The art and practice of the learning organization*. New York: Doubleday.
- Senge, P., Kleiner, A., Roberts, C., Ross, R., & Smith, B. (1994). *The Fifth discipline fieldbook: Strategies and tools for building a learning organization*. New York: Doubleday.
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Product Specifications

Each project culminates with some type of performance (e.g., role play of a supervisory conference, oral presentation of a plan), product (e.g., simulated implementation, strategic plan, corporate website, memo to the HR Director), or both. In our experience, these culminating experiences, along with the focal problem, exert a profound influence on what students learn during the project. Therefore, it is imperative that the project designers choose their product or

performance with considerable care. By consciously varying the products, one can enhance the learning that occurs as a result of participating in a series of PBL projects.

These products ensure that students will deal with issues involved in getting results through others. Team products require students to reach group decisions, to confront varying views about what the problem is and how it should be handled, and to figure out how they should organize themselves to create the product within the time constraints. These products provide a focus for the team's efforts, an incentive for learning, and a means by which the leader and team members can judge the effectiveness of their efforts. They contribute to learning by forcing students to transform abstract concepts and principles into workable solutions. The requirement to put the solution into the form of a relevant performance or product means that the solution can be assessed not only in academic terms, but also according to professional standards relevant to the workplace.

Since real-world products are often ambiguous, the product specifications reflect similar levels of imprecision. Prospective managers need to learn how to function effectively when the task is unclear and how to cope with the psychological discomfort that often accompanies such uncertainty.

The products specified in our illustrative project involve the simulated implementation of change in an organization. The students' results on the simulation itself, thereby, comprise the primary product or performance. The simulation actually classifies the results according to the level of mastery of the implementation strategy. However, in this project, we also ask students to write a reflective paper in which they elaborate on "their strategy" and then discuss "what actually happened" during implementation. The paper, while not a workplace product per se, assists the instructor in understanding the thinking of the students as well as stimulating students to explicitly relate important concepts to the application of the learning organization.

Sample: Product Specifications

1. *Simulation:* Following completion of the 3rd class session, play the simulation through to completion as a team. Print out and turn in your strategy record sheet.
 2. *Strategic Analysis of Change:* As a team, review your results in the simulation. Then prepare a team report that addresses the questions below. Attach your *strategy record sheet* to your report as an appendix.
 - a. Was your team *successful* in creating a learning organization? On what bases would you judge your success? Refer to your results to back up your response.
 - b. Describe your goals and strategy for each of the three years of the simulation. For each year, describe the change process by giving examples of the sequence of activities that you used to implement your strategy. Discuss why your strategy was successful, or not.
 3. *Simulation Results:* In the final class session, you will complete the simulation again individually in class. Print out your results and turn them in to the instructor.
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Guiding Questions

With each PBL project, we provide several guiding questions. These questions serve several purposes:

- To direct students to key concepts,
- To assist students in thinking through the problem, and
- To stimulate students to view the problem from alternative perspectives.

Students may elect to discuss any of the questions that seem important to them or to ignore the questions completely. Accordingly, they are not required to prepare written answers to the guiding questions or to set aside time for discussing them. How students choose to use these questions rests entirely with them.

Sample: Guiding Questions

1. What are the positions and interests of the various actors in this situation?
2. How do the problems presented by individuals affect the dynamics of their social groups and organizational units?
3. What are the main obstacles to systemic change in this company?
4. As a project team, which activities will assist you in developing a system-wide view of problems?
5. How does the collection and analysis of data assist in fostering your change effort?
6. What roles do people in the organization play in fostering system-wide change?
7. How do different sources of power affect the implementation of change?
8. Who do you need to include in activities in order for the activity to be successful?
9. What happens if you don't obtain participation from all stakeholder groups?

Assessment Exercises

As we underscored earlier, assessment in PBL serves learning and, thereby, promotes personal growth and improved performance. In line with this philosophy, within a PBL classroom environment, assessment accomplishes several purposes:

- To contribute to the revision of projects to make them more productive and meaningful learning experiences for students,
- To promote retention, transfer, and application of student learning,
- To foster introspection and reflection,
- To cultivate the appropriate use of knowledge and skills, and
- To determine the extent to which students, individually and collectively, have achieved the learning objectives of the project.

