



The What and Why of Problem-Based Learning

The Teacher's part, then, in the process of instruction is that of a guide, director or superintendent of the operations by which the pupil teaches himself.

—Joseph Payne, 1883,
Lectures on the Science and Art of Education

A Defining Moment

A practical place to begin the conversation about what problem-based learning (PBL) is and why it enhances traditional teaching approaches is with a working definition.

PBL is a method based on the principle of using problems as the starting point for the acquisition of new knowledge. Pivotal to its effectiveness is the use of problems that create learning through both new experience and the reinforcement of existing knowledge. Situations that are in the learner's real world are pre-

sented as problems and stimulate the need to seek out new information and synthesize it in the context of the problem scenario.

A simple example might be the situation in which you require driving directions to somewhere you have never been. You begin the process with what you already know or your existing knowledge: where you will start driving and where you intend to arrive. You then identify what you need to know to effectively and efficiently reach your destination: names of streets and highways, distinguishing landmarks to look for, and perhaps the mileage you should anticipate. You then integrate this information with your existing knowledge, for example, the amount of time it typically takes you to travel the number of miles given the type of road conditions you can expect. Often, after creating the experience of using the new information to travel a new route and successfully arrive at the appointed destination, you can then retrieve this new information and apply it to similar situations. It is also likely that you will retain much of the new information and be able to successfully travel the same route again when the need arises.

The real-world frame of reference for you in the example above is that it is likely you have had to acquire and follow driving directions unfamiliar to you before. Each learner has his or her own real-world frame of reference that should be attended to when PBL problem scenarios are developed and used in the classroom. The frame of reference of a 6-year-old is obviously quite different from that of an 11-year-old, but it is just as significant for the effective use of PBL.

There are further characteristics that define and determine the quality of how PBL shows up in classroom instruction. It is essential that the learners determine their own learning needs, or learning issues, based on the problem they encounter. This is the student-centered element of PBL. In the earlier driving example, imagine that someone else determined the directions you needed without taking into account your own existing knowledge. The information that person decided to provide you could discount your starting point, your familiarity with some of the route, or your own travel preferences. In essence, the person would be telling you what he or she thinks you need to know, with little regard for what you think you need to know. To get excellent informa-

tion, you must get answers to the questions that will help you. If this sounds familiar, it is because as educators we spend quite a lot of time telling our learners what they need to know without first determining what they already know or what they think they need to know.

Teachers are often nervous about this notion of allowing students to determine what they need to know or which learning areas they will pursue. They ask, “How do you know that students will come up with appropriate learning issues, or how can a teacher be certain that the intended content areas will be included?” PBL problem scenarios do not stand alone but are designed and facilitated by the teacher. Effective facilitation will prompt students into the intended learning areas, if necessary. Examples of effective PBL problem scenarios and instructional units are provided by grade level in the following chapters. The qualities and characteristics of effective PBL problem scenarios and their development are described in a later chapter as well.

The PBL approach also requires that students work in small groups to attain their learning objectives. Teachers will be further reassured about how learning issues are identified when they observe that within groups, the learning needs tend to be somewhat diversified. The learning needs of one student complement those of another as the group works together to address all of the learning issues.

As these small groups become the focus of the learning situation in classrooms, teachers must assume a different and sometimes unfamiliar role. Rather than being the sole content authority directing the learning process, the teacher now becomes the facilitator or coach of each small group. Suggestions for effective facilitation skills will be offered throughout the book.

Collaboration within the group is an element of PBL that is necessary to accomplish problem resolution. This is a lifelong skill that makes sense to begin developing and practicing as early as kindergarten. The type of intended collaboration in the small group includes resource identification, peer support, acknowledgment and continued reinforcement of existing knowledge, and assistance and assurance in integrating and synthesizing new information. The formation of small groups, their dynamics, and how well they function are all important considerations in the

PBL process. Because these elements are dependent on the learners' developmental stage, the principles to consider will be presented chapter by chapter as they relate to grade level.

