

International Journal of Process Education

Process Education is a performance-based philosophy of education which integrates many different educational theories, processes, and tools in emphasizing the continuous development of learning skills through the use of assessment principles in order to produce learner self-development.

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February 2016 Vol 8 Issue 1



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ISSN 2328-952X

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Published by Pacific Crest P.O. Box 370 Hampton, NH 03843

From the Editorial Board

We are excited to present to you this special edition of the *International Journal of Process Education*, celebrating 10 years since the inception of the Academy of Process Educators and 25 years of scholarship in Process Education.

The wealth of scholarship, learning tools, and best practices that have evolved over this period is immense. Many of the original Academy members contributed to this special edition of the IJPE, helping to trace the evolution of Process Education. The content of the article falls into five key areas: (1) Learner Development, (2) Cultural Transformation, (3) Assessment, (4) Educator Advancement, and (5) Curriculum Design. The practices or significant research that advanced each are shared within that area. These practices and research are presented chronologically so the development and connections can be observed. A special sixth area chronicles the Academy of Process Educators as a case study in a successful professional learning community.

An exciting addition to this special edition are online versions of the organizational structures shared in this article: the time line and the pictorial representation of Process Education. These interactive tools allows the user to explore Process Education and its evolution, with links to related publications and scholarship, for ease of exploration, reading, and review.

We hope that you enjoy this special edition and celebrate our accomplishments with us as you explore this edition of the *International Journal of Process Education*.

Sincerely,

Kathleen Burke

Chief Editor, *International Journal of Process Education*

25 Years of Process Education

*Commemorating 25 Years of Scholarship in Process Education
and the 10th Anniversary of the Academy of Process Educators*

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Abstract

Pacific Crest defined Process Education and worked to communicate the potential it offered for improving teaching and learning. This effort, in tandem with the work of a community of professional practitioners, has advanced the scholarship of Process Education, including the foundational concepts of learning to learn and self-growth, to the degree that they have had a noteworthy impact on the culture and practices of higher education over the last 25 years. This article provides a review and analysis of the body of Process Education scholarship and research, as well as a selective overview of Process Education practices across different educational contexts. In addition, two different organizational schema are offered to help the reader appreciate the key areas of Process Education and their interrelatedness.

Introduction

As of this writing, Process Education (PE) has been around for 25 years. If it were a person, we would expect to see it making its own way in the world — standing on its own two feet, as it were — in contexts that no longer necessarily involve those who brought it into being. And so it is. The life and growth of this philosophical approach to education consists of various stages of growth, important milestones, and noteworthy contributions and achievements. And as it has grown and evolved in clarity, organization and utility, its impact upon higher education has only increased.

Over the last 25 years more than 50,000 faculty, staff, and administrators have been exposed to the principles and practices of Process Education, largely through professional development and scholarly efforts. While there is no way to accurately tally those who have adopted even some of what Process Education offers, a diverse community of serious practitioners has evolved over time.

The genesis of this group began with a series of conferences entitled *Problem Solving Across the Curriculum* (1990–1996) and the community grew between 1999 and 2002 and became more coherent as a result of a major scholarship

effort (*The Faculty Guidebook: 2003–2007*), eventually culminating in the Academy of Process Educators (2007 to present). This group is not definitive; there are Process Educators who are not members of the Academy and, thanks to the “stickiness” of many of the ideas in Process Education — that they have import, attraction, and utility that are obvious to many educators — there are surely individuals who could be termed “Process Educators” who may well have never heard the term *Process Education*.

What follows is the story of Process Education as seen, understood, and experienced by those in its community of professional practice. We believe it provides convincing evidence that the adoption of the values, principles, and practices of Process Education by educational leaders at every level significantly enhances educational outcomes. We know that resources in higher education are always constrained but it is our hope that this evidence will enable Process Educators to receive the support they deserve while facilitating their endeavors to share what Process Educators have to offer their peers.

The 25 years behind Process Education were busy ones; there was much innovation, many lessons learned, and a great many discoveries. The sheer magnitude of available

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scholarship necessitates that we offer more than a linear “birth to adulthood” story for PE philosophy. In fact, there are two different organizers for the body of scholarship offered in this article:

Content Outline (Table 1): The major areas of Process Education are organized into six major categories (Learner Development, Cultural Transformation, Assessment, Educator Advancement, Curriculum Design, and a Case Study), each of which is then subdivided to provide necessary detail. This article is structured after this content outline. The article itself consists of approximately 30 related but differentiable areas of research and/or practice, each offered chronologically within the category. While Table 1 does order content within each category in a chronological way, there is a Timeline Organizer available online that provides an overall timeline for the development of each of the sections in this article, as well as each pertinent item of scholarship associated with that section. The online version of this organizer (www.processeducation.org/ijpe/25/timeline) is interactive and offers a vast majority of the linked publications themselves for reading and review.

Pictorial Representation (Figure 1): This graphic defines all major areas of Process Education and, through color-coding and placement, shows the interrelatedness between the areas. It works well as a navigator of the content of this article for the online version (there, each section is color-coded at the top: www.processeducation.org/ijpe/25/image).

By separating the different threads, we are able to trace individually small but cumulatively powerful narratives:

- How the Learning Process Methodology (LPM) evolved in its relationship with learning to learn
- How the concept and practice of assessment evolved and were clearly differentiated from those of evaluation, providing a conduit to the concepts and practices of self-assessment and self-growth
- How systematic design and assessment of curricula at program, course, and activity levels can ensure that intended learning outcomes and performance expectations are achieved at all levels
- How learning to learn can be systematically integrated into a curriculum by focusing on growing a set of transferable learning skills while learners actively construct knowledge
- How methodologies were identified as the ideal models for learner processes such as reading, writing, teaming, personal development, and problem solving, as well as faculty processes such as design, assessment, facilitation, mentoring, and evaluation
- How learning communities and teams support learning and growth by integrating mentoring and peer support systems
- How Process Education led to the Transformation of Education and the concept of a Culture of Success because of the central concept of a growth mindset developed in a quality learning environment

Table 1 Content Outline for this Article

<p>1. Learner Development</p> <ul style="list-style-type: none"> a. Learning to Learn (1990) b. Self-Growth / Growth Mindset (1992) c. Foundations of Learning Course (1992) d. Accelerator Model (1993) e. Learning to Learn Camps (1995) f. Performance Model (2007) <p>2. Cultural Transformation</p> <ul style="list-style-type: none"> a. Learning Communities (1991) b. Process Education Philosophy (1993) c. Creating a Quality Learning Environment (1994) d. Culture of Success (2007) <p>3. Assessment</p> <ul style="list-style-type: none"> a. Assessment vs. Evaluation (1991) b. Self-Assessment (1992) c. Reflection / Meta-cognition (1997) d. Performance Criteria (1997) e. Performance Measures (1997) 	<p>4. Educator Advancement</p> <ul style="list-style-type: none"> a. Professional Development (1991) b. Facilitation (1998) c. Mentoring (2000) d. Research-Based Best Practices (1990-2015) <p>5. Curriculum Design</p> <ul style="list-style-type: none"> a. Learning Process Methodology (1990) b. Methodologies (1990) c. Problem Solving (1990) d. Activity Books (1990) e. Classification of Learning Skills (1992) f. Role of Technology (1990) g. Activity Design Process (1995) h. Course Design Process (1998) <p>6. Case Study</p> <ul style="list-style-type: none"> a. Academy of Process Educators
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Figure 1 Pictorial Representation of the Major Areas of Process Education



- How the Theory of Performance, Forms and Levels of Knowledge, and the Classification of Learning Skills link learning theory with developing disciplinary practice by using performance criteria and performance measures
 - How key tools, structures, and systems (e.g., the *Student Success Toolbox*, Foundations of Learning course, and performance measures) all play a role in increasing meta-cognition
2. The cornerstone of Process Education scholarship was modeling the learning process with the Learning Process Methodology (one could then learn how to learn) and then connecting it with the practice of assessment, allowing individuals to improve their ability to learn (self-growth).
 3. The Academy of Process Educators focuses on generating research-based evidence, modeling quality implementation of the Process Education philosophy, and mentoring faculty and staff in their work to create a learning to learn culture.

Concluding Thoughts on the Vision of Process Education Research and Practices

Though the learning sciences (“interdisciplinary empirical investigation of learning as it exists in real-world settings and... how learning may be facilitated both with and without technology”; ISLS, 2015) are in their infancy, the broad outlines of how people learn are fairly well-developed. Much work needs to be done, and will need to be expanded upon as the learning sciences advance in order to realize the benefits of learning science with respect to actual curriculum design, assessment, learner development, educator advancement, cultural development, and change process. We believe strongly that this means connecting scholarship of the learning sciences with the scholarship of Process Education. We also feel that in order to take full advantage of what the learning sciences have to offer, education at all levels, from primary to post-graduate, will need to experience a cultural transformation. The Academy of Process Educators already sees the need for this cultural change; this is evident in the scholarship of Process Education and especially the work done (and in-progress) that focuses on the Transformation of Education. Process Education is a philosophy and mindset that is wholly amenable to what the learning sciences will teach us. The role of the Academy of Process Educators is a critical one as we move forward into this promising future; these educators will continue to produce scholarship that crosses and connects disciplines, drawing Process Education into contexts and applications that are yet unknown. It is their work to promote the ways in which the necessary cultural transformation can occur and to mentor faculty and staff in engaging in the research and implementing the best practices that emerge as a result of that research.

On a final note, the authors would like to highlight the ten most important things we learned from engaging in this extended review of the first 25 years of Process Education.

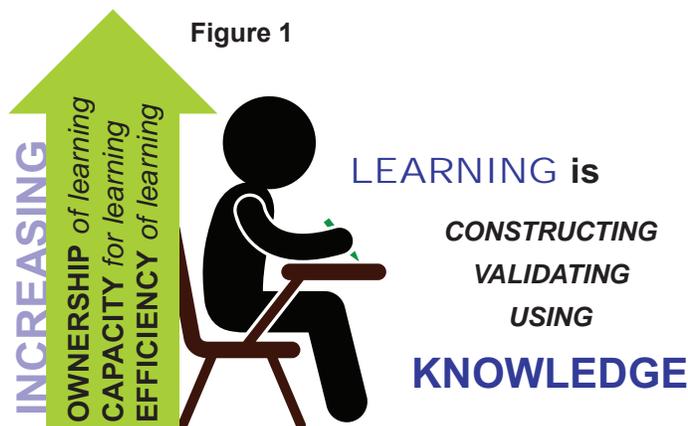
1. At the heart of Process Education and its philosophy and principles is the idea of empowering learners, faculty, and staff by building a culture which values and practices learning to learn, self-growth, and the ownership of one’s own learning.

4. Scholarship on the Transformation of Education illustrates how extensive the gap is between current values, mindsets, and practices and those of a culture of success in which learning to learn, assessment/self-assessment, and self-growth become pervasive.
5. In order to move towards a Process Education culture and empowerment of all, an institution should develop and publish its institutional educational philosophy so that its faculty, staff, and students can move in this direction with the support of the institution.
6. For each area of Process Education scholarship that is integrated into practice, student learning improves. Furthermore, due to the holistic nature of Process Education, when multiple areas of Process Education scholarship are embraced and integrated into practice, the impact is synergistic with respect to learning, growth, and student success.
7. Process Education is a way of living; its principles apply to every facet of life. It is also a journey rather than a destination, and once begun, never really ends, but continually increases the quality of life.
8. Since Process Education is a performance-based philosophy, the clarification of expectations—accomplished by sharing performance criteria with learners and educators and using performance measures—make it possible for everyone to excel because they can then assess and improve their own performance.
9. If an institution claims that it produces graduates who are life-long learners and future contributors to society, then that institution is morally obligated to facilitate this transformation in the students it admits. Process Education tells us that this kind of transformation is possible; to admit a student and yet not help them acquire the tools that make their success possible is simply unacceptable.

Reference

International Society of the Learning Sciences (ISLS). (2015). Available at: www.isls.org

Learning to learn focuses on improving the performance of learning through increasing the ownership, capacity, and efficiency learners demonstrate when constructing, using, and validating knowledge (Figure 1).



The idea of learning to learn was the direct result of an experiment with 22 colleges during the 1989/1990 academic year where freshmen and seniors were asked to compete in a learning challenge. To the surprise of nearly all, the learning performance of the seniors was no better than that of the freshmen; in four years of college, the ability to learn had not observably improved (Apple, Ellis, & Hintze, 2015). When shared, this discovery led to the creation of the Problem Solving Across the Curriculum (PSAC) conference. At the inaugural conference, hosted by Wells College in 1990, more than 120 faculty came together to share their insights and concerns regarding learning and the idea of learning to learn (Kramer & Beery, 1990). Participants collaborated on a model for the learning process at the first conference, which became the basis for subsequent activity by the conference community, including Pacific Crest in its first Teaching Institute in 1991 (Apple, 1991).

The key ideas shared at that Teaching Institute were about shifting the focus from teaching disciplinary content to teaching students how to learn:

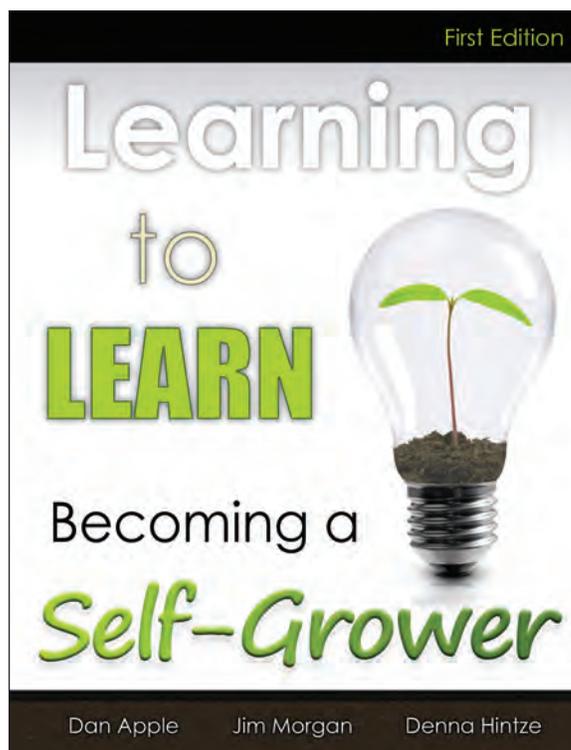
1. Students need to be the center of the learning process
2. Students must learn how to learn
3. Students must improve their critical thinking, problem solving, communication, and learning skills

It is worthy of note that together these principles offer the very definition of active learning, where the responsibility of learning lies with the learner (Bonwell & Eison, 1991).