The first four of these purposes are formative in nature and are accomplished in various ways. Throughout the project, students receive feedback regarding their process skills (e.g., facilitating meetings, setting agendas, handling conflict) and

their utilization of the problem-relevant knowledge. At the conclusion, each project contains assessment exercises that elicit students' reactions to the experience and stimulate them to reflect on what they have learned how they might use these insights in the future. We discuss these issues in greater depth in Chapter Six on Student Assessment.

The last of the assessment purposes noted above is summative in nature. It refers to our efforts to understand whether students learned "what we intended for them to learn." With this purpose in mind, the PBL projects include a variety of assessment exercises (i.e., quizzes, exams), products, and performances that are systematically assessed. In particular, as we shall elaborate upon in Chapter Six, the need to reliably assess student products and performances has been one of the most significant challenges to successful implementation of PBL in the program at Mahidol University.

In this PBL project, the assessment of student knowledge draws on a combination of performance products, examination, and reflective exercises. Evaluation in this project addresses the learning objectives and serves several purposes. Therefore, the evaluation components focus on:

- Student understanding of the core change theories,
- Student ability to think analytically and to apply change theories to the design and implementation of systemic change strategies,
- Student teamwork,
- Student perceptions of their own learning,
- Student feedback that can improve the design and implementation of the PBL project.

Sample: Supplementary Assessment Exercises

1. **Knowledge Exam:** You will complete a Knowledge Review exam during the final class session.
 2. **Teamwork Assessment:** Complete the Teamwork Assessment Form on each of your teammates and turn them in as directed by the instructor.
 3. **Talk-back Sheet:** Complete and turn in the *Talk Back Sheet* to the instructor when completely finished with the project.
 4. **Reflective Essay:** Following completion of the project, write a two page Reflective Essay reflecting on what you have learned from this project.
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Time Constraints

Most projects that we have designed require six to 21 hours of inside and/or outside class time. Projects terminate when the learning and product objectives have been achieved, or the clock has stopped. The clock is a constant enemy in the conduct of problem-based-learning projects. Team members find themselves continually struggling with the dilemma that confronts every conscientious manager, namely, how to achieve a reasonably high level of performance within given time

constraints. Managing this dilemma requires participants to make difficult choices and to set priorities (e.g., family vs. work, quantity vs. quality of output, learning objectives vs. product objectives). Moreover, the dilemma underscores the need to work efficiently and to adopt time-saving measures.

We have used PBL in a wide variety of time formats. These include once per week for three hours, week-end mode with all-day sessions, and twice per week for 90 minutes. While the instructor must shape the delivery of the project to these constraints, we have not found one mode to be superior to others. With proper planning, any of these formats can succeed.

Using the Template

To assist those who choose to use our template in developing a PBL project, we describe the process that we have generally followed. When reading our description, bear in mind that the actual process is less straightforward and sequential than our discussion suggests. The process is more fluid and dynamic; the developer moves back and forth among the components to ensure that they align to form a coherent whole. Moreover, the process of project development is more challenging than it initially appears. In the words of one student:

Developing the PBL project was far more work than I ever imagined. The project kept growing...I learned that although the projects look as though they'd be easy to develop when you're working on one in class; they aren't.

Although we organize our discussion of the process around each of the components, we have tried to show the relationships among a project's various parts. We have discovered that students often become preoccupied with getting the individual components right and lose sight of the linkages between and among them. One of our students underscored this point when he wrote in his "Talk Back":

I learned the importance of integrating the introduction, learning objectives, performance requirements, resources and evaluation. I now view the project as more of a system than discrete parts. Seeing the interrelationship of the sections gave me new insights into the difficulty of developing a good PBL project and the power of that project for the participant.

The Problem

The starting point for developing a PBL project is a focal problem; *the problem comes first, then the learning*. When selecting a problem, the designer of the project should attempt to choose one that is representative of the kinds of problems students are likely to encounter in the roles and contexts for which they are being prepared. Moreover, the problem should be one that affects large numbers of people for an extended period.

Since an important skill to be obtained through problem-based learning is problem-finding, we strive to create problem scenarios that contain numerous sub-problems. If the problems presented are too clearly defined, two things often happen. First, students lose the opportunity to engage in problem-finding. Second, the problem loses some of the flavor of reality. Sometimes the sub-problems are

included in the initial problem scenario given to students; in others, such as the *Systems Thinking/Systems Changing* problem cited earlier, they are revealed later.