The last essential element of PBL is that in the process, students must take responsibility and be held accountable for their own learning. Once the students have identified their own learning issues, it is fundamental to the success of PBL to make them accountable for that learning in meaningful ways. Students must be able to demonstrate that within the process they have acquired new content and that they can apply that new information toward problem resolution. Creating the situations that allow students to acquire new content and demonstrate application constitutes an entire chapter dedicated to authentic assessment strategies.

The Why Behind PBL

There are philosophical underpinnings to the PBL process that explain why one would choose to make a shift to PBL in the classroom. In *How to Use Problem-Based Learning in the Classroom*, Delisle (1997) gives a thorough and informative description of the how and why of PBL in the classroom. In this book, the focus will be a more practical overview of why shifting to PBL practices in the classroom creates advantages for both the learners and the teacher.

PBL creates opportunities in the classroom that traditional approaches simply do not. The most significant is the relevance of the learning that occurs. Because the problem scenarios are from the real world and because the students determine their own learning needs, the learning that occurs is highly relevant. This contributes to holding the students' interest, developing a deeper understanding of the content, and increasing the retention of new information.

The emphasis in PBL is on conceptual understanding rather than the memorization of facts. The intended learning is presented through the problem scenario in a way that leads the student to want to know and need to know the new information, much like the driver who needs directions. The problem then requires the students to use the new information to present reso-

lutions to the problem. As the students work in their small groups toward solutions, they must collaborate and negotiate within the group to rule in and rule out viable solutions. They learn to create functional relationships with each other to accomplish the group's goals. Students develop communication skills and more sophisticated interpersonal skills. They develop respect for one another's contributions and find ways to acknowledge and encourage each other.

In addition to these benefits, students report that they become excited about resolving the math or science or political problems and about discovering new information that helps in figuring out what is going on in the problem. Discovery, fun, and excitement are all elements that most learners prefer to have as part of instruction. We tend to work harder and longer on the endeavors that we enjoy. When students work longer and harder, they learn more and are more likely to be able to use the new information in similar contexts and situations. Also, teachers are assured that students have learned when they can apply new content.

Another outcome for students is the development of a process for lifelong learning. Students become aware that they are able to figure out what they need to know, to find what they need to know, and to use this new information to create solutions in situations that have no obvious answer. They grow more confident in their abilities in these areas and soon are engaging the process even outside the classroom.

A parent shared the story of how her third grader helped to figure out the type of gift to buy a coworker by asking PBL questions: What does she like? What does she not like? Where do you find the kinds of things she likes? What is her favorite color? How much money can you spend? Does she have kids, pets, and so on? This young student was using the process of determining what was known, what additional information was needed, and what resources were available. The significance of this example is that the student was concerned not about getting the answer right but rather about collecting information to pose questions that would lead to "right" answers.

This leads us to the most significant benefit of using PBL. Focusing on multiple solutions rather than on correct answers allows students to be successful in ways that have not been avail-

able to them in traditional approaches. There are limited opportunities to be considered successful in most classrooms. Success tends to be defined by the highest scores, the most right answers, the neatest work, and, often, the most conventional work. Although there is value in high scores, correct answers, and neatness, there is also value in creativity, discovery, contribution to a process, and contribution to the development of other people. Students not only are afforded these opportunities in the PBL process but are positively acknowledged as they engage the opportunities. We all have the tendency to return to and continue the things that make us feel successful. Students return to PBL each time feeling more confident, motivated, and excited about what they are able to accomplish.

The PBL Process in Action

When observing a PBL lesson, it is sometimes difficult for the novice to discern the underlying structure. There are actually very specific components to the process that are there to ensure that the principles underlying PBL remain intact.

A typical PBL session will begin in this fashion: The students, either as a large group or in small groups of five to seven students each, encounter the PBL problem scenario. The delivery of the scenario may vary from projecting the problem using an overhead projector, to a PowerPoint projection, to providing a hard copy of the problem scenario to each student or student group. For a fourth-grade class, the problem might be as modest as this:

The PTA has given your class \$50 to run a class store selling school supplies. Your group must plan a presentation with visual aids about how the store should be run, what will be sold in the store, and how the profits should be used. You should start with an inventory of ten items to sell. Following the presentations, the class will vote on how to best operate the store and spend the profits.

