

Activity books contain disciplinary-focused learning activities of use both in and outside the classroom to help students become more active in the process of constructing knowledge and improving their level of learning and learning performance.

In 1989 Pacific Crest Software, Inc. first began to work with other publishers to bring more active learning into the classroom, providing more technology-based learning resources for students. The first major project was to produce a supplement for *Calculus with Analytical Geometry* (5th ed.) (Swokowski, 1990); this provided a library of 50 learning objects modeled after key concepts located on specific pages in the book. These learning objects made textbook examples come alive for the learners and allowed them to explore concepts by asking critical thinking questions and testing through "what if" exercises (PWS-Kent, 1990). At the Problem Solving Across the Curriculum Conference (Kramer & Beery, 1990) many workshops focused on the use of activity books while many others focused on designing learning experiences using technology. This led to the development of a series of activity books using PC:SOLVE. The series included activities for problem solving (Apple, 1990), contemporary math (Luciano, 1991), statistics (Housman, 1993), calculus (Kaplan, 1994), and physics (Burgess, 1993).

As scholarship focused on Process Education and activity design improved the quality of the activity books improved. Each advancement in the understanding of the learning process and the design of learning activities led to more effective workshops for faculty who were interested in developing their own activity books (Apple, 1993). At this time a spate of new activity books appeared: *Foundations of Mathematics for Beginners* (Casler, 1994), *Foundations of Chemistry* (Hanson, 1995), *Foundations of Learning* (Krumsieg & Baehr, 1996), *Beginning Algebra: A Process Approach* (Atnip & Benner, 1996), and *Pre-Algebra: A Process Approach* (Atnip & Benner, 1997).

An activity template, based on the Learning Process Methodology, was a direct result of the work in designing *Foundation of Learning* (1st ed.) (Krumsieg & Baehr, 1996), and became the standard generalized template for activity books published by Pacific Crest. While this template continues to evolve, its basic structure remains the same:

Chapter Level

- a) a "why" activity for chapter content
- b) orientation of this knowledge area

- c) problem solving
- d) validation of learning

Activity Level

- a) a title
- b) why
- c) learning objectives
- d) performance criteria
- e) vocabulary
- f) information (especially methodologies)
- g) resources
- h) plan
- i) model(s)
- j) critical thinking questions
- k) exercises
- l) self-assessment

The *Curriculum Design Handbook* (Apple & Krumsieg, 1998) and workshops triggered another wave of activity books, which were a significant improvement and/or upgrade from previous versions or editions: *Foundations of Learning* (3rd ed.) (Krumsieg & Baehr, 2000), *Gateway to Business* (Bobrowski & Cox, 2001), *Foundations of Scientific Research* (6th ed.) (Bole & Miyazaki, 2004), *Foundations of Mathematics* (2nd ed.) (Freneau, 2005), and *Foundations of Chemistry: Applying POGIL Principles* (2nd ed.) (Hanson, 2006). Again, because of the obvious efficacy of the Learning Process Methodology as the backbone of high-quality activity design, POGIL curricula (including curricula not published by Pacific Crest) make use of the activity design offered here, as seen in *Designing A POGIL Activity* (Hanson, 2007) and *Assessing Learning Activities* (Loertscher & Minderhout, 2007).

After twenty years of implementation, discoveries still continue to strengthen and advance the design of learning activities in activity books. For example, based on experience and feedback from instructors, we realized that the time spent on in-class learning activities could be made more effective if students completed pre-activities before class. Similarly, we found that the learning gained through participation in an in-class activity could be strengthened if students completed a post-activity designed to help them contextualize, generalize, and apply what they had

Figure 1 Structure of a Learning Experience in *Learning to Learn: Becoming a Self-Grower*