A large portion of the problems that managers face are messy, ill-defined, and difficult to disentangle. Therefore, even if there is a set of technical skills that the designer wants students to acquire within a given project, it is likely that those skills will be used in an organizational setting that is rife with cultural norms, ethical conflicts, and corporate politics. Students need to experience applying technical skills with due consideration of the problematic contextual issues that tend to complicate organizational life.

Having chosen the problem to be included in the project, the developer then decides how to present it. Focal problems can be presented as a written case, a case incident, a live role-play, a real-time issue, an interactive computer simulation, an interactive videodisc presentation, or a videotaped episode. We offer examples of most of these approaches in Part II of the book.

Features of Distinctive Problems

- High impact on the manager, the organization, and/or clients
- Typical, rather than atypical, of managerial problems
- High importance to those experiencing it
- Messy, rather than narrow and clear
- Realistic, not contrived
- Sufficient information for the reader to know what is in the situation and to prepare the products

Sole reliance on written cases or verbal vignettes, as Bransford¹⁰ and others have noted, may have dysfunctional consequences for the learner. For example, the manager who is trained to make assessments based solely on verbal vignettes may be at a loss when confronted with real people! Since the verbal vignette itself is “the output of an expert’s pattern recognition process, the student may not learn “to recognize symptoms like ‘slightly defensive’ and ‘moderately depressed’ on their own.”¹¹

To become an expert, a great deal of perceptual learning must occur, and this cannot happen unless the student learns to recognize the salient visual, auditory, and nonverbal cues. When designing a series of PBL projects, program designers should strive to include problem representation that incorporates a variety of modalities. If students encounter only verbal descriptions of problems, they may be unprepared to deal with real people and real problems.

Moreover, in contexts, such as Asia, where many of the students are studying management courses in a second language, text cases can be problematic. Video cases provide additional modalities for students to understand the nuances of a problem scenario.

The Product

Once the problem and its mode of representation have been chosen, the next task is to specify the nature of the product or the performance through which resolution of the problem will be expressed. We view the product as the second most critical element of the project. From the outset of the project, it shapes the students' perception of how the knowledge and skills to be acquired figure into the work of a leader. Moreover, the product represents in the minds of students the action element of the project. The performance aspect of the product, therefore, acts as a major motivator and mediates the students' understanding of the project.

Features of Distinctive Products

- Forces students to go beyond analysis to solution implementation
- Mirrors the form of problem resolution and expression in the real world
- Promotes collaboration among team members
- Builds on previous learning
- Requires a performance that is reasonable in light of the information provided about the problem and the context, the resources, the learning objectives, and the time allocated
- Identifies prerequisite skills needed for completing the product and provides the resources needed to acquire necessary skills

When creating products and product specifications, designers should strive to follow these guiding principles:

- Primary products should be authentic, similar to ones a manager would actually create or engage in when resolving the problem.
- Products should enable students to use knowledge and skills learned in the current as well as previous projects.
- Product specifications should require students to take action and to grapple with issues of implementation.
- Products should challenge students to transform theoretical analysis into the format and language of action, be it in a memo, a supervisory conference, or an interview.
- Product specifications should place students in situations where they experience the consequences of their actions and the actions of other team members, and are able to gain feedback.¹²

When developing the product specifications, we have found it useful to involve practicing managers in designing realistic products and performances.

Learning Issues

With the focal problem and the culminating product or performance chosen, the next step is to identify the learning issues that are inherent in solving the problem and preparing the product. We have found it helpful in identifying the learning issues to distinguish between the problem-relevant knowledge that is the focus of the project

and the related, requisite skills and knowledge that students need to complete the project successfully.

By way of illustration, in the *Systems Thinking/Systems Changing* project we identified problem-relevant knowledge by convening a group of relevant experts and asking them the same sorts of questions that we ordinarily pose to ourselves:

- What knowledge, drawn from theory, research, practice, is most directly pertinent to the core issues in the problematic situation?
- What other knowledge domains (for example, legal, financial, historical, organizational, political, and psychological) might be helpful to the student in understanding and dealing with this situation?

Once we identified the problem-relevant knowledge, we turned to uncovering the additional skills and knowledge required to complete the project. These skills and knowledge are more difficult to discern because they are often implicit and taken for granted. In an effort to identify these potential learning issues, we consider the centrality of various skills in solving the problem and developing the solution products. This analysis could point towards skills in problem-solving, running meetings, managing task forces, leading a project, preparing memos, making oral presentations, and conducting conferences. If we suspect that students may lack one or more of these skills, we include them in our list of learning issues.