One student reads the problem aloud. This accomplishes several things: One student practices reading aloud, and the other students and the teacher follow along so there is confidence that

all have heard and read the same problem without omitting key words or skipping sentences. PBL is a student-centered method, so it is always a student who reads the problem.

Once the students have encountered the problem, they proceed to create at least two lists. One is headed “Facts” and should itemize all of the facts they have been given in the problem. This helps them begin to identify what they know. They then make a list headed “Need to Know,” in which they list all the information they would like to have to better understand the problem and their role in resolving the problem. From this “Need to Know” list, students should begin to derive a “Learning Issues” list of the things they need to look up, research, or explore in order to move forward with problem resolution. Following the exploration phase, the students should then list their “Possible Solutions.” This list will have ideas about how to resolve the problem and should require the development of a new “Learning Issues” list. This new list is used to gather additional information that will allow the students to rule in or rule out the possible solutions they created (see Table 1.1).

Here is an example of a seventh-grade science problem regarding weather and the process for working through it.

You are a weather forecaster in Morehead, North Carolina. You are currently concerned about a tropical storm off the coast of Africa. You must track and predict where it is going and when it will strike land. Once you have collected this information, you must give warnings to ships and military aircraft that could be affected by the storm.

The students’ Facts list may contain things such as: We are weather forecasters; we are in Morehead, North Carolina; there is a tropical storm; and the storm is near Africa. The Need to Know list may contain questions such as: Where is Morehead, North Carolina? Where is the storm on Africa’s coast? How fast is the storm moving? There are additional facts that may be supplied to the students by providing them with maps and other information. The Learning Issues list may contain things such as: What makes a storm tropical? How are storms classified? What affects storms’ movements? From these learning issues, the

Table 1.1 PBL Process

Facts List	Need to Know	Learning Issues

Possible Solutions	New Learning Issues

Defendable Solution(s)

This or a similar form is the basic document in the PBL process. It may be structured slightly differently or it may take two to three pages, but the categories are constant. See Appendix C for an example of a filled-in chart.

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students might gather information about barometric pressures, ocean currents, and wind scale. They will further explore geographic issues around the landfall of the storm and where the potentially affected military bases are located. They will use mathematical equations to determine storm speed as they predict its movements. After gathering this kind of new information, stu-

dents will make their list of possible solutions. In this case, that list might contain two or three hypotheses about where the storm will land. Then, in the context of the problem scenario, students should be provided with enough additional information about the storm's movements to eventually choose one of their hypotheses as the most viable.

Throughout this process, the teacher's role is very active as the facilitator and guide. Sometimes the teacher may take the role of "expert resource" in order to provide some of the needed information. For the most part, however, the teacher is monitoring the process and progress of the students, helping them to explore the intended learning objectives, and reassuring them or redirecting them as needed. It is important to understand that the teacher is anything but absent from the dynamics and effectiveness of this learning approach. The teacher is pivotal to the opportunities available to the students in the PBL methodology.

In a Nutshell

The intent in this book is to provide teachers with an understanding of the PBL process and with sample instructional materials to support classroom implementation. Chapters 2 through 5 will address these issues by grade level, giving special attention to the developmental characteristics of young learners. The additional elements that contribute to the success of PBL instruction, such as group size, group work, supporting content learning, timing, pacing, and the teacher's role, will be discussed by grade level as well.

Chapter 6 will provide an overview of the appropriate and effective use of authentic assessment techniques and PBL. Sample evaluation tools and strategies are provided as well as assessment templates specific to evaluating the student's process skills and group function levels. Guidance for evaluating students as individuals and for evaluating a student's group performance are discussed. Also included in this chapter is information about assessing the effectiveness of PBL as an instructional approach. Many teachers are concerned about being able to determine if

the methodology is working in their classroom. How does a teacher know if a student is learning more, retaining more, and becoming able to apply more and be a better collaborator or negotiator as a result of engaging the PBL methodology? This chapter also makes the point that there can be very strong linkage between local and state standards and PBL. PBL is a powerful method that can work with almost any curriculum.