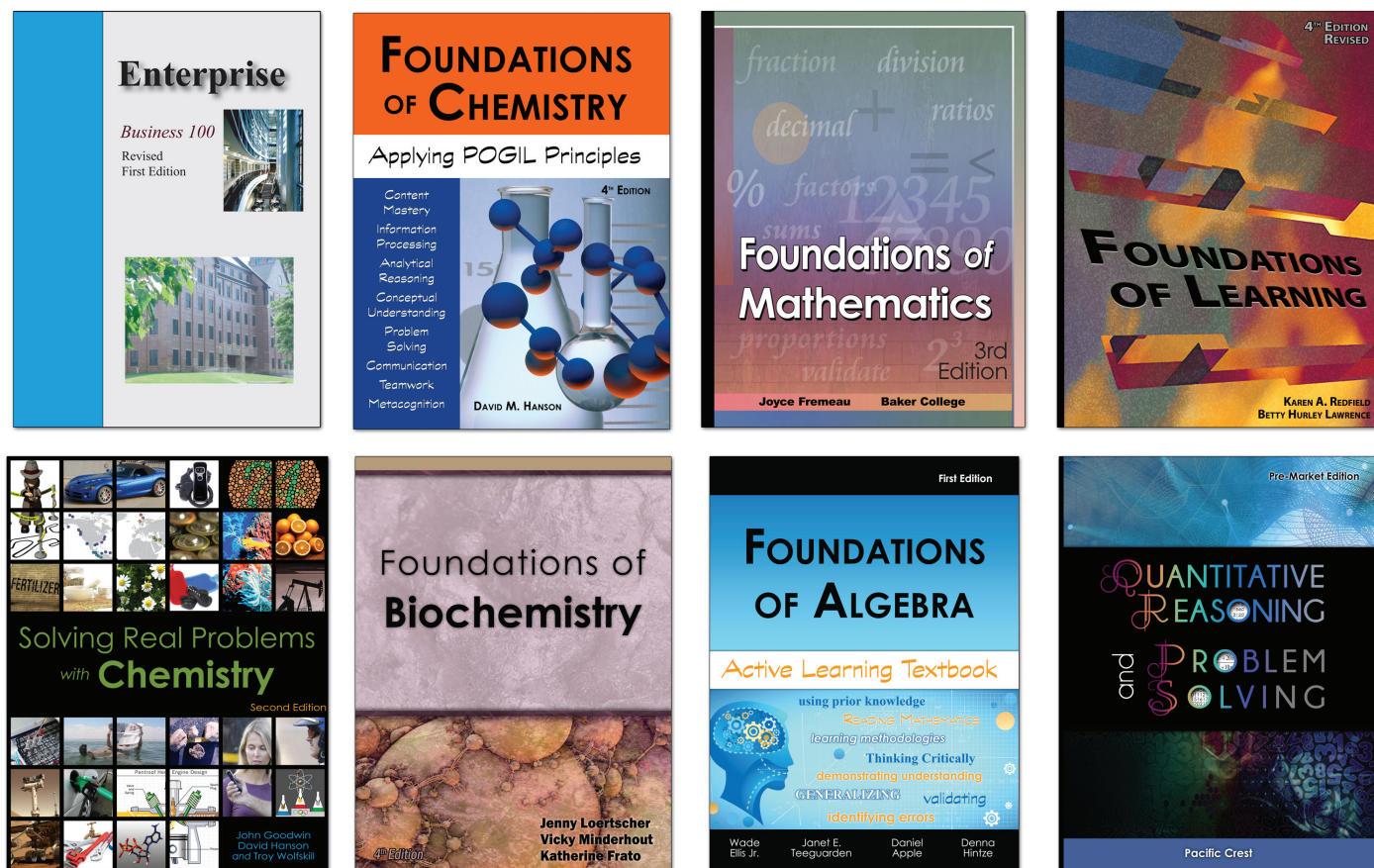
Pre-activity	In-class activity	Post-activity
<i>On My Own</i>	<i>In My Class</i>	<i>My Learning & Growth</i>
Purpose Objectives Discovery Exercise Readings Resources Exploration Questions Am I Ready for Class?	Why Learning Objectives Performance Criteria Plan Resources Models Critical Thinking Questions Worksheets	Challenge Tools/Worksheets Preparation Problems to Solve My Life Vision Self-Assessment

learned at the level of problem solving. This combination of a pre-, post-, and in-class activity is referred to as a *learning experience* and its structure is shown in Figure 1 (Apple, Morgan & Hintze 2013).

These advancements are seen in the latest round of activity books and activities embedded in textbooks (shown in Figure 2): *Enterprise* (Newgren, 2006), *Foundations of Chemistry* (4th ed.) (Hanson, 2010), *Foundations of*

Mathematics (3rd ed.) (Fremeau, 2006), *Foundations of Learning* (4th ed.) (Redfield & Hurley Lawrence, 2009), *Solving Real Problems with Chemistry* (Goodwin, Slusher, Gilbert & Hanson 2009), *Foundations of Biochemistry* (4th ed.) (Loetscher, Minderhout & Frato, 2015), *Foundations of Algebra: Active Learning Textbook* (Ellis, Teeguarden, Apple & Hintze, 2013), and *Quantitative Reasoning and Problem Solving* (Ellis, Apple, Watts, Hintze, Teeguarden, Cappetta, & Burke, 2014).

