Learning Process Methodology (1990) — Curriculum Design

The Learning Process Methodology is a 14-step model of the learning process that is the cornerstone for both learning to learn and Process Education. As such, it is nearly omnipresent, with particularly obvious utility in activity design, facilitation, assessment of learning performance, measurement of levels of learning, and implementation of learning skills within the learning process.

An abstract model of the generalized learning process was developed at the first Problem Solving Across the Curriculum Conference at Wells College (Kramer & Beery, 1990). After the formal conference had ended 20 faculty members stayed an extra day in order to collaborate in producing a model of the learning process. The Learning Process Model was first shared in the *Notes for the Teaching Institute* (Apple, 1991) and were then formally published in the opening chapter of *Learning through Problem Solving* (Apple, Beyerlein & Schlesinger, 1992). In each subsequent chapter the learning activity reinforced the Learning Process Model in order to strengthen learner understanding and use of the model. The model proved attractive and began to be used in select classrooms. A discussion of how the Learning Process Model can be used together with active and collaborative learning to help students improve their critical thinking and problem solving skills in engineering classrooms is found in *Using a Learning Process Model to Enhance Learning with Technology* (Apple, Beyerlein & Ford, 1993). The model and the classroom experience gained through this were integrated into *Teach for Learning: A Handbook for Process Education* (Apple, 1993) and used in Pacific Crest's teaching institutes.

The Learning Process Model was later upgraded and became the Learning Process Methodology (LPM; see Figure 1) in the pre-market edition of *Foundations of Learning* (Pacific Crest, 1995). That same year the LPM

Figure 1 Learning Process Methodology

Step	Explanation
Stage 1: Preparing to Learn	
1 Why	Identify and explain your reasons for learning.
2 Orientation	Develop a systematic overview of what is to be learned.
3 Prerequisites	Identify necessary skills and background knowledge needed to perform the learning.
4 Learning Objectives	Set appropriate goals and objectives for the learning activity.
5 Performance Criteria	Determine specific desired outcomes used to measure and gauge performance.
6 Vocabulary	Identify and learn key terminology.
7 Information	Collect, read, and study appropriate resources.
Stage 2: Performing a Learning Activity	
8 Planning	Develop a plan of action to meet the performance criteria.
9 Using Models	Study and review examples that assist in meeting the learning objectives and performance criteria.
10 Thinking Critically	Pose and answer questions that stimulate thought and promote understanding.
11 Transferring/Applying	Transfer knowledge to different contexts; apply knowledge in new situations.
12 Problem Solving	Use knowledge in problem-solving situations.
Stage 3: Assessing and Building New Knowledge	
13 Self-assessment	Assess use of the learning process and mastery of the material learned.
14 Research	Create and develop knowledge that is new and unique.

Figure 2 Activity 2.3, Evaluating a Formula in *Quantitative Reasoning and Problem Solving*

What Do You Already Know?

Tapping into your existing knowledge

1. What is a formula?
2. What formulas have you used in the past?
3. If a formula has three variables, and you want to "evaluate the formula," for how many of the variables do you need to know values?
4. What is the Order of Operations?
5. What is a code word or phrase (mnemonic) you can use to help yourself remember the Order of Operations?

Note that a simple listing of prerequisite knowledge (as opposed to activating that knowledge) for this section might read as:

Students should be familiar with using and evaluating formulas and the Order of Operations.

also appeared in the *1995 Teaching Institute Handbook* (Apple) as a way to help faculty understand and improve their skills with respect to facilitating student learning and improving student learning through the practice of assessment and design of learning activities. The LPM was fully integrated into the processes of activity design, assessment, and facilitation, and was linked with the concept of learning skills as presented in *A Classification of Learning Skills for Educational Enhancement and Enrichment* (Apple, 1997) in the *1998 Teaching Institute Handbook* (Apple & Krumsieg).