Improving Learning Performance

During the 1991/1992 academic year, 20 members of this same community worked together to produce a freshmen course and curriculum focused on improving student learning performance. The first chapter of *Learning Through Problem Solving* offered a model of a high-quality learner and added that “everyone can improve their ability to learn” (Apple, Beyerlein, & Schlesinger, 1992). This idea of learning as a malleable and improvable process was further advanced in *Everyone Can Learn to Learn* (Arah & Apple, 1993), which noted a variety of ways in which learning rate or learning performance can be improved: by targeting life skills, intervening in and teaching students about the learning process, the use of cooperative learning, and the practice of self-assessment.

Figure 3



Foundations of Learning (Krumstiegl & Baehr, 1996) continued along this same vein; Chapter 2, titled "Learning to Learn," presented the Learning Process Methodology as a concrete way to improve learning performance, with the profile of a high-quality learner as a model for what a strong learner should look like, in practice. Four editions

Table 1 Performance Levels for Learners

Trained Individuals
<ol style="list-style-type: none">1. Must have new things explained to them.2. Need to be told what to do.3. Must have explicitly defined rules, procedures and policies.4. Find that managing others is extremely difficult.5. Need constant supervision and monitoring of performance.
Learned Individuals
<ol style="list-style-type: none">1. Feel comfortable learning within their base of experience.2. Can perform low level problem solving within their base of experience.3. Are willing to accept challenges within their areas of expertise.4. Can train others in the areas of knowledge they know best.5. Accept feedback based on “what they produce” better than feedback on “how they perform.”
Lifelong Learners
<ol style="list-style-type: none">1. Can tackle a reasonable percentage of learning requirements in a changing environment.2. Are able to apply previous problem solutions to new situations.3. Seek out new challenges in related areas of knowledge.4. Are willing to manage people who have more expertise than they do.5. Accept and use feedback based on their performance.
Enhanced Learners
<ol style="list-style-type: none">1. Accept all learning challenges and adapt readily to changing environments.2. Seek out greater challenges, responsibilities, and problems to solve.3. Seek to push the boundaries of their performance.4. Are willing to manage a team effort and mentor team members.5. Seek out mentors to help them improve their own performance.
Self -Growers
<ol style="list-style-type: none">1. Seek to improve their own learning performance with every experience.2. Create their own challenges.3. Take control of their own destiny—“there are no bounds.”4. Serve as a mentor to others.5. Self-assess and self-mentor to facilitate their own growth.

later, the core learning to learn content was joined with the research and experiences gained from 20 years of Learning to Learn Camps, resulting in *Learning to Learn: Becoming a Self-Grower* (Apple, Morgan, & Hintze, 2013; see Figure 2).

Twenty-two years after *Everyone Can Learn to Learn*, Apple & Ellis performed a fruitful analysis of learning as a performance in itself in *Learning How to Learn—Improving the Performance of Learning* (2015). They identified 13 components that contribute to a learning performance, each of which can be targeted to improve the performance of learning.

Defining and Measuring Learner Performance: From the General to the Specific

The first *Teaching institute handbook* provided a list of characteristics of a “Good Learner” (e.g., “1. Good learners have the self esteem, confidence, and self worth to tackle the unknown with the knowledge that they will be able to master any learning exercise with which they are presented or need...”) which was then formally published in *Learning Through Problem Solving*.

This general list of characteristics was revised and reordered into the Levels of Learner Performance published

in *The Classification of Learning Skills for Educational Enrichment and Assessment* (Apple, 1997), highlighting the characteristics of high-level learners and their learning skills (see Table 1). This basic rubric was greatly upgraded into a model of a strong learner, found in the *Faculty Guidebook* module *Profile of a Quality Learner* (Nancarrow, 2007). This extended profile was further revised as the *Rubric for an Engaged Learner*, allowing for the level of learner performance to be measured (Pacific Crest, 2013).

The most current contribution to defining learner performance is the Profile of a Quality Collegiate Learner (Apple, Duncan, & Ellis, 2016). With respect to measuring learner performance, we have come a long way, as is obvious with the Analytical Rubric of a Collegiate Learner, an excerpt of which is shown in Figure 3 and can be distributed and completed online (Pacific Crest, 2015).

Learning to Learn and...

The majority of topics that follow in this article are related more or less closely with learning to learn and have grown from some of the same research and scholarship. Of particular note are the following:

1. Methodologies
2. Learning Process Methodology
3. Reflection/Meta-Cognition
4. Self-Assessment
5. Performance Criteria
6. Self-Growth/Growth Mindset
7. Accelerator Model
8. Performance Measures
9. Performance Model
10. Classification of Learning Skills

Figure 3

<h1>Analytic Rubric of a Collegiate Learner</h1> <p>(Across 50 Dimensions of Performance)</p>		Name: _____		Date: _____	
		Rater: _____		Point Total: 50 to 250 possible <div style="border: 1px solid black; padding: 5px; display: inline-block;">0</div>	
		Scoring timepoint: <input type="radio"/> initial <input type="radio"/> in-process <input type="radio"/> final			
Behavior and Profile	Survival Learners 1	Need-Based Learners 2	Contained Learners 3	Professional Learners 4	Pioneer Learners 5
1 COLLEGIATE/ACADEMIC MINDSET (6 to 30 points) total for section: 0					
Clarifies Expectations <i>Knows what others want delivered by which dates and can establish standards of quality by writing performance criteria</i>	Mostly in the dark regarding what is due, at what level of quality, and by when <input type="radio"/>	Know the major requirements and roughly when they are due <input type="radio"/>	Have a task list of what needs to be done by what dates <input type="radio"/>	Have a task list that specifies the requirements for each task <input type="radio"/>	Align personal standards to those of the instructor to exceed expectations prior to deadlines <input type="radio"/>
Self-Efficacious <i>Has a strong belief in who they are, who they can become, and their ability to succeed in each new activity</i>	Lack conviction except in tasks previous achieved <input type="radio"/>	Believe they can succeed in certain situations where others have confidence in them <input type="radio"/>	Believe in meeting challenges that are within their comfort zone <input type="radio"/>	Willing to attempt challenges outside their comfort zone <input type="radio"/>	Believe they will be successful in everything they try <input type="radio"/>
Evolve a Life Vision <i>Evolves life vision based on analysis of past, present, and future, including life goals, and a well constructed plan for achieving them</i>	May have a wish or dream for their life but no clear direction/plan whatsoever <input type="radio"/>	Have developed some passion that guides a general life focus but live day to day <input type="radio"/>	Have some analysis of who they are and where they want to go directed by some life goals <input type="radio"/>	Have values, actions, and plans lined up and use them to move towards a set of life goals <input type="radio"/>	Have a well thought-out life plan that is annually adapted to integrate new opportunities <input type="radio"/>
Self-Motivated <i>Has passion and desire to explore new information, concepts, and challenges in areas of interest as well as tackling weekly commitments</i>	Are trained to respond to teacher requests and the grade system they set up <input type="radio"/>	Can find some interest in the learning by asking some questions themselves <input type="radio"/>	Create some learning goals that have more important value to them <input type="radio"/>	Try to make learning meaningful for themselves by finding relevant context for use <input type="radio"/>	Are intrinsically motivated by what they want to learn and from their own growth goals <input type="radio"/>
Self-Confident <i>Approaches each new task with self-assurance that mastery of a new challenge can be met</i>	Are insecure in most situations, questioning the need for most actions <input type="radio"/>	Perform only in areas where they excel <input type="radio"/>	Consistently perform in skilled areas <input type="radio"/>	Perform to expectations in all situations except those that are truly novel <input type="radio"/>	Willing to "fake it till they make it" and learn as they go <input type="radio"/>
Inquisitive <i>Constantly seeks new knowledge in multiple forms and from many disciplines by asking lots of interesting questions</i>	Ask very few questions even in new environments and situations <input type="radio"/>	Only explore things that have immediate impact on what they really care about <input type="radio"/>	Will freely explore and asks very interesting questions in areas of interest <input type="radio"/>	Want to see the connections to what they are doing in other closely related areas or disciplines <input type="radio"/>	Want to be on top of every situation, new environment, research activity or conversation <input type="radio"/>

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Learners with a growth mindset believe that they have the ability to increase their knowledge (learn) as well as their capacity to perform on the basis of that knowledge (grow). Self-Growers are people who consciously and continuously strive to mentor their own self-development, challenging and assessing themselves to increase their capacity for performance.

Learning vs. Growing

The importance of a growth mindset and the potential for self-growth is only apparent if we're able to differentiate between *knowledge* and *growth*. Professor of Psychology Cy Leise draws the difference succinctly: "Knowledge is the result produced from learning. Growth is the result of personal development produced by self-assessment" (2007). He further explains that while a learner can easily **increase** the amount of knowledge they have, the increase does not automatically lead to **improved** learning performance. This jibes with the experience shared in the section **Learning to Learn**, in which freshmen and seniors competed in a learning challenge, and although the seniors had much more knowledge, this did not correspond to an increased ability to perform as learners (Apple, Ellis, & Hintze, 2015). In the simplest possible terms, learning is about increasing knowledge, whereas growth is about improving performance.

The term, "growth mindset" is properly attributed to psychologist Carol Dweck, author of *Mindset: The New Psychology of Success* (2006). Dweck defines *growth mindset* in apposition to "fixed mindset":

Fixed Mindset

"In a fixed mindset, people believe their basic qualities, like their intelligence or talent, are simply fixed traits... They also believe that talent alone creates success—without effort."

Growth Mindset

"In a growth mindset, people believe that their most basic abilities can be developed through dedication and hard work—brains and talent are just the starting point."

The goals of the first Teaching Institute were to improve student learning, faculty teaching, and instructional design to increase productivity (Apple, 1991). This focus on improvement has remained and is at the heart of Process Education. While the actual phrase "growth mindset" is absent, its meaning and the emphasis on **improving learner capacity for performance** is ever-present, even in the earliest handbook. Throughout the handbook, one finds phrases such as,

- *Students will need to learn at a continually increasing rate*
- *Empower students to become better problem solvers, critical thinkers, and communicators*
- *Developing students' assessment skills*
- *Educational process needs to focus on learning skills*
- *Students must learn how to learn*

This makes clear that improvement and growth are the objectives of teaching and learning...not simply making students more knowledgeable.

Growth and Learning Skills

In the textbook *Learning Through Problem Solving* (Apple, Beyerlein & Schlesinger, 1992), a major focus was to help students learn how to learn, improve problem solving and critical thinking, and to improve their learning skills by using self-assessment; a fairly potent recipe for growth. This is because learning skills (see the section **Classification of Learning Skills**) are one of the critical ingredients for self-growth...so much so that perhaps they should have been called "growth skills," instead.

Teach for Learning — A Handbook for Process Education (Pacific Crest, 1993) was used as the institute handbook during Teaching Institutes in 1993 and 1994. It articulated a growth-oriented educational focus, explaining that the acquisition and improvement of learning skills would improve learning performance by increasing the rate of learning.

Assessment for Self-Growth

Assessment is the trigger for improvement of performance; in 1995, Apple and Duncan-Hewitt, in their book *A Primer for Process Education* set out a definition of Process Education as being comprised of

1. Education focused on the development of learning process skills ("The rate at which you learn is a function of your investment in learning how to learn and your commitment to developing your learning skills.")
2. The use of cooperative learning, problem solving, and discovery-based learning in an environment of continuous assessment and reflection

3. Student-centered instruction in learning processes

The first piece is learning skills and the growth they make possible. But now we also have an educational environment marked by continuous assessment. The third statement, though seemingly trivial, is actually critical and should be discussed in some depth.

Self-Growers

A “student-centered” approach in learning processes is what puts the “self-” in “self-grower;” this is more than mere ownership of learning (itself a strong principle; see the section on **Culture of Success**); when understood in the context of the first statement, this is ownership of the growth process. This formula was strengthened in *Process Education — A New Educational Mission* (Apple, 1997), in which a self-grower was described as “a life-long learner who continues to grow by utilizing strong self-assessment skills to improve future performance.” Self-Growers:

1. Create their own challenges
2. Seek to improve their own learning performance with every experience
3. Take control of their own destiny — “there are no bounds”
4. Serve as a leader and mentor to others
5. Self-assess and self-mentor to facilitate their own growth

This formulation offers learning skills, assessment, and ownership of the growth process (“self-mentor”). But what is the relationship between taking control of one’s own destiny and growth or self-growth? It is also part of taking ownership of the growth process, but there is another aspect as well: the idea of creating a life vision was first included in *Foundations of Learning*, (1st ed.) (Krumsieg & Baehr, 1996) as a way to help students make meaning of their current life and set a direction for their

future life plan. This provided the motivation needed for students to begin their journey of self-growth to realize the life plan articulated in their life vision. See Figure 1 for a visual summary of how these pieces and dynamics interrelate. (Each subsequent chapter of *Foundations of Learning* provided tools and challenges to support the first few steps of the student’s journey of self-growth.)

Scholarship on Growth and Self-Growers

The description of a self-grower was expanded in the *Faculty Guidebook* module *Performance Levels for Learners and Self-Growers* (Myrvaagnes, 2007) with a rubric for determining performance level as a self-grower (see Figure 2). According to Myrvaagnes,

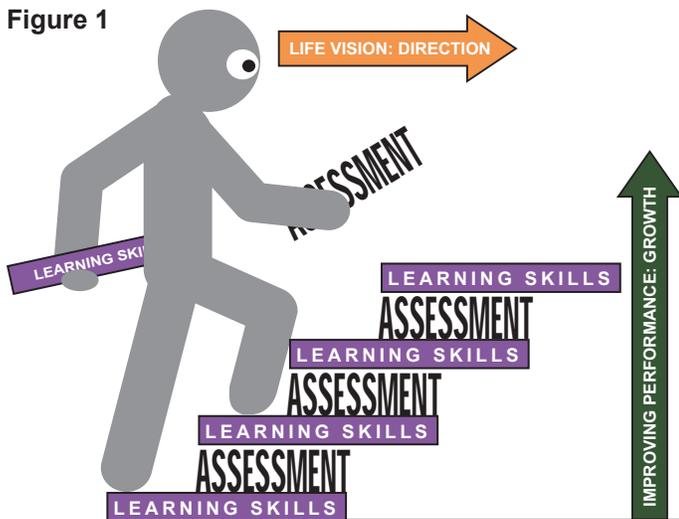
Self-Growers have defining characteristics which include an enduring interest in assessment and self-assessment in order to maximize performance in every aspect of life. High-level self-growers... are both motivated and able to use their life vision, self-assessment skills, self-control in the face of challenging situations, positive orientation toward growth, and aptitude for servant leadership to move to the next level.