Figure 2 Current Activity Books (2016)



References

- Apple, D. K. (1993). *Curriculum developer's guide: Learning with technology, teaching critical thinking and problem solving, and teaching process through a content course*. Corvallis, OR: Pacific Crest.
- Apple, D. K. (1990). *Introduction to Problem Solving using PC:SOLVE*. Pacific Crest: Corvallis, OR.
- Apple, D. K. & Krumsieg, K. (1998). *Curriculum design handbook* Corvallis, OR: Pacific Crest.
- Apple, D., Morgan, J., & Hintze, D. (2013). *Learning to learn: Becoming a self-grower*. Hampton, NH: Pacific Crest.
- Atnip, C. (2002). *Basic mathematics: MTH 099A*. Lisle IL: Pacific Crest.
- Atnip, C., & Benner, R. (1996). *Beginning algebra: A process approach*. Corvallis, OR: Pacific Crest.
- Atnip, C., & Benner, R. (1997). *Pre-algebra: A process approach*. Corvallis, OR: Pacific Crest.
- Bobrowski, P., and Cox, P. (2001). *Gateway to business* (3rd ed.). Corvallis, OR: Pacific Crest.
- Bole, G., & Miyazaki, J., (2004). *Foundations of scientific research* (6th ed.). Lisle, IL: Pacific Crest.
- Burgess, D. (1993). *Physics using PC:SOLVE*. Corvallis, OR: Pacific Crest.
- Casler, B. (1994). *Foundations of mathematics for beginners*. Corvallis, OR: Pacific Crest.
- Ellis, W., Teegarden, J., Apple, D., & Hintze, D. (2013). *Foundations of algebra: Active learning textbook*. Hampton, NH: Pacific Crest.
- Ellis, W., Apple, D. K., Watts, M., Hintze, D., Teegarden, J., Cappetta, R., & Burke, K. (2014). *Quantitative reasoning and problem solving*. Hampton, NH: Pacific Crest.
- Freneau, J. (2005). *Foundation of mathematics* (2nd ed.). Lisle, IL: Pacific Crest.
- Freneau, J. (2006). *Foundation of mathematics* (3rd ed.). Lisle, IL: Pacific Crest.
- Goodwin, J., Slusher, D., Gilbert, T., & Hanson, D. M. (2009). *Solving real problems with chemistry*. Lisle, IL: Pacific Crest.
- Hanson, D. M. (1995). *Foundations of chemistry*. Corvallis, OR: Pacific Crest.
- Hanson, D. M. (2006). *Foundations of chemistry: Applying POGIL principles* (2nd ed.). Lisle, IL: Pacific Crest.
- Hanson, D. M. (2007). Designing a POGIL activity. In S. W. Beyerlein, C. Holmes, & D. K. Apple (Eds.), *Faculty guidebook: A comprehensive tool for improving faculty performance* (4th ed.). Lisle, IL: Pacific Crest.
- Hanson, D. M. (2010). *Foundations of chemistry* (4th ed.). Lisle, IL: Pacific Crest.
- Housman, D. (1993). *Introductory statistics using EZ_Stats*. Corvallis, OR: Pacific Crest.
- Kaplan, D. (1994). *Exploring calculus using PC:SOLVE*. Corvallis, OR: Pacific Crest.
- Kramer, P., & Beery, D. (1990, July-August). *PASC conference program*. Problem Solving Across the Curriculum Conference, Wells College, Aurora, NY.
- Krumsieg, K., & Baehr, M. (1996). *Foundations of learning* (1st ed.). Corvallis, OR: Pacific Crest.
- Krumsieg, K., & Baehr, M. (2000). *Foundations of learning* (3rd ed.). Corvallis, OR: Pacific Crest.
- Loertscher, J., Minderhout, V., & Frato, K. (2015). *Foundations of biochemistry* (4th ed.). Hampton, NH: Pacific Crest.
- Luciano, A. (1991). *Contemporary math using PC:SOLVE*. Corvallis, OR: Pacific Crest.
- Minderhout, V., & Loertscher, J. (2007). Assessing learning activities. In S. W. Beyerlein, C. Holmes, & D. K. Apple (Eds.), *Faculty guidebook: A comprehensive tool for improving faculty performance* (4th ed.). Lisle, IL: Pacific Crest.

Newgren, K. (2006). *Enterprise*. Lisle, IL: Pacific Crest.

Pacific Crest (1995). *Foundations of learning* (pre-market edition). Corvallis, OR: Pacific Crest.

PWS-Kent (1990). *PC:SOLVE calculus concept library*. Boston: PWS-Kent.

Redfield, K., & Hurley Lawrence, B. (2009). *Foundations of learning* (4th ed.). Lisle, IL: Pacific Crest.

Swokowski, E. (1990). *Calculus with analytical geometry* (5th ed.). Boston: PWS Kent.