Learning Objectives and Resources

Describing the focal problem, specifying the product(s), and identifying the potential learning issues lay the groundwork for choosing the major learning objectives and key resources. In selecting these major objectives, we generally emphasize ones that relate to the learning issues identified as directly relevant to the core issue or issues in the problematic situation. When constructing these objectives, we strive to state them in terms of what students are expected to *learn* from the project, not in terms of what they will be *doing* in the project.

The resources that we include with each project cover a broader range of learning issues than the ones directly applicable to the learning objectives. In addition, these resources illuminate various facets of the problematic situation (for example, pertinent legal and historical content), and they provide knowledge and skills that students may lack but are essential to solving the problem and/or preparing the product. Whenever possible, the resources expose students to the relevant theory and research and provide examples of how theory and research have been translated into organizational policy and practice.

Features of Distinctive Learning Objectives

- Stress different learning domains (i.e., cognitive, skill, and affective)
- Emphasize development of analysis, application, and synthesis, as well as basic knowledge and comprehension
- Appear reasonable in scope given the other parts of the project (for example, time constraints, resources, problem, and product)
- Accent what students will learn from the project, not what they will be doing to prepare the product

In choosing resources for a project, we have used consultants in various ways. For example, practitioners who have encountered similar problems in their own professional practice may be invited to suggest materials that they have found useful in understanding and dealing with the problem that is the focal point of the project. Practitioners and professors who are expert in the problem may also be provided for the students as they work on the project, either live or via a video clip.

When we include consultants, we establish a set of norms. Consultants are prohibited from providing advice on how to handle the problem. Instead, they are encouraged to answer questions that student might ask in relation to the problem and to raise questions that might sensitize students to aspects of the problem they may have overlooked.

Features of Distinctive Resources

- Variety of forms (print, video, human, internet)
- Useful in framing/resolving the problem and developing the product
- Interdisciplinary, rather than single subject
- Representative of multiple types of knowledge (theory, research, practical wisdom) and points of view relevant to the problem
- Reasonable number in light of time constraints

Guiding Questions

The next step in the process of developing a PBL project involves stating a set of “guiding questions.” When we discussed the template in an earlier section, we suggested three purposes that may be served by these questions. In choosing which purposes to emphasize, we generally have relied on our judgment about whether the problem was so messy and complex that students may need some assistance in thinking through the problem. We also have considered whether students are likely to frame the problem by making a fundamental error, namely, viewing the problem solely from the perspective of the people involved. Finally, we have exercised our judgment as to whether students may overlook or dismiss without much thought concepts that may prove useful in illuminating and dealing with this type of problem.

Features of Distinctive Guiding Questions

- Stimulate consideration of alternative viewpoints
- Suggest issues that may not be apparent to students given their stage of professional development
- Foreshadow issues that pertain to the product, as well as to the problem
- Raise issues relevant to the knowledge domains included in the resources

Assessment Exercises

With each project, we include several types of assessment exercises. To ensure that projects continue to provide productive and meaningful learning experiences, we include a “Talk Back” sheet. At the completion of a project, students use the

“Talk Back” sheet to discuss what they liked about the project and how it might be improved. Their suggestions for improvement usually center on the resources, the problem, or the product. Regardless of how many times the project has been used, we continue to solicit students’ reactions to it. Through repeated assessments conducted over time, we can obtain suggestions for improving the project and determine when it no longer provides a productive and meaningful learning experience for students.

To encourage reflection, retention, and transfer, we often ask each student to prepare a two-page integrative essay at the end of a project. These essays capture what students have learned and how they propose to use their knowledge in the future. The designer of the project should suggest some possible questions for students to address in this essay. We have suggested questions like the following:

- What principles or approaches have you learned in working with this problem that will help as you work on future problems with similar characteristics?
- What new information did you acquire that changed your knowledge and understanding of this problem?
- Is it possible for you to construct an outline, model, or generalization about the processes involved in dealing with this problem?
- What have you learned about project leadership, meeting management, problem-solving, and the work of the manager that may be of use to you in the future?
- What did you learn about yourself, your ability as a leader, and your participation in a management team as you worked on this project?
- What did you learn in a previous project that proved helpful in this one or needed to be revised in light of what happened during this project?
- What strongly held personal views, beliefs, or opinions have been changed during this project?
- What questions have been raised in working with this problem that suggest the need for further study?¹³

Depending on the preferences of the designer, the student may be given the option of choosing what to discuss from a list of possible questions or may be required to discuss one or two questions of particular interest to the person constructing the guidelines for the essay.