In *Becoming a Self-Grower*, Leise offers the means for developing into a self-grower. He focuses on the aspects of life vision, self-assessment, control, and servant leadership, adding that, “Individuals who focus on growth find it to be the most compelling motive in their lives” (2007). While the bulk of the focus is on helping learners become self-growers, Hurd speaks directly to the importance of faculty making the same commitment in *Self-Growth Plans for Faculty Members* (2007):

If faculty members hope to model the behaviors that they are expecting from their students, and to mentor students to become self-growers, they must themselves aspire to become better at their own self-growth, and must consciously work at such development in a disciplined fashion.

The most recent scholarship on self-growth, *What Is Self-Growth?* (Jain, Apple, & Ellis, 2015) offers 10 key components that enhance self-growth (see Figure 3).

Figure 1



Self-Growth in Curricula

While both *Foundations of Learning* (Redfield & Hurley Lawrence, 2009) and *Learning to Learn: Becoming a Self-Grower* (Apple, Morgan, & Hintze 2013) predate *What Is Self-Growth?*, all 10 of the components of self-growth are targeted by both books. This should not be surprising; the very definition of Process Education calls for “the continuous development of learning skills through the use of assessment principles in order to produce learner self-

Figure 2 Performance Levels for Self-Growers

	Cognitive	Social	Affective	Psychomotor
Level 5 Star Performers	Understand the reasons for deficiencies in the current paradigm, and readily construct more appropriate paradigms.	Create movements and organizations that often become self-perpetuating.	Control their emotions in challenging situations while managing the affect of others.	Outperform others because of reserves in strength and endurance.
Level 4 Self-Starters	Respond to the needs of research communities, adding incrementally to knowledge in their discipline.	Initiate and manage social structures to accomplish more out of every hour of their time.	Feel frustrated when they are not being challenged to perform at higher levels.	Engage in a rigorous physical routine which provides them with resources for dealing with stress.
Level 3 Responsive Individuals	Use their problem-solving, learning, and thinking skills to improve their performance and get higher-quality results.	Are positive people whom others enjoy and want to have on their teams.	React to challenges with improved performance rather than complaints, feeling good about their accomplishments.	Exercise regularly and pay attention to nutrition because they want to exceed expectations.
Level 2 Content Individuals	Are satisfied with their modest levels of effort in learning, thinking, and problem-solving.	Interact freely with family and friends, but do not seek more diverse contacts and more challenging relationships.	Feel like a cog in the machinery, doing little more than what is asked, feeling their contributions are not very significant.	Want to maintain their current health and fitness levels but are unable to realize much visible progress.
Level 1 Static Individuals	Try to minimize or avoid the effort needed to think, learn, or solve problems.	Limit their social interactions to like-minded individuals who complain about what they are not getting out of life.	Feel that whatever they do will have little impact, that most things are not worth the effort.	Must conserve energy to deal with frequent health issues

Figure 3 The Key Components of Self-Growth

Key Components	Explanation
1 Having a growth mindset	Start with an unconditional and unwavering belief in self
2 Planning	Think before doing
3 Developing a life vision	Initiate or update a life vision of what one wants to achieve or become in life
4 Set performance criteria	Measure the performance
5 Self-assessment	Assess each significant performance with to improve the <i>next</i> performance
6 Reflection	Increase self-awareness and metacognition
7 Self-challenge	Take significant risks and continually push oneself outside of the comfort zone
8 Mentoring	Improve self and others
9 Grit	Persevere and commit in spite of personal factors
10 Passion	Self-motivation to walk the walk of one's own values

development.” Indeed, the creation of self-growers is the ultimate goal of Process Education (Pacific Crest, 2011, <http://www.pcrest.com/resources/pedef.html>). Figure 4 lists the 10 components of self-growth along with a suggestion for how to target each component. For each component, the content, activities, or strategies in *Foundations of Learning* and *Learning to Learn: Becoming a Self-Grower* that most strongly supports that component are shared.

In addition to helping learners improve every component of self-growth, both *Foundations of Learning* and *Learning to Learn: Becoming a Self-Grower* include an activity that challenges students to write a self-growth paper,

documenting their development in self-growth and capacity. This task is considered the capstone assignment in the Learning to Learn Camps and has proven to be one of the key research tools for analyzing growth outcomes as discussed in *Learning to Learn Camps: Their History and Development* (Apple, Ellis, & Hintze, 2015). The measurement of growth is now being integrated into Learning to Learn Camps and the academic recovery courses with the analytical rubric based upon the Profile of a Quality Collegiate Learner (Pacific Crest, 2015).

Figure 4 The 10 Components of Self-Growth and How They Are Targeted in *Foundations of Learning* and *Learning to Learn: Becoming a Self-Grower*

Key Components	Steps, Actions, and Activities
1 Having a growth mindset	All aspects of the Theory of Performance can be improved: identity, learning skills, knowledge, context, and personal factors, and the rate of this growth are in their own hands.
Students are introduced to the concept of growth and given not only performance levels for learners and self-growers, but models and examples for each level of performance. Students are also given the Theory of Performance and tasked with using it as a way to assert their own ability to improve and grow.	
2 Planning	Detailing an overall strategy with reasonable timelines for each of the desired aspirations. A concept map can help organize links between identity, skills, knowledge, context, personal factors, and fixed factors.
There is a chapter or experience on “Time, Planning, and Productivity” and students practice prioritizing and writing action plans. Students also practice making both short and long-term goals when introduced to the Life Vision Portfolio.	
3 Developing a life vision	Knowing and analyzing who you are, where you come from, what you want to become, and what you would like to accomplish; or determining what one wishes to be or achieve in life.
Students create a Life Vision Portfolio in an early activity or experience and are then tasked with adding to it repeatedly through the course.	
4 Setting performance criteria	Determining one’s current level of performance with respect to self-growth. The key is to continually increase the level of performance from the current level with clear understanding of the elevated levels and the corresponding pre-established measurement criteria.
The activity/experience that introduces the Theory of Performance also offers the Performance Level for Self-Growers rubric (see Figure 2). Additionally, in the chapter/experience focused on assessment, students are taught to write performance criteria for performances.	
5 Self-Assessment	Continually assessing and envisioning outcomes for strengths, improvements, and insights.
Students are prompted to assess their performance in each chapter or learning experience. Further, they are challenged with elevating their assessment skills in the chapter/experience on assessment.	
6 Reflection	Taking time to step back from doing to understanding why you are doing what you are doing. This updating of your intrinsically driven inner compass helps you to align your actions and decisions with your values to keep you moving towards your life vision.
<i>Foundations of Learning</i> contains chapter sections titled, “Reflection” where students are prompted to engage in reflective thinking and writing. <i>Learning to Learn: Becoming a Self-Grower</i> contains an experience focused on increasing self-awareness and metacognition. It also offers an extended excerpt from “A Comparative Analysis of Reflection and Self-Assessment,” by Desjarlais and Smith (2011).	

Key Components	Steps, Actions, and Activities
7 Self-Challenge	Learning to eliminate self-doubt and boosting self-image through preparation, commitment, and timely completion of established as well as impromptu actions, activities, and challenges.
In both texts, students are challenged to set and achieve short-term goals. The content on “Time, Planning, and Productivity” ups the ante with respect to “preparation, commitment and timely completion” as students are tasked with completing a semester calendar, gathering all due dates and assignments for all courses. In <i>Learning to Learn: Becoming a Self-Grower</i> , the experience, “Performing when Being Evaluated” contains the Preparation Methodology and gives students the opportunity to work through an upcoming challenge by doing everything they can to prepare.	
8 Mentoring	Establishing a clearly-bounded, trusting, and confidential relationship based on mutual respect to achieve clearly-defined goals using the SII principles.
<i>Foundations of Learning</i> offers information about “Selecting a Mentor” as part of the discussion about the Personal Development Methodology. <i>Learning to Learn: Becoming a Self-Grower</i> contains an entire chapter (experience) focused on mentoring: “Choosing and Using Mentors Effectively” which tasks students with identifying potential mentors and then entering into a mentoring relationship.	
9 Grit	Having self-control, accepting failure as a necessary condition to self-growth, being open-minded, optimistic, courageous, patient, persistent, and hardworking, and having willpower, mental toughness, tenacity, perseverance and resilience.
Both books offer student examples of grit, where challenges were not necessarily met upon first effort but after persistence and perseverance. <i>Learning to Learn: Becoming a Self-Grower</i> offers an experience, “Using Failure as a Stepping Stone for Success” that is all about recovering from and learning from failure.	
10 Passion	Taking the first step and continuing the commitment with the same conviction, energy, and enthusiasm throughout.
While passion is difficult to teach, it can be modeled and is, in both books. Student examples at Level III or higher on the Performance Levels for Self-Growers demonstrate conviction, energy, and enthusiasm. Additionally, the final experience in <i>Learning to Learn: Becoming a Self-Grower</i> is titled, “Shifting from Extrinsic to Intrinsic Motivation.” In this experience, students explore how to build a life vision and life based on their values and passions.	

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A Foundations of Learning course teaches first-year students how to learn and become self-growers, instilling in them the characteristics of a collegiate learner who will succeed in any undergraduate program.

The Curriculum

The novel idea of teaching students **how to learn** as they enter college arose from the many workshops and discussions that took place during the first annual Problem Solving Across the Curriculum Conference (Kramer & Beery, 1990). With the help of more than 20 faculty members, 21 different learning activities were created and then carefully assembled into *Learning Through Problem Solving* (Apple, Beyerlein & Schlesinger, 1992), a curriculum for incoming first-year students. This curriculum was designed to help students improve their capacity for learning, problem solving, writing (journals and reports), giving presentations, computing, and analyzing (graphs and data). The purpose and features of this course were offered in *A Foundations Course for College Freshmen* (Baehr & Apple, 1994) and the first published implementation of this ideal course was *Foundations of Learning* (pre-market edition), (Pacific Crest, 1995). Based on feedback and assessments gathered during the 1995/1996 academic year, Pacific Crest announced publication of the first edition of *Foundations of Learning* in 1996 (Krumsieg & Baehr). This refined resource provided activities and methodologies to help faculty facilitate students in improving their ability to learn, read, write, work in teams, process information, communicate, assess, manage, and make the transition to college. The learning activities in *Foundations of Learning* were also designed to help students develop transferable

learning skills, as set out in the Classification of Learning Skills (Apple, Beyerlein, Leise, & Baehr, 2007), to further ensure their success as collegiate learners.

For the second edition of *Foundations of Learning* (Krumsieg & Baehr 1999), based on the expressed needs of a variety of colleges, the design of the activities was improved, and additional content was integrated. A quick yet fundamental redesign for the 3rd edition (Krumsieg & Baehr, 2000) separated the activities book from the content, such that each could be used alone.

A description of the purpose, key considerations, and the critical components of such a course are found in the *Faculty Guidebook* module, *Designing a Foundations Course* (Newgren, 2007). As Newgren shares, one of the most critical issues in creating a foundations course is a strong commitment to its success on the part of both administrators and faculty. Table 1 lists the stakeholders to a foundations course, along with the roles they should assume to ensure success for the course. Newgren's work led to the first formal course design document for a Foundations of Learning course which was created at Hinds Community College. That unpublished document for an EDU 1203 course was upgraded in 2008 by Redfield and Lawrence, even as they worked on authoring the 4th edition of *Foundations of Learning* (2009); see Figure 1 for the contents of this curriculum and course.

The most current curriculum is a one or two-credit course, *Learning to Learn: Becoming a Self-Grower* (Apple, Morgan, & Hintze, 2013) which consists of 15 weekly learning experiences designed to successfully counter the most prevalent factors that put college success at risk for many first-year students (Apple, Duncan, & Ellis, 2016).

Implementations

The first practical implementation of a Foundations of Learning course was at St. Augustine College in Raleigh NC, where the course was offered within their Learning Communities Program. As part of this program, all students attended a Learning to Learn Camp, and took both a Foundations of Learning course in the fall and a community service project course in the Spring (Knowles, 1995). The description of a very effective implementation of a foundations course may be found in *Enhancing a First-Year Success Course Through Process Education* (Jones & Kilgore, 2012).

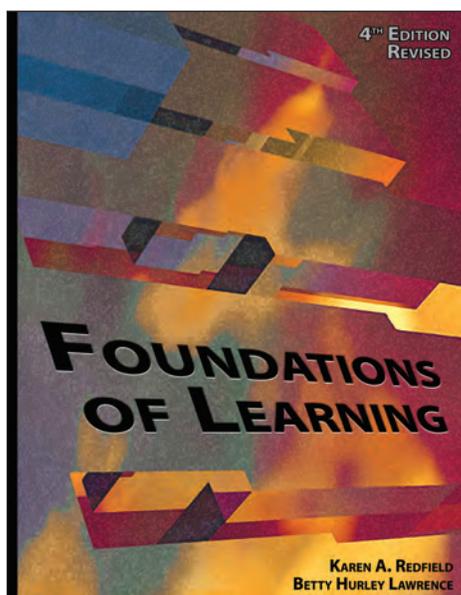


Table 1 Foundation Course Stakeholders and Their Roles

Administrators
<ul style="list-style-type: none">• Acknowledge the need for the course• Provide resources for course development• Identify and resolve staffing constraints, including teaching assignments within and among academic units• Be open to changes in pedagogy and program culture
Design Team
<ul style="list-style-type: none">• Inventory the needs of course stakeholders• Align course outcomes with desired long-term behaviors• Select learning activities and pedagogies for the course• Assemble instructional materials• Recommend training for course instructors• Participate in regular course review activities
Course Instructors
<ul style="list-style-type: none">• Attend recommended orientation sessions/meetings• Communicate and uphold course expectations• Refine activities to better meet course outcomes• Be open to exploring student-centered pedagogies• Cooperate with other instructors in delivering a common, high-quality experience to all students• Collect data on the effectiveness of learning activities for review by the instructional team• Make recommendations for how the foundations course can be leveraged in upper-level coursework
Senior Faculty
<ul style="list-style-type: none">• Provide timely input to the course design team• Value the efforts of the design team and instructors• Be willing to teach a foundations course on an occasional basis to stay abreast of changes in program culture• Modify the expectations and delivery of upper-division courses to take advantage of foundations course outcomes
Support Staff
<ul style="list-style-type: none">• Consult with the design team to ensure that needed resources (i.e. library, career center, and computer labs) are available for use in the course• Provide feedback on learning activities associated with the resources/services they provide• Share success stories with other units on campus
Students
<ul style="list-style-type: none">• Openly communicate with peers and instructors• Actively participate in all learning activities.• Accept personal accountability for class assignments and interpersonal behaviors both in and out of the classroom• Develop a mentality of exceeding course standards, not just being satisfied with minimum acceptable performance

The content from *Foundations of Learning* is also easily adapted to disciplinary contexts, as is seen in the introduction to business course, *Gateway to Business* (Bobrowski & Cox, 2001), developed at SUNY Oswego, which integrated content and activities from *Foundations*

of Learning within a business context (Bobrowski & Cox 2003). Illinois State University also designed their own foundations course, *Enterprise* (Newgren, 2003, 2004), to stand as the Business 100 course.