The Curriculum Design Institute Handbook (Apple & Krumsieg, 2001) focused more specifically on design, offering the LPM to faculty to help them create learning activities and Process Education courses. The use of the LPM as a basic design methodology spread; a host of activity books were developed using this design process and the activity templates offered in the handbook. As of 2015, Pacific Crest has published more than 50 texts and activity books using this LPM in the development process and as a guide for the basic layout and design of the activities. The impact of the LPM on activity design extends far beyond curricula created by Pacific Crest however; the community of chemists who oversaw the design and development of Process-Oriented Guided-Inquiry Learning (POGIL) activities used the LPM as their base, integrating 10 of the LPM's 14 steps (1, 3, 4, 6, 7, 9, 10, 11, 12, 13) into the POGIL activity template (POGIL, 2015).

The Learning Process Methodology in Student Hands

Not only does the LPM form the basis for design of learning activities, the methodology itself is offered to learners in a variety of student curricula in order to give students the key to improving their own learning. In *Quantitative Reasoning and Problem Solving*, activity 1.1 is "The Learning Process Methodology" and offers an extended model of using the LPM to learning to multiply and divide fractions (Ellis, Apple, Watts, Hintze, Teeguarden, Cappetta & Burke, 2014). See Figure 3 for an excerpt. Both *Foundations of Learning* (Redfield & Hurley Lawrence, 2009) and *Learning to Learn: Becoming a Self-Grower* (Apple, Morgan & Hintze, 2013) explicitly teach the Learning Process Methodology, not only offering discussion of each step but extensive modeling of the use of the LPM. In addition, students are challenged to assess the use of the LPM in one model. There is a learning object that echoes these models available at www.pcrest.com/LO/LPM.

Looking Forward

The *Faculty Guidebook* module, *Learning Process Methodology* (Leise, 2007) connected the LPM research with other research in the *Guidebook.* The template and interpretation of how best to support the steps of the LPM continue to be advanced. For example, during an activity, when one lists prerequisite knowledge, brain-based research (see especially Maguire, Frith and Morris, 1999) recommends activating prior knowledge in order to increase comprehension. This strategy was incorporated in *Quantitative Reasoning and Problem Solving* with a new section activity called "What Do You Already Know?" which prompts students to explore both the potential richness and boundaries of their prior knowledge (Ellis, Apple, Watts, Hintze, Teeguarden, Cappetta & Burke, 2014); see Figure 2. See the section **Research-Based Best Practices** for more on activating prior knowledge.

Figure 3 Model use of the Learning Process Methodology from Activity 1.1 in *Quantitative Reasoning and Problem Solving*

Step	Explanation
1. Why	I am tired of not knowing how and why the calculations of fractions work, especially when multiplying and dividing
2. Orientation	Numbers can be represented in many ways: as whole numbers, decimals, and fractions. Having to switch representations in order to perform calculations is slow and limiting. I therefore need to be able to perform calculations in all three of these forms.
3. Prerequisites	addition, subtraction, and multiplication of whole numbers
4. Learning Objectives	1. Learn to multiply fractions 2. Learn to divide fractions 3. Learn the relationship between the multiplication and division of fractions
5. Performance Criteria	Perform the multiplication and division of any improper fraction, giving an accurate, validated, and well-reasoned answer
6. Vocabulary	*numerator* — the top portion of the fraction *denominator* — the bottom portion of the fraction *multiplicative identity* — multiplying by 1 leaves a number unchanged *reciprocal* — the fraction multiplied by its reciprocal is 1
7. Information	$\frac{a}{b}\times\frac{b}{a}=1 \quad \frac{a}{b}\times\frac{c}{d}=\frac{ac}{bd} \quad \frac{\frac{a}{b}}{\frac{c}{d}}=\frac{a}{b}\times\frac{d}{c}=\frac{ad}{bc}$
8. Plan	How will I use multiplying and dividing fractions in the future? Most likely, when finding how I can divide things among people and how many portions make up how many wholes.
9. Models	Dividing a pizza among a group of people

10. Thinking Critically

Q1. What is a half of a half of a pizza (one half divided in two)? 1/4

Q2. How do you calculate this mathematically? $\frac{1}{2}\div 2=\frac{1}{2}\times\frac{1}{2}=\frac{1}{4}$

Q2. Assume there are three people and there is only 2/3 of a pizza. How much does each person get? This is 2/3 divided in 3: $\frac{2}{3}\div 3=\frac{2}{3}\times\frac{1}{3}=\frac{2}{9}$

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