If the problem-relevant knowledge is relatively technical (for example, legal requirements for intellectual property), the designer may wish to include a knowledge review exercise and to provide the answer key after students complete the exercise. In Chapter Six, we supply an example of a Knowledge Review exercise.

Time Constraints

Setting realistic time limits for a project becomes more feasible as the designer gains experience with PBL. In the beginning one can expect to underestimate the time students need to complete a project. The upside of underestimating the time is that it provides students with an opportunity to experience how they react to the stress and

time pressures that are so characteristic of managerial work. However, the downside is that underestimates can frustrate students and result in their slighting the learning to “get the product out the door.”

Given this potentially undesirable outcome, we are now inclined to make liberal estimates of the time required to acquire the knowledge and to use it to produce a high-quality product or performance. If students lack a background in meeting and project management and have not worked together previously, they will require even more time to complete a project.

Introduction

Although this component of a project appears first, we have discovered that it is easier to prepare the “Introduction” last. Possessing greater familiarity with the problem, the product, the learning objectives, and the resources, one has a deeper sense of how and why the project is relevant to the work of the administrator.

When writing the “Introduction” different techniques can be used to engage the reader. An interesting quote or an anecdote can capture the readers’ interest and assist them in understanding why the problem to be addressed in the project is important. Citing statistics that show the prevalence of the problem can also underscore the significance of the problem.

Identifying the consequences of failing to handle the problem successfully can further highlight its importance and relevance. For example, choosing the wrong candidate for a shift supervisor position creates numerous future problems – time spent on responding to customer complaints, assisting the staff member, documenting the poor performance; and profound pain and anguish for the staff member and manager if the employee must be dismissed.

Features of Distinctive Introductions

Content

- Describes how and in what form this issue arises the current organizational context
- Indicates why this issue is salient to administrators
- Suggests how the knowledge and skills included in the project are useful in dealing with this issue

Style

- Engages the reader
- Uses active voice and straightforward, intelligible language
- Discusses the content succinctly and to the point

Finally, concluding the introduction with a statement that tells readers explicitly what they are going to learn through this project may stimulate their interest in the project.

Field-Testing the Project

When the designer has completed a draft of the project, it should be field-tested. The importance of field-testing a project is reflected in this student’s comments:

“The field test was essential. I thought the project was in good shape, but the test revealed it needs more depth and more clarity in the instructions.”¹⁴

We heartily agree with her observation, and other project developers have echoed these same sentiments. Prior to the main field-test, we have found it useful to conduct a preliminary field-test. This dry run ordinarily occurs with a small group of colleagues (student or faculty) whom we have asked to review the project and to provide feedback. Their feedback usually centers on the clarity and unity of the project, as well as the suitability of the resources and the guiding questions. Their comments often lead to another round of revision prior to the main field-test.

The main field-test represents the real thing. Students receive a copy of the entire project (all components), along with the resources, and implement it within the time constraints. By observing students work on the project and reviewing their “Talk Back” sheets, the author of the project may discover problems like the ones that we have uncovered in our own field-tests.

The following are representative of issues that we have encountered:

- Students experienced the problem or the product as contrived.
- We overlooked some critical knowledge or skills students needed to complete the project successfully.
- The instructions or guidelines that we gave the persons providing the feedback were inadequate or unclear.
- We either underestimated or overestimated the time required to complete the project.
- We included too many resources.
- Some of our resources were either poorly written or of little value in dealing with the problem or preparing the product.
- Our guidelines for the product were too ambiguous.
- The various components of the project were insufficiently linked to one another.

When issues like these surface during the main field-test (as they nearly always do), they become an occasion for revising the project.

The *completed* PBL project should not, however, be viewed in the same way as a completed sculpture. We contend that the instructor is best served by viewing any PBL project as a continuous work in progress. In our own experience, at the start of any given term, we may tweak the project in terms of the learning resources, the time frame, or the learning process or products.

Designing Multiple Versions of a PBL Project

Given that the development of PBL materials represents a considerable investment of time and effort, it makes sense to gain maximum benefit from each PBL project. Here we wish to alert readers to the fact that a field-tested PBL project also represents a foundation for the development of additional versions of a single project.