Figure 1 Contents for *Foundations of Learning*, 4th Edition

Chapter 1 Improving Performance Activity 1.1 Building Learning Communities Activity 1.2 Analyzing a Course Syllabus	Chapter 8 Living in the Information Age Activity 8.1 Information Processing Methodology Activity 8.2 Using a Software Help System
Chapter 2 Strengthening Identity Activity 2.1 Creating Your Life Vision Portfolio Activity 2.2 Exploring Your Campus	Chapter 9 Finding and Working with Sources Activity 9.1 Academic Honesty Activity 9.2 Team Research Plan
Chapter 3 Reading Methodology Activity 3.1 Using a Reading Log Activity 3.2 Practicing the Reading Methodology Activity 3.3 Analyzing a Literary Text	Chapter 10 Writing in College Activity 10.1 Applying the Writing Methodology Activity 10.2 Assessing and Revising Activity 10.3 Interviewing about Reading and Writing
Chapter 4 Learning to Learn Activity 4.1 Analyzing the Learning Process Methodology Activity 4.2 Applying the Learning Process Methodology	Chapter 11 Communication and Teamwork Activity 11.1 Exploring Team Roles Activity 11.2 Team Logo Competition Activity 11.3 Team Design Competition
Chapter 5 Problem Solving Skills Activity 5.1 Analyzing the Problem Solving Methodology Activity 5.2 Applying the Problem Solving Methodology	Chapter 12 Assessment for Self-Improvement Activity 12.1 Exploring the Assessment Methodology Activity 12.2 Building a Criteria List Activity 12.3 Assessing a Work Product
Chapter 6 Context of Performance Activity 6.1 The Terminology of College Activity 6.2 The Student Handbook Activity 6.3 Developing an Educational Plan	Continuing the Journey Final Activity Self-Growth Paper
Chapter 7 Addressing Personal Obstacles Activity 7.1 Becoming a Self-Grower Activity 7.2 Personal Development Methodology	

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Concepts such as “raising the bar,” “raising expectations,” and “getting students outside their comfort zone” are all part of the research behind the Accelerator Model; also included are the importance of taking risks and accepting failure as a frequent and productive means to growth and success.

As part of Pacific Crest’s PC:SOLVE demonstrations, we designed a script of activities for students in order to show faculty how well students could perform. These activities intentionally created a dynamic and energetic environment in which teams were challenged to compete at solving problems. In such an environment, students took risks, were aggressive in experimenting, learned from failure by figuring things out, and showed all the signs of thinking critically and reflecting on their performance. We discovered that the harder we pushed these students, the more impressive their responses and the more confidence they developed. (Dan Apple, personal recollection)

The model of this environment—especially with its elements of strategic risk-taking, a culture of “try it,” and accepting failure as frequent and productive means to success—was developed in *Learning Through Problem Solving* (Apple, Beyerlein & Schlesinger, 1992). *Teach for Learning — A Handbook for Process Education* (Pacific Crest, 1993) described discovery learning as a stimulus for prompting students to not just passively take in information, but to actively engage by asking “Why?” when presented with information. This same handbook also helped instructors learn to model the behaviors sought from students, so that students would learn to experience the process of learning for themselves rather than “being taught.” Instructors were advised to respond to student questions with insightful questions, modeling what students could ask themselves. In modeling such questions, instructors caused a productive kind of frustration, as most students initially prefer simply being given an answer instead of having to assume the mantle of questioner, discoverer, and researcher themselves. *Teach for Learning* also recommended that, as with the PC:SOLVE demonstrations, instructors should constantly increase the challenge as students succeed with current challenges, a strategy that increases student confidence and engagement.

The concept of *time pressured learning* was introduced in the *Teaching institute handbook* (Apple, 1995), noting that instructors can achieve the desired amount of pressure by raising expectations or limiting the time available for completing activities. A Teaching Institute activity, “Frustration,” gave faculty the opportunity to discover that

not meeting performance criteria (failing, to at least some degree) can provide:

1. An opportunity for future motivation
2. The impetus for students to improve their learning performance by improving their learning skills
3. An insight into the value of reflection time in helping students learn more about learning

The 1998 *Teaching institute handbook* (Apple & Krum-sieg) saw the first publication of the Accelerator Model (so named because varying the level of challenge is analogous to varying the pressure on an accelerator) as a way to help faculty appreciate how raising the level of challenge (pushing down on the accelerator) can lead to greater student learning and growth. The *Faculty Guidebook* module *The Accelerator Model* (Morgan & Apple 2007) effectively links the model to scholarship concerned with learning, degree of challenge, emotional skills, engagement, and motivation (see especially Bandura 1997, Bransford, Brown, & Cocking 2000, Damasio 2005, Gist, Schwoerer & Rosen 1989, Goleman 1997, Mikulincer 1998, and Picard 1997), even as it demonstrates the relationships among the pieces previously laid out: challenge, raised expectations, risk-taking, productive frustration, failure as a motivator, and time-pressured learning.

According to the Accelerator Model, there are three variables that regulate the growth and development of students’ cognitive and affective learning skills: the cognitive skill set of students, the affective skill set possessed by students, and the degree of challenge initiated by the instructor (Figure 1 shows these variables set as axes in the model).

The z-axis, “Affective Skill Set” is of particular note, as it includes affective skills such as risk-taking, persisting, managing frustration, and handling failure, all skills that are critical if learners are to be actively engaged and high performing. As Figure 2 makes clear, the stronger a learner’s affective skill set, the more effectively he or she will be able to meet learning challenges without significant anxiety, anger, frustration, or disengagement. Conversely, personal growth in affective skills can only occur when a learner is below his or her “happy zone.” This means that we build affective skills by increasing challenge (depressing the accelerator) either by increasing complexity or restricting time available to the point that learners are outside of their

Figure 1 The Accelerator Model

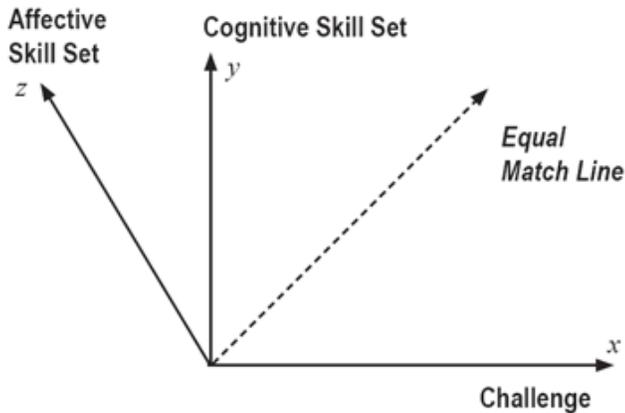
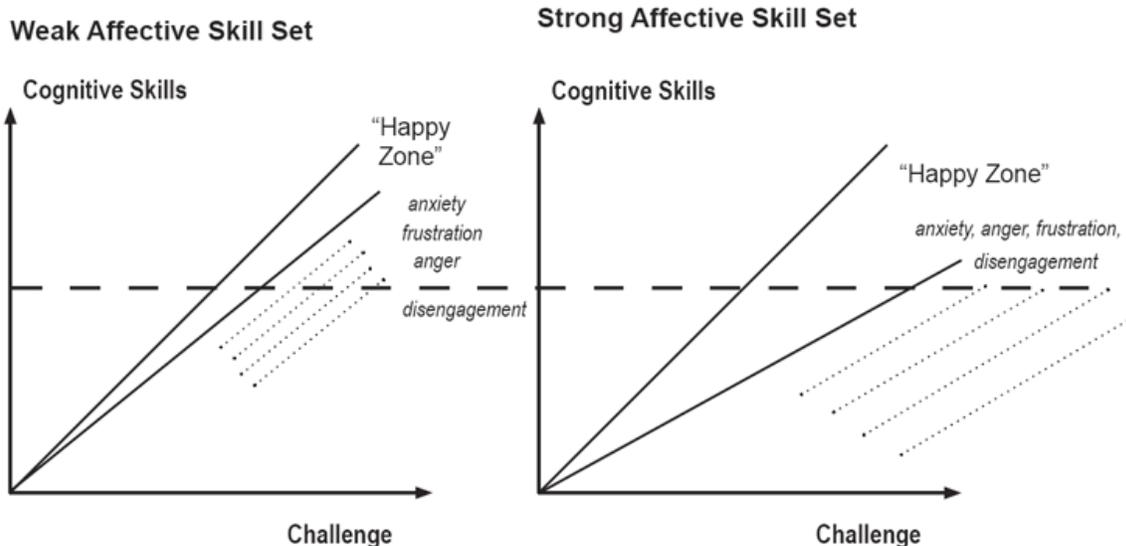


Figure 3

1. Establish initial respect.
2. Start with no prejudging.
3. Obtain shared commitment.
4. Foster and support risk-taking.
5. Permit the learner to fail.
6. Set high expectations.
7. Establish clear performance criteria.
8. Implement a quality assessment system.
9. Document performance.
10. Continuously challenge performance.

Figure 2 Consequences of Weak Versus Strong Affective Skill Sets



happy or comfort zone. As their affective skills grow, they are better able to increasingly meet more difficult learning challenges that build their cognitive skills.

A learning environment in which the Accelerator Model works and in which students evince a willingness to take risks and embrace a “try it” attitude must be conscientiously and deliberately created. The *Methodology for Creating a Quality Learning Environment* (Smith & Apple, 2007) from the *Faculty Guidebook*, includes the 10 steps available in Figure 3, as the process for creating just such an environment, with Steps 4, 5, 6, and 10 speaking directly to the importance of learners having the opportunity to build strong affective skills (see also *Setting High Expectations* by Smith, 2007).

While many learning activities available to students may target affective skills and raise the level of challenge over the course of the activity, the bulk of discussion available

about the Accelerator Model and what comprises a quality learning environment is written for educators rather than students. In *Learning to Learn: Becoming a Self-Grower* (Apple, Morgan & Hintze 2013), we tip our hand in Experience 12: Using Failure as a Stepping Stone to Success, actively challenging students to step outside their comfort zone. While the Accelerator Model itself is absent, students are given appropriate context and information about the affective skills discussed previously, in the context of personal development. The learning objectives for this experience are to help students learn the value of failure as a frequent and productive means for achieving success, increase their willingness to take on greater risks so that new opportunities become available to them, and assess failures so that they can turn them into successes—all skills evident in engaged, confident, and successful learners.

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Learning to Learn Camps are five-day intensive experiences that model how every student can become a successful collegiate learner by learning how to learn and developing a growth mindset.

In 1989, Pacific Crest conducted dozens of demonstrations at colleges across the country, asking teams of freshmen to compete against teams of seniors in a learning challenge. Time and again, the seniors performed no better than the freshmen. “Though the seniors might have had more facts at their disposal and knew more, they had no greater facility in learning than did the freshmen. It was evident that if learning were to be improved, someone needed to teach students to **how** to learn” (Apple, Ellis & Hintze, 2015). Teaching students to learn became one of the top goals for Pacific Crest.

Curricula

The first step in this process was for Pacific Crest, with the help of many faculty in the Process Education community, to design and publish curricula that would successfully support learning to learn.

The initial set of materials identified included *A Fresh Look at Math and Graphing Skills* (Merton & Apple, 1992), *Learning Through Problem Solving* (Apple, Beyerlein & Schlesinger, 1992), *Learning Assessment Journal* (Carroll & Apple, 1995), and the Life Vision Portfolio component of *Foundations of Learning* (Pacific Crest, 1995a). During 1996, the curriculum was standardized with three books: *Foundations of Learning* (Krumstiegl & Baehr, 1996), *Learning Assessment Journal* (Carroll & Beyerlein, 1996), and *Math and Graphing Skills* (Merton & Apple, 1992).

With the integration of the self-grower model and the activity “Becoming a Self-Grower” in *Foundations of Learning* (3rd ed.) (Krumstiegl & Baehr, 2000), the Learning to Learn Camp curriculum not only supported the personal growth of students (and faculty) but also became a way to help learners develop the ability to shepherd their own growth. Where previously they had only been learning to learn; now they were also “learning to grow.” Support of student self-growth was again strengthened with the creation of the *Life Vision Portfolio* in 2002 (Mettauer).

The curriculum used in today’s Learning to Learn Camps is more polished and contains more tools, but is very similar to the curriculum of 10 years ago: the *Student Success Toolbox* (Pacific Crest, 2011), which is based on the *Learning Assessment Journal* but greatly expanded; *Math and Graphing Skills* (4th ed.) (Lawrence, Burke, & Hintze, 2008); and the fourth edition of *Foundations of Learning* (Redfield & Hurley Lawrence, 2009), the redesign of which was informed by feedback and lessons learned from

14 years of designing, facilitating, and assessing Learning to Learn Camps. One of the features of this text is its fully integrated Life Vision Portfolio.

Practice

The first opportunity to use these materials in a week-long camp came in 1994 with 20 foster children in Scranton, Pennsylvania. The results of this experience were so positive that camp organizers worked to find the resources necessary to hold the first Learning to Learn Camp in the summer of 1995. The first camp focused on developing student learning skills by organizing the students into learning teams led by faculty coaches through a schedule of hourly learning activities. Students were assessed by their coaches during activities in mathematics, physics, calculus, economics, and career planning, with the goal of assessment being to improve student learning performance. Because the camp was performance-based, it used a point system to help make an engaging, competitive, and challenging learning and problem-solving environment (Pacific Crest, 1995b).

While there have been changes in the design and logistics of the Learning to Learn Camps, they are surprisingly few. The greatest changes have been the broadening of the focus of activities, as informed by the newer curriculum. The general logistics of the Learning to Learn Camps and the experiences by multiple colleges are presented in the *Faculty Guidebook* module, *Learning-to-Learn Camps* (Armstrong, Anderson & Nancarrow, 2007); the website www.learningtolearncamp.com offers additional information about the structure and organization of the camps, more about the curriculum, feedback from past participants, and a manual for facilitators.

Integration of the Camp

Because the general focus of the Learning to Learn Camp is on learning to learn and learning to grow, it lends itself particularly well to integration with larger campus- or college-based programs seeking to better equip students and faculty with critical learning and teaching skills. In 2000, for example, the Learning to Learn Camp became an integral part of the Emerging Scholars Program at the Kuskokwim Campus of the University of Alaska, Fairbanks – College of Rural and Community Development (Kuskokwim, 2015). The Learning to Learn Camp has been integrated as part of a professional development program at Madison Area Technical College (MATC) where,

15 years after its first camp in 2001, the LLC at MATC is now an August practicum linked to their annual spring professional development series on assessment, teaching, and mentoring (Barlow, 2015).

Customizing the Camps

Not only are the Learning to Learn Camps integrated into programs, they are also customized to include disciplinary emphasis (Apple, Ellis & Hintze, 2015). This is possible because many of the core modules of *Foundations of Learning* can be applied with a range of actual disciplinary content, i.e., those such as “Practicing the Reading Methodology” that are so essential to learning that they must be included in any version of the camp (see Figure 1). Figure 2 shows an excerpt of the Algebra Learning to

Learn Camp schedule, demonstrating how customized Learning to Learn Camps combine core content from *Foundations of Learning*, blending some of that content with disciplinary content, and including purely disciplinary activities (Pacific Crest, 2013).

The following list offers some of the customized Learning to Learn Camps that have been held since 2009:

- Nursing Recovery Camp (Hinds Community College, 2009)
- Calculus Learning to Learn Camp (SUNY Buffalo State University, 2009)
- Scholar's Institute for Honor Students (Grand Valley State University, 2010)

Figure 1 Core Modules from *Foundations of Learning*

1.1 Building Learning Communities	5.2 Applying the Problem Solving Methodology
1.2 Analyzing a Course Syllabus	7.1 Becoming a Self-Grower
2.1 Creating Your Life Vision Portfolio	7.2 Personal Development Methodology
2.2 Exploring Your Campus	9.1 Time Management
3.1 Using a Reading Log	11.1 Applying the Writing Methodology
3.2 Practicing the Reading Methodology	12.1 Exploring Team Roles
4.1 Analyzing the Learning Process Methodology	13.1 Exploring the Assessment Methodology
4.2 Applying the Learning Process Methodology	14.1 Self-Growth Paper
5.1 Analyzing the Problem Solving Methodology	

Figure 2 An Excerpt from the Algebra Learning to Learn Camp Schedule

FOA = Foundations Algebra FOL = Foundations of Learning

Activity	Reading	Focus	Type
DAY 2			
Analyzing the Learning Process Methodology (FOL 4.1)	FOL Ch. 4	Learning Mathematical Content	Blended
Math Skills		Basic Mathematical Skills Review	Blended
Equivalent Equations	FOA 2.1		Content
Time Management (FOL 9.1)	FOL Ch. 9		Core FOL
Validation	FOA 2.4		Content
Analyzing the Problem Solving Methodology (FOL 5.1)	FOL Ch. 5		Blended
Practicing the Reading Methodology (FOL 3.2)	FOL Ch. 3		Blended
Applying the Learning Process Methodology (FOL 4.2)	FOL Ch. 4		Blended
Solving Basic Equations	FOA 2.2		Content
Solving Systems of Linear Equations	FOA 2.3		Content
Solving and Graphing Linear Inequality	FOA 3.1		Content
Open Lab & Self-Assessment of Day Two Using Engaged Learner and Professionalism Measures		Book of Performance Measures	Blended

- STEM UP Learning to Learn Camp (Hinds Community College, 2011)
- Algebra Learning to Learn Camp (Hinds Community College, 2012)
- Smart Grid Learning to Learn Camp (Job Corps, 2013)
- Learning to Learn Camp for a college basketball team (Lamar University, 2014)
- Academic Recovery Course (Grand Valley State University, 2015)

The Learning to Learn Camp as a Learning to Learn Course

While the model of a week-long Learning to Learn Camp has been successful, there have also been requests that Pacific Crest find a way to convert the Learning to Learn Camp experience into a one- or two-credit course that could potentially be offered to all incoming students. The result is *Learning to Learn — Becoming a Self-Grower* (Apple, Morgan, & Hintze, 2013), a course and curriculum with 15 weekly (plus two supplemental) learning experiences:

- 1 Performing Like a Star
- 2 Becoming a Master Learner
- 3 Your Past Doesn't Define Your Future
- 4 Self-Assessment: The Engine of Self-Growth
- 5 Time, Planning, and Productivity
- 6 Methodologies: Unlocking Process Knowledge

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- 7 Visioning Your Future
- 8 Performing in Teams and within a Community
- 9 Performing when Being Evaluated
- 10 Reading for Learning
- 11 Metacognition: Thinking about My Thinking
- 12 Using Failure as a Stepping Stone for Success
- 13 Choosing and Using Mentors Effectively
- 14 My Turn to Shine
- 15 Shifting from Extrinsic to Intrinsic Motivation
- S1 Wellness: Taking Care of Your Whole Self (Supplemental Experience on Wellness)
- S2 They Say It Makes the World Go 'Round (Supplemental Experience on Financial Planning)

Scholarship

The environment of Learning to Learn Camps is special and offers unique opportunities to study first-hand how practices such as high expectations, active mentoring, and assessment can positively impact learner performance. As such, it should not be surprising that the Learning to Learn Camps tend to foster scholarship focused on learning and growth. Recent articles include: Learning How to Learn — Improving the Performance of Learning (Apple & Ellis, 2015), What is Self-Growth? (Jain, Apple, & Ellis, 2015), and Key Learner Characteristics that Produce Academic Success (Apple, Duncan, & Ellis, 2016).

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The Theory of Performance defines the core components of a performance as identity, learning skills, knowledge, context, personal factors, and fixed factors. This theory provides the basis for analyzing performance, defining performance criteria, and developing meaningful performance measures.

Defining Performance

As Process Education was increasingly clarified as a performance-based philosophy (Academy of Process Educators, 2007), it became more critical to determine what we mean by *performance*; to define a performance, determine how to analyze a performance, formulate criteria for a performance, and consider how a performance can and should be measured.

Figure 1 shows the relationship between performance, performance criteria, and performance measures. It almost goes without saying that we have expectations for learning. In a performance-based environment, those expectations are phrased as *performance criteria* and it is upon the basis of these that performance measures are set (Figure 1 should help clarify the relationship between the

two). Only when performance expectations are clearly set and stated can performance be improved. For example, if we say, “Do X better,” we necessarily have some idea of what constitutes “better” and are able to visualize the level of performance desired. The more clearly we understand what the target performance looks like (as described by the performance criteria), the more surely we can work to perform to that level. Once we are clear about what the target is, we can create measures for determining where a current performance falls in relation to the targeted performance.

The Components of Performance

Within Process Education, when we say, “Do X better” what we mean is, “Improve your performance of X.” In order to keep this from being purely theoretical or

Figure 1 Performance, Performance Criteria, and Performance Measures (Pacific Crest, 2009)

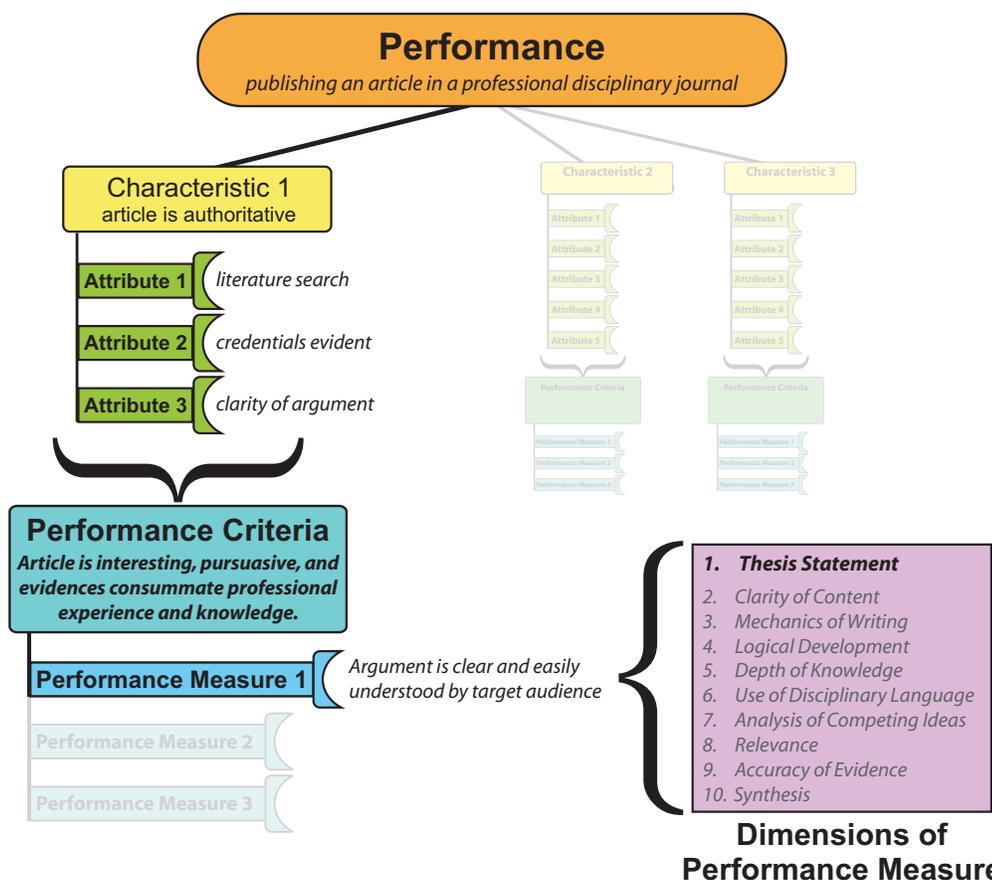


Figure 2 The Performance Model

These six components can be used to define and analyze a performance:



mathematical, let's substitute something real and familiar for X: bird watching. In the *Theory of Performance* (2007), Elger synthesized the scholarship and teaching practices regarding performance criteria, performance measures, and the culture of assessment and growth to analyze the nature of performance, itself. He offered a model of performance that delineates the components that contribute to the quality of a performance. These are identity, learning skills, knowledge, context, personal factors, and fixed factors (see Figure 2). A helpful learning object about the Performance Model and Theory of Performance is available at: www.pcrest2.com/LO/performance (Pacific Crest, 2012; see Figure 3 for a screenshot of this learning

object). Table 1 offers a thumbnail definition for each of the components of performance, as well as an idea of what each component might look like for the performance of bird watching.

Supporting and Improving Performance

What is powerful about the Theory of Performance (and Performance Model) is that, with the exception of fixed factors, any of the components of performance may be targeted and improved in order to improve overall performance. (And though fixed factors cannot be altered, they can often be accounted and compensated for.) Existing scholarship addresses how each component not only affects performance, but can be improved. The *Life Vision Portfolio* (Mettauer, 2002) focuses on identity and how to clarify and strengthen it. Learning skills, more than any other component of performance, have been dealt with comprehensively elsewhere in this article (see the section **Classification of Learning Skills**, Apple, Beyerlein, Leise, & Baehr, 2007); it remains only to be noted that targeting learning skills in order to improve a specific performance area also improves other performance areas as well as the performance of learning itself. Bobrowski (2007) and Nygren (2007) offer a great deal of insight on knowledge and, more specifically, levels of knowledge and how to elevate them. The concept of context for performance is addressed by Quarless (2007) with "context" (conditional environment) and "way of being" (values and culture) as

Figure 3

The screenshot shows a web interface for the Pacific Crest Learning Module. At the top left is the logo for Pacific Crest Learning Module. The main title is "The Performance Model". Below the title is a navigation bar with "Sample Performance" selected. On the left is a "LEARNING OBJECT" menu with options like Introduction, Performance Equation, Identity, Learning Skills, Knowledge 1 2, Context, Personal Factors, Fixed Factors, and Sample Performance. The main content area features a large thought bubble containing the text: "Jennifer's goal is to become fluent in Spanish and work as a journalist for a Spanish-language newspaper or journal." Below the thought bubble is an image of a woman in a red shirt sitting and writing in a notebook. To the right of the thought bubble is an image of a woman in a black suit sitting at a desk with a newspaper. Below these images is the text: "We can use the Performance Model to analyze her performance in pursuit of her goal...". At the bottom left of the interface is the URL "www.pcrest.com" and at the bottom right is a small copyright notice "© Pacific Crest".