As we shall elaborate in Chapter Seven, at Mahidol University the Master of Management program serves a large number of students. More than 300 students

could be studying in the PBL track at one point in time. This means a PBL project could be delivered to as many as four or five different class *sections* in a single term.

This situation produces two significant problems for the sustainability of the PBL program. The first issue concerns educational quality. With this number of students studying the same PBL project term after term, it is hard to avoid the *sharing of information* by students who already completed the project. Although we seek to avoid a *one right answer* approach, information sharing from *graduates of the project* can reduce our certainty in what students have learned. This potential problem is exacerbated by the fact that assessment in PBL requires a large amount of substantive feedback to students. The provision of extensive feedback at the conclusion of the project can, however, work against our learning goals if former students share the feedback with subsequent students.

The second issue concerns instructor freshness and motivation. Even though the teaching load for our PBL projects is taught by several instructors, some instructors will teach the same project several times each year. Over a period of time, it can become routine and the instructor's motivation may diminish.

Our solution to these problems has been for instructors to design additional versions of the same PBL project. They essentially use their own original version as a template for the subsequent versions. The new versions focus on a similar type of problem, but at a different organization. The new organizational context not only keeps the project fresh for the instructor, but it also creates new and different issues in terms of sub-problems and solutions. This translates into products and performances that differ substantively from those of prior cohorts.

Moreover, the time required for the re-design of a project that the instructor already understands in-depth is reduced dramatically. Indeed, in several projects our instructors undertook this task on their own initiative. They saw the problems noted above and designed new versions of their projects quite spontaneously.

For example, in the project *Reorganizing for Competitiveness* (see Chapter Thirteen), the lead instructor designed the first version around a competitiveness problem at an up-country ceramics factory. After using this version for four or five terms, he designed a second version based on his experiences consulting for a private hospital in Bangkok. He later designed a third version following completion of a consulting assignment for a scientific R & D center at a university. In each instance, he used his prior experience to develop a new problem scenario and simply placed the new scenario within the structural design of his PBL project (see Chapter Thirteen).

Instructors have used a similar process successfully in creating multiple versions of our *Data to Intelligence* (see Chapter Ten), *Retail to e-tail* (see Chapter Twelve), and *Employee Selection* projects (see Chapter Fourteen). This has reduced concerns over student sharing of information about solutions as well as maintaining high levels of instructor motivation.

Finally, and critically important for this book, this experience also increases our confidence that instructors elsewhere in the world could follow a similar process of PBL project design to create locally relevant PBL projects. As the reader will see in the subsequent sections of this volume, PBL projects come in a wide range of styles. They vary in terms of the problems they address, the learning process in which

students engage, and in the types of solution products that they deliver. Based on our experience, it should be equally feasible and effective for an instructor in Brazil or Tokyo to adapt a field-tested PBL project using a similar process of problem substitution. This will result in the greatest reduction of time with the highest likelihood of a successful outcome.

ADAPTING PBL MATERIALS

In recent years, we have reduced our own front-loading of time and effort by exchanging PBL projects with one another as well as with other instructors. In some instances, we have used the projects in their original form. We will discuss this in more detail after introducing the reader to the PBL project template. For example, in Mahidol University's Master of Management curriculum we introduce students to PBL with a project on *Meeting Management* that was designed by Bridges for his Prospective Principals Program. Despite differences in the audience – corporate managers vs. school managers, Asian context vs. Western context – we have made surprisingly few substantive modifications to the project.

Other project adaptations have been more substantial. For example, Bridges developed the *Write Right!* Project (available with a Teaching Note from ERIC/CEM) for use in the Stanford Prospective Principals Program. While working at Vanderbilt University, Hallinger decided to use this project with a class of upper division business undergraduates. Given the nature of the group he was teaching and the purpose of the course, he retained the structure of the project but revised it substantially. His revisions included the following: minor changes in the introduction, additional learning objectives emphasizing situational leadership, a new problem based on a case from the Harvard Business School series, a new set of guiding questions, revised product specifications, and some additional readings. Although these modifications were substantial, he saved considerable time by reusing the format and structure of the original project.

When designing the PBL track for Mahidol University's Master of Management programs, Hallinger saw a similar opportunity to save time by adapting a PBL project on *Teacher Selection* already designed by Bridges for use in the Stanford Prospective Principals Program. However, since the Mahidol program focuses on preparing managers for business organizations located in Thailand and the Asia Pacific region, significant changes were necessary to ensure the project's relevance.