Table 1 Components of Performance with a Performance Example of Birdwatching 

Component	Definition
Identity	<i>As individuals mature in a discipline, they take on the shared identity of the professional community while elevating their own uniqueness.</i>
<i>example</i>	While a birdwatcher may start by wearing certain clothes and carrying a camera, binoculars, and a notebook, taking on the shared identity of a birdwatcher might include joining a club, 'birding' with others, etc. The identity is as a 'birder' or 'birdwatcher.'
Learning Skills	<i>Specific actions/abilities that are transferable across contexts and allow individuals to improve their mastery of subject matter</i>
<i>example</i>	Learning Skills for bird watching would include: cognitive: observing, recording, predicting, categorizing, searching, validating completeness, strategizing, selecting tools, identifying missing knowledge social: illustrating, sharing knowledge, belonging, collaborating, planning, documenting, valuing communities affective: being curious, being active, persisting, responding to failure, managing resources, being self-disciplined, preparing, trusting self, valuing nature, being patient
Knowledge	<i>Knowledge involves facts, information, concepts, theories, or principles acquired by a person or group through experience or education.</i>
<i>example</i>	Learning types of birds in an area, their habits, how to identify them, interpret behavior, etc., are all potential aspects of birding knowledge.
Context	<i>This component includes variables associated with the situation in which the individual or organization performs.</i>
<i>example</i>	While one might perform bird watching alone, one might also perform bird watching in the context of a group outing or as part of a club. Bird watching in a wetlands environment is also a different context from bird watching in a forest or desert.
Personal Factors	<i>This component includes variables associated with the personal situation of an individual.</i>
<i>example</i>	If a birdwatcher has limited funds, travel to exotic environments would be prohibited. Perhaps a birder lives in a region with a smaller assortment of bird types or is unavailable to go bird watching during the morning hours, when many birds are active.
Fixed Factors	<i>This component includes variables unique to an individual that cannot be altered.</i>
<i>example</i>	If a birdwatcher is deaf, for example, he or she cannot use birdsong or calls to help identify birds and must rely purely on visual cues or input from others.

forms of knowledge. Horton helpfully speaks to personal factors, the vast majority of which are personal rather than fixed, in *Identifying At-risk Factors that Affect College Student Success* (2015). Put in terms of performance, Horton identifies personal factors that can jeopardize the successful performance of college students.

While the goal of educators is to help students improve their educational performance, Process Education recommends shifting ownership of learning to the learner. For this reason both the Theory of Performance and Performance Model are included in *Foundations of Learning* (Redfield

& Hurley Lawrence, 2009) a text aimed at students; Chapter 1 is titled, "Improving Performance." It gives students the opportunity to dissect the performance of a model student, working with each of the components of that student's performance, as they learn to appreciate their own performances as students. Once they can identify the components of performance, they can begin to target those components and improve their overall performance. Beyond this direct engagement with the learner, the design of *Foundations of Learning* also uses the Performance Model as a guide for the development of each chapter. The chapter begins with a description of the

performance area (knowledge), shares a profile of a high quality performer in that area (identity) and lists specific learning skills that support performance in that area. For most student examples (performer profiles), context, personal factors, and fixed factors are shared as well. In addition a performance measure is usually offered, giving students the opportunity to see performance measurement in action, to measure sample performances, and learn to measure their own performances.

The Theory of Performance was also integral in the development of *Learning to Learn: Becoming a Self-Grower* (Apple, Morgan & Hintze, 2013), with primary focus on the growth and development of key areas of performance: (as a) self-grower, master learner, self-assessor, time manager, problem solver, team player, reader, reflective practitioner, mentee, risk-taker and self-challenger, public performer, and self-motivated professional. These performance areas form the basis for the Profile of a Quality Collegiate Learner (Apple, Duncan, & Ellis, 2016).

Learning as the Performance

Apple and Ellis (2015) asked, “What happens if we treat learning itself as a performance, rather than as an integrated aspect of a disciplinary or general performance?” In

their article, *Learning How to Learn: Improving the Performance of Learning*, they answer that question. As they explain,

The act of learning is usually thought of as something done preparatory to a performance; a student learns and then can perform on the basis of what has been learned. This article frames the act of learning as a performance in its own right, allowing the Theory of Performance to be used as schema for naming and exploring the various dimensions of the learning performance that can be improved. This paper’s exploration is conducted with the future improvement of the learning performance very much in mind — learning how to learn.

Table 2 offers the 13 aspects of performance that can be targeted in order to improve the performance of learning (divided into the usual components: identity, knowledge, learning skills, context, and personal factors).

As the authors explain, these pieces of a learning performance are interrelated and interdependent; most importantly, they are based on the concept that learning is a process and a performance that can be improved. The importance of this cannot be overstated; when we say, “Learn better,” what we mean is, “improve your

Table 2 The 13 Aspects of Performance

Identity (as a Learner)
1. Learner Efficacy: Belief in oneself and one’s capability
2. Learner Ownership and Responsibility: “I am responsible for my own learning.”
Knowledge
3. Levels of Learner Knowledge: Elevating the level of learning
4. Learning Process Methodology (LPM): Building awareness of one’s own learning process
5. Forms of Knowledge: Aligning best learning practices with each type of knowledge
Learning Skills
6. Cognitive: Elevating thinking skills for processing information, constructing meaning, and applying knowledge
7. Social: Building social skills for producing effective team learning
8. Affective: Increasing emotional maturity to take risks, accept failures, and persist through to success
Context (of Performance)
9. Immersion in a High-Quality Learning-to-Learn Experience (Learning-to-Learn Camp/Course)
10. Cooperative Learning: Adapting the best learning practices from team members
11. Active Learning: Publicly performing the act of learning
Personal Factors
12. Life Challenges: Transforming past problems into opportunities for growth
13. Making the Right Choices: Making a better future

performance of learning.” The model offered in Table 2 shows us exactly how to do that – by targeting the aspects of learning. Even greater, however, is the efficacy of the Theory of Performance when the performance in question is learning itself; “improving one component of the learning performance will improve other components of the learning performance” (Apple & Ellis, 2015). This means, for example, that as we accept greater responsibility for our learning, we are able to make better choices when faced with life challenges; and that as we elevate our level of learning, we have a greater sense of our own efficacy as learners.

Performance and Tools

The concept of performance is prevalent within Process Education; so much so that “PE” could also stand for “Performance Education.” Because nearly any aspect of learning is both a process and potential performance, Process Educators have created and use a wide variety of tools that target performance. More than 50 such tools are available in the *Student Success Toolbox* (Pacific Crest, 2011). Between the text and its supporting web site, there are tools that support the analysis, planning, and improvement of performance in the following: learning, reading, writing, assessing, problem solving, collaborating, and communicating. Additional tools are available to support the analysis and improvement of

any area of performance. These include, getting a handle on performance: the Performance Model, continuum of performance levels, performance analysis and assessment, performance assessment, and a preparation worksheet.

Improving Performance of and Within a Discipline

Performance at a disciplinary level can also be improved. The Performance Model suggests a schema for how that might be done or where the pertinent scholarship might focus:

- **Identity:** Develop a profile for the discipline's key areas of performance.
- **Knowledge:** Clarify/create performance criteria and measures in the discipline.
- **Learning Skills:** Identify and rank the critical learning skills for the discipline.
- **Context:** Challenge disciplinary performances in new and novel situations.
- **Personal Factors:** Develop strategies to address the discipline's most common risk factors (those factors that jeopardize success within the discipline).

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Learners working in communities or teams expand their knowledge and grow their learning skills through collaborating, cooperating, communicating, peer-assessing, and peer-mentoring.

Cooperative and Collaborative Learning

In 1985 when we were running POINT FIVE workshops, there were often a limited number of computers, so the workshop facilitators often paired two faculty members on a single computer. We observed that faculty moved more quickly and effectively through the workshop content when they worked in pairs than when they worked alone because in pairs, they taught each other. In student demonstrations, the results were much more positive when students worked in teams of three or four than in pairs. A specific instance springs to mind: At Albertson's College in Idaho, we scheduled a student workshop on a Saturday morning with about 10 faculty members watching an experiment. We grouped the 11 students into four teams (three 3-person teams and a single 2-person team). After ten minutes, the 2-person team was significantly behind the other teams in points so we moved a person from the top performing team to the 2-person team. Within about 10 minutes, the new 2-person team went from first place to last place. This off-the-cuff experiment was repeated several times, and always gave the same results. This led to the decision that Pacific Crest would strive to consistently use cooperative learning in its workshops and institutes so that faculty could experience the positive impact of working cooperatively. (Dan Apple, personal recollection).

The knowledge and experience gained from the second annual Problem Solving Across the Curriculum Conference helped to strengthen the understanding of and commitment to collaborative learning practices for many attendees especially after Karl Smith's plenary session on cooperative learning (PSAC, 1991). Shortly thereafter, a cooperative learning model was presented in *Cooperative Learning* (Duncan-Hewitt, Mount & Apple 1994), highlighting both the strengths and drawbacks of practicing cooperative learning for all potential stakeholders: learners, learning teams, facilitators, and an educational system. In *A Handbook on Cooperative Learning*, the same authors focus on how to design teams and team activities, the role of journal writing, and tips for facilitating cooperative learning (1996). The *Faculty Guidebook* also offers a set of cooperative learning resources. The fundamental principles of and steps for

incorporating cooperative learning are shared in the module *Cooperative Learning* (Van Der Ker & Burke, 2007; see Figure 1). The module *Teamwork Methodology* (Smith, Baehr, & Krumsieg, 2007) helps faculty facilitate the team building process, with *Designing Teams and Assigning Roles* (Smith, 2007) providing more narrowly focused information about the use of roles in teaming activities. Finally, *Team Reflection* (Hare, 2007) provides methods that faculty can use to help increase productivity for learning teams.

Figure 1 Steps for Incorporating a Cooperative Learning Activity

1. Provide background information and content that is necessary for discussing the activity.
2. Form groups in meaningful ways and identify physical space for each group.
3. Present the activity.
4. Determine group roles.
5. Facilitate during and after the activity.
6. Process the experience with the students.

Learning Communities (Student & Professional)

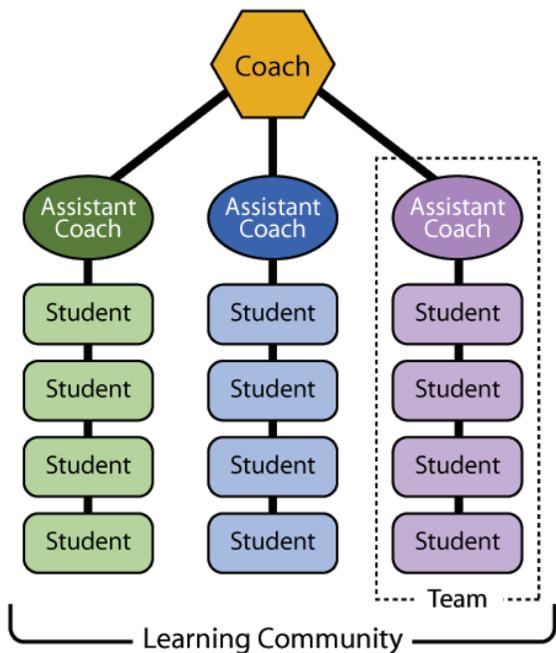
Learning communities, defined as an intentional restructuring of curriculum around a cohort of courses or a context in which students engage in cooperative learning activities, all tend to demonstrate cohesion of a group with commitment to a collaborative environment and shared learning outcomes (Gabelnick, MacGregor, Matthews, & Smith, 1990; Ashe & Romero, 2007). While we most often think of learning communities as being comprised of students, there are highly effective professional learning communities consisting of faculty and staff who also reap the benefits of commitment to collaboration and shared learning outcomes.

At Kirkwood Community College, for example, a three-year project focused on using process learning together with cooperative learning involved the creation of a professional learning community of faculty members. The members of this community helped one another improve their performances in the areas of active learning, cooperative learning, assessment, and curriculum design. This project is effectively described in *Taking the Helm: Targeting Student Learning* (Klopp, 1996). Similarly, the University of Idaho, supported by an NSF grant, developed

a professional community that counted members across multiple institutions, all of whom were focused on improving teaching and learning through the practice of mentoring (Utschig, Elger, & Beyerlein, 2005).

The benefits of a learning community structure were realized as the size of the Learning to Learn Camps increased, with students assigned to learning teams within learning communities (Pacific Crest, 2015a; see Figure 2).

Figure 2 Learning to Learn Camp Structure



An early example of a student-based learning community within a first-year program is seen in the implementation by St. Augustine College of a learning community program that assigned mentors to a learning community of 32 first-year students (Knowles, 1995). An advanced example of a learning community structure is found at Stony Brook University, where learning communities are simply how students are organized for many courses in order to provide a stronger first-year experience (Hanson & Heller, 2009).

Tools for Advancing Teams and Community Membership

The years between 1995 and 2015 saw the creation of numerous additional resources to support learning communities and teams, both cooperative teams with assigned roles as well as more loosely collaborative teams. Cooperative team tools include the team role markers designed at Sinclair Community College in 1998, as ways to help students learn and perform assigned roles more quickly and to help faculty members facilitate teams more effectively (Sinclair Community College 1998; see Figure 3).

Figure 3 Sample Role Marker



Additional cooperative and collaborative team tools were available in the *Learning Assessment Journals* (editions 1 – 4) (Carroll, Beyerlein, Ford, & Apple, 1997) and now appear as part of the *Student Success Toolbox* (Pacific Crest, 2011): Reflector's Report, Recorder's Report, Weekly Recorder's Report, Weekly Reflector's Report, Spokesperson's Report, Planner's Report, SII Team Assessment, and a Profile of a Strong Team Player. The expanded online *Student Success Toolbox* (available to adopting instructors) also includes the Teamwork Methodology and Rubric for Performing in a Team (Pacific Crest, 2015b).

Actual learning activities geared toward building teamwork and community membership skills are found in *Foundations of Learning* (4th ed.) (Redfield & Hurley-Lawrence, 2009) and include activity 1.1 Building Learning Communities, 12.1 Exploring Team Roles, 12.2 Team Logo Competition, and 12.3 Team Design Competition. A slightly different approach to growing teamwork and community skills appears in "Experience 8: Performing in Teams and Within a Community" from *Learning to Learn: Becoming a Self-Grower* (Apple, Morgan & Hintze, 2013); it integrates many of the tools and expertise/best practices already noted. The content of this learning experience includes the following:

- **DISCOVERY EXERCISE** Using the Holistic Rubric for Performing in a Team, perform an assessment of your learning team for the last team-based activity. Use the **SII team assessment worksheet** contained in this activity.
- **EXPLORATION QUESTIONS** These prompt students to consider times when teams and participation in them were fundamental to what

they were doing, answering questions focused on team success, feeling like part of a team, roles that were effective or ineffective, the importance of common goals, and common practices that can improve teamwork. Students then answer the same questions, this time with respect to a community and membership in it, instead of a team.