In Chapter Fourteen, we discuss in-depth design considerations related to the adaptation of the project. In brief, after reviewing the *Teacher Selection* project materials, Hallinger concluded that project's structure engaged students in an active learning experience related to employee selection. His adaptation, therefore, sought to maintain the overall structure of the project while substituting a local selection problem.

- The new design incorporated all major features of the *Teacher Selection* project template: type of problem, learning process, products, and assessment.

- Students completing the new project focus on a very similar set of *process tasks*: problem analysis, design of a selection process and selection tools, implementation of the selection tools with job candidates in a final role play.
- The new design, however, substituted a local, corporate problem scenario: hiring a new shift supervisor for a branch of Starbucks (Thailand) in place of the problem of teacher selection for a school in California.
- The new design also updated and changed the learning resources to be more relevant to staff selection in the local business context.

As we discuss in Chapter Fourteen, this adaptation of existing materials required far less effort than would have been the case if we had tried to design a new project from scratch. We have adapted other projects as well including projects focusing on problems of Time Management, Meeting Management, and Leadership. The nature of the adaptation and time needed to create the new project has varied widely. In general, we conclude that adaptation of existing materials is a very useful means of reducing the front-loading of development time. Indeed, management instructors in other parts of the world could easily adapt many of the projects included in this book by following a similar approach.

This approach has added benefits. When compared with the purchase of “ready-made materials” the process of adaptation ensures that the instructor is intimately familiar with the project when s/he uses it in the classroom. In addition, the process of adaptation creates a feeling of ownership for the product that builds the instructor’s self-confidence in the classroom.

CONCLUSION

Developing PBL projects and instructional materials is a formative, iterative, and continuous process. The process relies heavily on student feedback gathered in a systematic fashion each time the project is used. This developmental process comes to an end only when the project becomes outdated and no longer serves the purposes for which it was created. Before that time arrives, the author of the project and the students who have participated in it will have savored the joy, the satisfaction, and the challenge inherent in problem-based learning. In our experience, the front-loading of time and effort inherent in PBL is well worth it.

NOTES

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- ² The content of this chapter was adapted from an earlier version that appeared in Bridges, E.M. & Hallinger, P. (1995). *Implementing problem-based leadership development*. Eugene, OR: ERIC. The content has been used with the permission of the prior publisher.
- ³ *Ibid.* See Chapter Five which describes this in detail.
- ⁴ Waterman, R., Akmajian, P., & Kearny, S. (1991). *Community-oriented problem-based learning at the University of New Mexico*. Albuquerque, New Mexico: University of New Mexico School of Medicine.
- ⁵ Duck, J. (1993, Nov.-Dec.). Managing change: The art of balancing. *Harvard Business Review*, 109-118.
- ⁶ Senge, P. M. (1990). *The fifth discipline: The art and practice of the learning organization*. New York: Doubleday.
- ⁷ Bransford, J. (1993). Who ya gonna call? Thoughts about teaching problem-solving. In P. Hallinger, K. Leithwood & J. Murphy (Eds.), *Cognitive perspectives on educational leadership*. New York: Teachers College Press, 171-191. Bransford, J., Franks, J., Vye, N., & Sherwood, R. (1989). New approaches to instruction: Because wisdom can't be told. In S. Vosniadou & A. Ortony (Eds.), *Similarity and analogical reasoning (470-497)*. New York: Cambridge University Press. Wagner, R. (1993). Practical problem-solving. In P. Hallinger, K. Leithwood & J. Murphy (Eds.), *Cognitive perspectives on educational leadership*. New York: Teachers College Press, 88-102.
- ⁸ Leithwood, K., & Stager, M. (1989). Expertise in principals' problem-solving. *Educational Administration Quarterly*, 25(2), 126-151.
- ⁹ Senge, *op cit.*
- ¹⁰ Bransford, et al 1989, *op. cit.*, pp. 470-475.
- ¹¹ Bransford, et al. 1989, *op. cit.*, p. 484.
- ¹² Bridges, E., with Hallinger, P. (1992). *Problem-based learning for administrators*. Eugene, OR: ERIC Clearinghouse for Educational Management, 98.
- ¹³ *Ibid.*, pp. 66-67.
- ¹⁴ March 1995, Personal Communication to Professor Hallinger from B. Habschmidt