- **TEAM DESIGN COMPETITION** Teams design and build a tower using paper and tape; they then report on the teaming aspect of the activity, using the reflectors' and recorders' reports, and answering a series of critical thinking questions about the roles and efficacy of their team as they worked on their tower.
- **PROBLEM** Students select one team and one community of which they are a member and identify areas in which they feel that they are not contributing enough value. They are prompted to perform a formal SII self-assessment of their performance,

using the Holistic Rubric for Performing in a Team. They then answer one of two questions: 1) How important is it to understand every team role so that you can play your role more effectively by helping others play their roles more effectively? OR 2) What makes a community effective, and what obligations do community members have to help strengthen their communities?

- **MY LIFE VISION** The final prompt for this experience asks each student to write a minimum of two pages either analyzing a community he or she came from or describing the type of community he or she wishes to be part of in the future.

Team and community learning has become an integral part of Process Education learning environments, with practitioners striving to make the techniques, tools, and processes that support learning communities ever more effective.

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Process Education is a performance-based philosophy of education which integrates many different theories, processes, and tools in emphasizing the continuous development of learning skills through the use of assessment principles in order to produce learner self-development.

Process Education has its roots in both systems philosophy (Laszlo, 1972) and systems engineering (Schlager, 1956), especially the aspects of systems engineering that focus on discovering patterns and designing and managing complex systems over their life cycles by elucidating and optimizing processes and controls. One of the most powerful tools in systems engineering, is structured dialogue as defined by Christakis (2006). Structured dialog is one of the central processes evident in the Process Education discussions, collaboration sessions, and workshops which have taken place over the last three decades. One of the goals of structured dialogue is to use collaborative interaction to construct theories or schema that are concise, accurate, explanatory, defensible, and powerful; this is a near perfect description of the dynamic and process at the Problem Solving across the Curriculum Conferences that took place in the 1990s (PSAC, 1990 - 1996).

Establishing the Philosophy

The first PSAC conference (Kramer & Beery, 1990) led to the development of Pacific Crest's first Teaching Institute with the intended result of "building confidence in using Process Education" (Apple 1991). Specifically, this Teaching Institute focused instructor attention on the stepwise processes or methodologies underlying cooperative learning, communication, self-assessment, discovery learning, critical thinking, and problem solving,

also explicitly teaching 26 learning skills that support the successful implementation of these methodologies. During the 1993/1994 academic year, a series of papers were published that explored the implications of these ideas: *Everyone Can Learn to Learn* (Arah & Apple, 1993), *Expanding Mathematics Education into a Process* (Apple, 1993b), and *Education as a Process* (Apple & Lawrence, 1994). This led to the creation of a new Teaching Institute resource, *Teach for Learning — A Handbook on Process Education* (Pacific Crest, 1993).

A major conclusion drawn from this scholarship and conversations focused on it was that the shared philosophy behind these innovative teaching and learning practices — by this time already referred to as *Process Education* (PE) — needed to be further delineated and explicitly defined. Between 1994 and 1999, a series of papers and documents (see Figure 1) did just that by refining and fortifying the theoretical and philosophical underpinnings of the philosophy.

While the list of processes and tools of Process Education continues to grow even now, the core principles, as articulated between 1994 and 1999 remain constant. These are enumerated in Figure 2.

As Process Education began to be implemented in practice, its impact was chronicled in a number of reports as shown in Figure 3.

Figure 1 Scholarship Focused on Process Education: 1994 to 1999

Transforming Engineering Education from a Product to a Process (Neff, Beyerlein, Apple & Krumsieg, 1995)
Process — The Missing Element (Hanson & Apple, 1995)
Concept Map of Process Education (Duncan-Hewitt, 1995)
Process Map for Mentoring (Duncan-Hewitt, 1999)
A Primer for Process Education (Apple & Duncan-Hewitt, 1995)
The Taxonomy of Process Education (Duncan-Hewitt & Apple, 1996)
The Classification of Learning Skills for Educational Enrichment and Assessment (Apple, 1997)
Process Education — A New Educational Mission (Apple, 1997)
A Model of Higher Education (Apple, 1997)
Comprehensive Overview of Process Education Philosophy (Apple & Foreman, 1999)

Figure 2 The Core Principles of Process Education

1	Faculty must fully accept responsibility for facilitating student success.
2	In a quality learning environment, facilitators of learning (teachers) focus on improving specific learning skills through timely, appropriate, and constructive interventions.
3	Mentors use specific methodologies that model the steps or activities they expect students to use in achieving their own learning goals.
4	A Process Educator can continuously improve PE concepts, processes, and tools used by doing active observation and research in the classroom.
5	Educators should assess students regularly by measuring accomplishments; they should model assessment processes, provide timely feedback, and help students improve their self-assessment skills.
6	Every learner can learn to learn better, regardless of current level of achievement; one's potential is not limited by current ability.
7	Although everyone requires help with learning at times, the goal is to become a capable, self-sufficient, life-long learner.
8	An empowered learner is one who uses learning processes and self-assessment to improve future performance.
9	To develop expertise in a discipline, a learner must develop a specific knowledge base in that field, but must also acquire generic, life-long learning skills that relate to all disciplines.
10	An educational institution can continually improve its effectiveness in producing stronger learning outcomes in several ways: By aligning institutional, course, and program objectives; By investing in faculty development, curricular innovation, and design of performance measures; By embracing an assessment culture.

Figure 3 Scholarship Focused on Implementing Process Education

<p><i>Reforming the Teaching of Entry Level Math in the Electronic Age</i> (Pierce & Wright, 1995)</p> <p><i>Taking the Helm — Targeting Student Learning at Kirkwood Community College</i> (Klopp, 1996)</p> <p><i>A Process Education Approach to Teaching Computer Science</i> (Smith, 1996)</p> <p><i>A Focus on Process Improves Problem-Based Learning in Large Classes</i> (Duncan-Hewitt, 1996)</p> <p><i>Improving the Teaching/Learning Process in General Chemistry</i> (Hanson & Wolfskill, 1998)</p> <p><i>A Process Approach for Improving Student Performance in Learning Mathematics</i> (Atnip & Apple, 1999)</p> <p><i>Process Education and Continuous Quality Improvement at Western Michigan University</i> (Williams, Litynski & Apple, 2001)</p>

Process Education and the *Faculty Guidebook*

By the year 2000, the individuals practicing and supporting Process Education began to evolve into a community of research-based PE practitioners. The first formal gathering of this group took place at Elmhurst College in June, 2004. An important outcome of their collaboration was the inception of the *Faculty Guidebook* (Beyerlein, Holmes & Apple, 2007). The *Faculty Guidebook* consists of more than 150 modules, the content of which ranges from exploring the potential impact of Process Education on the world and culture of higher education systems to concise how-to instructions and tips. *Faculty Guidebook* modules

directly concerned with the philosophy of Process Education include those listed in Figure 4.

The International Journal of Process Education

In 2007, this community of practitioners was officially named “the Academy of Process Educators” at a conference hosted by the University of the District of Columbia (see also the **Academy of Process Educators** section). One of the central goals of the Academy was to produce a journal focusing on Process Education; since 2009, the Academy has produced seven volumes of the *International Journal of Process Education (IJPE)*. While

every article in the *IJPE* is concerned with some aspect of Process Education, articles of particular note with respect to the theory and practice of Process Education include those listed in Figure 5.

The year 2016 represents the 25th anniversary of Process Education. We have come a long way since that first Teaching Institute in 1991, with its goal of building confidence in using “process education.” This anniversary

will be celebrated at the annual Process Educator’s Conference at Grand Valley State University, with a host of workshops, symposia, and sessions to be held, each offering collaborative interaction and structured dialogue, so that PE practitioners can continue to construct theories and schema that are concise, accurate, explanatory, defensible, and powerful (Process Education Conference, 2016).

Figure 4 *Faculty Guidebook* Modules Focused on Process Education

Introduction to Process Education (Beyerlein, Schlesinger & Apple, 2007)
Knowledge Table for Process Education (Schlesinger & Apple, 2007)
Classification of Learning Skills (Apple, Beyerlein, Leise & Baehr, 2007)
Process Education as a Motivation and Self-regulation System (Leise, 2007b)
Framework for Implementing Process Education (Duncan-Hewitt, 2007a)
Becoming a Self-Grower (Leise, 2007a)
Role of Process Education in Fulfilling the Changing Roles in Higher Education (Duncan-Hewitt, 2007b)
Learning Processes through the Use of Methodologies (Leise & Beyerlein, 2007)
Moving Towards an Assessment Culture (Utschig, 2007)
Annual Professional Growth Plan (Hurd, 2007)

Figure 5 *IJPE* Articles Focused on Process Education (Academy of Process Educators, 2016)

Process Education: Past, Present, and Future (Burke, El-Sayed & Apple, 2009)
Process Education and Constructive Alignment: The Challenge of Student Assessment Online (Lawrence & Snyder, 2009)
Process Education Best Practices for Teaching Open-Ended Problem Solving in a Project Context (Morgan & Williams, 2010)
The Transformation of Education: 14 Aspects (Hintze, Beyerlein, Apple & Holmes 2011)
Enhancing a First-Year Success Course through Process Education (Jones & Kilgore, 2012)
What is Special About Process Education? (Desjarlais & Morgan, 2013)
Online Professional Development for Process Educators (Beyerlein, Burke, Mutisya, & Cordon 2014)
Learning to Learn Camps: Their History and Development (Apple, Ellis, & Hintze 2015)
Learning How to Learn: Improving the Performance of Learning (Apple & Ellis 2015)
What is Self-Growth? (Jain, Apple, & Ellis 2015)

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A quality learning environment is characterized by respect, trust, openness, high expectations, support for risk-taking, a willingness to challenge performance, continuous assessment, and a growth-oriented mindset for everyone.

The question of what constitutes a high-quality or productive learning environment is not likely to be answered anytime soon, not least because we are not yet in agreement about who “we” are (A university? A culture? A nation?), let alone how “we” define the terms, *learning* and *education*. What we (the authors and scholars of Process Education) **can** do, and with a great degree of utility, is to define and explore what constitutes a high-quality learning environment within the bounds of Process Education (PE) and its principles.

While we do have a set of those PE principles, they were not the result of a thought experiment, where we asked, “What does a quality learning environment look like?” and “How does it function?” Instead, the principles arose as a result of a critical analysis of what was sought as a result of education, what worked best to meet those needs, and possibly more critically, what didn’t.

Defining a Preferred Learning Environment

The handbook for the first Teaching Institute set forth the idea that, for facilitating the development of problem solving and critical thinking skills, “the traditional learning environment (in which the instructor delivers content and the students copy from the blackboard) is the wrong environment” (Apple, 1991). From this perspective, the ability to think critically and solve problems is the **preferred** result of education, and the traditional education dynamic does **not** lead to that result. Faculty were reminded of the characteristics they long to see in learners and the kind of environment that tends to foster those characteristics:

Inherent to the problem-solving process are an inquisitive spirit and critical-thinking skills. However, most educational processes do little today to stimulate students to develop an attitude of asking “why?” or encouraging students to explore and experiment. Somewhere along the way, students are losing the exploring nature they had as children and have become afraid to be wrong. The most desirable type of learning environment for problem solving emphasizes a “process-oriented” approach where self-discovery on the part of the student is paramount. The role of the instructor in this environment is to facilitate student learning

through the use of timely critical thinking questions. The objective is to develop students who are able to “process” or evaluate a data base of knowledge rather than render the data base (that was taken from the text to the blackboard) (Apple 1991).

By 1993, the key characteristics of a learning environment that best foster critical thinking and problem solving were slightly more polished and included the ideas that,

1. Students need to experiment, explore, test, and seek their own answers with the help of their teammates.
2. Students should be forced to think, but not to the point that they become overwhelmed.
3. Frustration is valuable but must be continually monitored; some frustration is good, and provides motivation to find a solution and resolve the frustration.
4. Discovery learning works well in tandem with cooperative learning; the students have a pool of thinking and learning skills to draw on in addition to their own, and the effort, excitement, and frustration can be shared (Pacific Crest, 1993).

Let’s take a pause to summarize what has thus far been claimed about the characteristics of a Process Education quality learning environment:

It should...

- Build critical thinking skills
- Foster an inquisitive spirit in learners where they ask “Why?,” explore, and experiment
- Support risk taking and student willingness to be wrong and make mistakes
- Be process-oriented
- Foster self-discovery
- Facilitate student learning
- Shift responsibility for learning to the learner with facilitators asking critical thinking questions
- Challenge students, with facilitators creating/allowing enough frustration to motivate
- Include cooperative/team learning
- Incorporate problem solving

How to Create a Quality Learning Environment

During the fall of 1994, a peer coaching visit to Rick Moog's general chemistry class at Franklin & Marshall College led to an ongoing discussion of what characteristics make up a quality learning environment (Moog, 1999). The question was turned into an optional activity, "Designing a Challenging Learning Environment" that appears in the 1995 *Teaching institute handbook* (Apple), giving faculty the opportunity to participate in the discussion and to realize the benefits of potentially improving their practice. The 1998 *Teaching institute handbook* (Apple & Krumsieg) provided a summary of the learning environment characteristics that had been identified to date and further introduced the 10-step Methodology to Create a Quality Learning Environment. Within two years, the one-page outline had been expanded to include a discussion and tips for implementing all 10 steps of the methodology (Apple & Krumsieg, 2000).

This work was formalized between 2003 and 2007 and published in the *Faculty Guidebook* in the modules, *Overview of a Quality Learning Environment* (Apple & Smith 2007b) and *Methodology for Creating a Quality Learning Environment* (Apple & Smith 2007a). The 10 Principles for Establishing a Quality Learning Environment (Figure 1) include nearly all of the points offered previously.

The Methodology for Creating a Quality Learning Environment (Figure 2) not only offers steps for realizing a Quality Learning Environment; it also offers justification and rationale for each step, all of which are supported by additional modules from the *Faculty Guidebook* (see Figure 3).

Beyond the *Faculty Guidebook*, the article Conditions for Challenging Learner Performance notes that, with regard to Step 10, growth occurs not when we are 'coasting,' but, rather, when we are challenged... it is especially important

Figure 1 Principles for Establishing a Quality Learning Environment (QLE)

1. Establish a high degree of trust and respect.
2. Make sure both learner and mentor are committed to the learner's success.
3. Get student buy-in very early in the process.
4. Challenge students.
5. Set clear and high expectations.
6. Encourage risk-taking.
7. Seek student feedback regularly by using assessment on a consistent and timely basis.
8. Measure and document progress and growth.
9. Create a collaborative learning space.
10. Create a balance between structure and flexibility.

Figure 2 Steps in the Methodology for Creating a Quality Learning Environment

1. Establish initial respect.
2. Start with no prejudging.
3. Obtain shared commitment.
4. Foster and support risk-taking.
5. Permit the learner to fail.
6. Set high expectations.
7. Establish clear performance criteria.
8. Implement a quality assessment system.
9. Document performance.
10. Continuously challenge performance.

Figure 3 Correlation of Steps in the Methodology with Supporting *Faculty Guidebook* Modules

Step(s)	Supporting <i>Faculty Guidebook</i> Modules (all from 2007)
1. Establish initial respect. 2. Start with no prejudging.	<i>Establishing Initial Respect Without Prejudging</i> (Smith)
3. Obtain shared commitment.	<i>Getting Student Buy-In</i> (Burke) <i>Obtaining Shared Commitment</i> (Smith & Beyerlein)
4. Foster and support risk-taking 5. Permit the learner to fail	<i>Letting Students Fail So They Can Succeed</i> (Hadley)
6. Set high expectations.	<i>Setting High Expectations</i> (Smith)
7. Establish clear performance criteria.	<i>Writing Performance Criteria for a Course</i> (Hinton) <i>Writing Performance Criteria for Individuals and Teams</i> (Utschig)
8. Implement a quality assessment system. 9. Document performance	<i>Creating Meaningful Assessment and Documentation Systems</i> (Wicks)
10. Continuously challenge performance.	<i>The Accelerator Model</i> (Morgan & Apple)

to have a supportive, risk-friendly environment so that educators and learners feel secure enough for performance to be challenged” (Smith & Spoelman, 2009). The steps in the methodology and principles behind them are thus reaffirmed to be interdependent, just as the attributes of a learning environment were assumed to be when they were first articulated and shared in 1991.

QLE and the Transformation of Education

The principles of a quality learning environment are also present in the 14 aspects of the Transformation of Education (Hintze, Beyerlein, Apple & Holmes 2011), which

may be helpfully read as an extended description of the environment and practices of a high-quality Process Education learning environment — possibly the ideal PE learning environment. A mapping of the aspects from the Transformation of Education to the principles of a Quality Learning Environment (Figure 4) shows that there is not only alignment between the two, but that the Transformation aspects may provide a useful perspective for educators who are unsure of how to shift their current practice to practice that creates a quality learning environment. A learning object for the Transformation of Education is available at <http://www.transformation-of-education.com/>

Figure 4 Mapping the Aspects from the Transformation of Education to the Principles of a Quality Learning Environment

Aspect from the Transformation of Education	Correlates to Principle for Establishing a Quality Learning Environment (QLE)
Challenge <i>The level of difficulty is increased in order to grow capacity for learning and performing</i>	4. Challenge students. 5. Set clear and high expectations.
Cognitive Complexity <i>The degree to which training and doing is elevated to problem solving and research</i>	4. Challenge students. 5. Set clear and high expectations.
Control <i>The locus of power/authority for the learning situation or experience</i>	3. Get student buy-in. 4. Challenge students. 5. Set clear and high expectations.
Delivery <i>The means by which information/knowledge is obtained by learners</i>	4. Challenge students. 9. Create a collaborative learning space. 10. Create a balance between structure and flexibility.
Design <i>The purposeful arrangement of instructional environment, materials, and experiences to support learning</i>	9. Create a collaborative learning space. 10. Create a balance between structure and flexibility.
Efficacy <i>The well-founded belief in one’s capacity to change and to make a difference</i>	2. Make sure both learner and mentor are committed to the learner’s success. 5. Set clear and high expectations. 6. Encourage risk-taking. 8. Measure and document progress and growth
Feedback <i>Information about what was observed in a performance or work product</i>	7. Use assessment on a consistent and timely basis. 8. Measure and document progress and growth.
Measurement <i>The process of determining the level of quality surrounding a performance or product</i>	8. Measure and document progress and growth.
Ownership <i>The degree to which the learner accepts responsibility and accountability for achieving learning outcomes</i>	1. Establish a high degree of trust and respect. 2. Make sure both learner and mentor are committed to the learner’s success. 3. Get student buy-in very early in the process.
Relationship <i>The degree of emotional investment an instructor or mentor has in his or her students or mentees</i>	1. Establish a high degree of trust and respect. 2. Make sure both learner and mentor are committed to the learner’s success.
Scope of Learning <i>The contexts across which learning occurs and its application are demonstrated</i>	4. Challenge students. 5. Set clear and high expectations.
Self-Awareness <i>The degree to which reflective and self-assessment practices are used by the individual to foster the growth of his or her learning skills across the cognitive, affective, and social domains</i>	3. Get student buy-in very early in the process. 4. Challenge students. 7. Seek student feedback regularly by using assessment on a consistent and timely basis.

(continued on the next page)

Figure 4 (continued)

Aspect from the Transformation of Education	Correlates to Principle for Establishing a Quality Learning Environment (QLE)
Social Orientation <i>The investment, interdependence, and responsibility for learning throughout a community.</i>	9. Create a collaborative learning space.
Transparency <i>The degree to which stakeholders can view individual, team, or collective performances.</i>	6. Encourage risk-taking. 9. Create a collaborative learning space.

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An educational institution's culture has a dramatic impact on the quality of the educational experiences it provides students and the potential it creates for transformative learning experiences for its students, faculty, and staff.

Recently, there has been increased interest in the role that the culture of an academic institution plays in student success, especially in light of the perceived decline in academic standards and low student graduation rates. In response to these issues, many institutions have increased their student support services and provided more coaching and mentoring for students. Offering a different perspective, Hersh and Keely argue that what academic institutions need to do is develop a culture that supports transformative education.

To say it plainly: in both quantity and quality, college learning is inadequate. The root cause of this learning crisis is that at most institutions the campus culture itself does not prioritize and foster transformative learning.

Without high academic expectations and standards challenging students to exceed their own expectations, too much time is wasted, and peer norms that are less demanding, less intellectual, and less respectful become dominant. Students regulate their performance by the high or low expectations of them.

The culture change we espouse includes significantly higher expectations and standards, far greater student effort, an incentive and reward system focused on learning and, at its core, extensive learning assessment that is timely, formative, summative, standard based and transparent.

(Occasional Paper 17: Changing Institutional Culture to Promote Assessment in Higher Learning, 2013)

Process Education and Success

Process Education is transformative education. Since 1985, Pacific Crest has actively collaborated with a wide variety of academic institutions, working with faculty and staff on projects and research, all of which seek to articulate what transformative education looks like in the classroom. The most recent scholarship, more than 30 years later, still focuses on transformative education, phrased now in terms of *success* and the *educational culture* that leads to success. This scholarship describes the qualities of a successful collegiate learner, the institutional cultural conditions that create and support student success, and those changes in institutional culture that promote student empowerment

for self-growth, self-assessment, and academic success (Apple, Duncan, & Ellis, 2016).

The theory and practice for creating an institutional culture of success that fosters student empowerment and self-growth is fundamental to Process Education and is documented in *Process Education: Past, Present, and Future* (Burke, Lawrence, El-Sayed, & Apple, 2009) and *What is Special About Process Education?* (Desjarlais & Morgan, 2013). A review of this work is also offered in *Work in Progress — Process Education: Growing Performance Across Domains* (Litynski & Apple, 2008).

Pacific Crest began developing a process for training faculty to create a culture of success at their universities and providing opportunities for these faculty to actively engage in cultural change through the Learning to Learn Camps. *Reflections on Student Success* (Pacific Crest, 2006) offers a list of 10 factors that bear consideration for any institution working to increase student success:

1. There are pitfalls associated with having someone from within an institution try to facilitate institution-wide change. It is better to use an external facilitator.
2. The change process at an institution must be facilitated through the work of internal coordinators and internal mentoring teams (while an external facilitator can bring an objective perspective in coordinating and helping to facilitate change, the actual work must be done by individuals and teams who are part of the institution).
3. Success begins with clearly described outcomes and definable projects to attain them.
4. Key institutional events are crucial for building the critical mass you need to support change processes throughout your institution.
5. The Learning-to-Learn Camp model has been a cornerstone in many of the change processes.
6. Courses and programs should be redesigned according to quality design principles.
7. Continuous quality improvement begins with high quality program assessment practice.
8. Administrative support is critical throughout the transformational change process.

9. Institutions must foster communities of practice to better support growth.
10. Institutions must set up a system for rewards-based process, and recognition must be given for strong performances.

The language used here (“change,” “success,” “transformational,” “administrative,” “institutions”) makes clear that the aim, even then, was to shift the culture of belief and practice institution-wide in order to achieve greater student success.

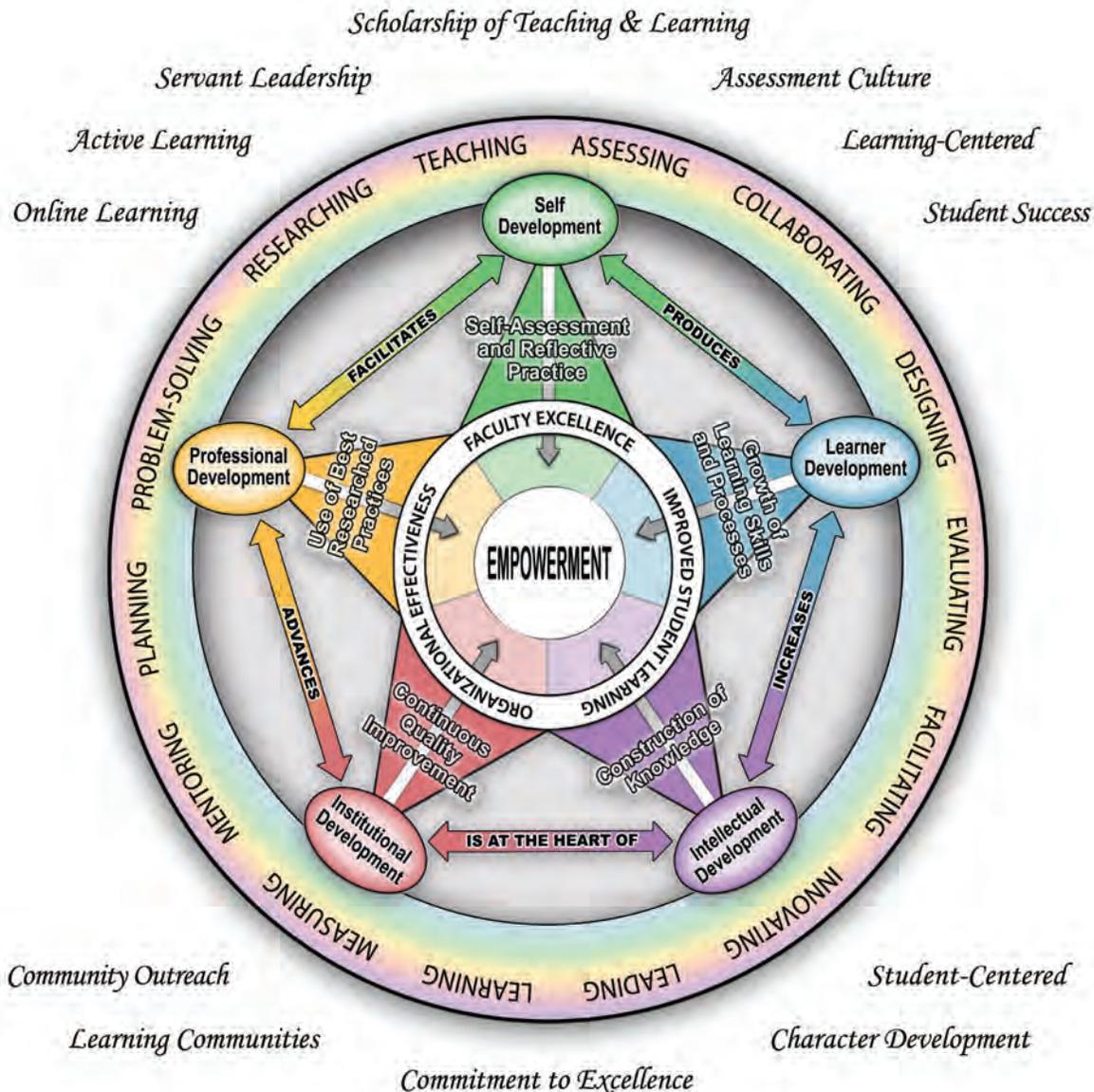
The Compass of Higher Education

It was at this time that the Compass of Higher Education was developed as a way to not only explain Process Education, but to outline its broad methods and goals in transforming educational culture (see Figure 1). The Com-

pass became the roadmap for institutional transformation, a pathfinder for Process Education scholarship contained within the *Faculty Guidebook* (Beyerlein, Holmes & Apple, 2007), and the basis for ongoing and future work in Process Education. While a strong argument could be made that every module within the *Faculty Guidebook* ultimately speaks to transforming education and creating a culture of success, several modules explicitly address the need or call for educational transformation:

- *Efforts to Transform Higher Education* (Holmes, 2007b)
- *Role of Process Education in Fulfilling the Changing Mission of Higher Education* (Duncan-Hewitt, 2007)
- *Changing Expectations for Higher Education* (Holmes, 2007a)
- *Learning Colleges* (Armstrong & Holmes, 2007)

Figure 1 The Compass of Higher Education



- *Introduction to Expectations and Change Movements in Higher Education* (Lindborg, 2007)

The Transformation of Education

Additional scholarship focused on the culture of success and the success of the Learning to Learn Camps led to a deeper analysis of the elements necessary for institutional cultural change to succeed. The Transformation of Education: 14 Aspects (Hintze, Beyerlein, Apple & Holmes, 2011) presents 14 aspects of traditional educational culture and demonstrates how the assumption behind and practice of each aspect might be shifted in order to achieve greater educational success (see Figure 2). The Transformation of Education is used as the basis for a cultural analysis and comparison of the traditional and transformational frame-

works for education in two articles currently being written. One focuses on the traditional framework as it correlates to *risk factors* (characteristics in learners and learning situations that lead to failure or jeopardize success; see also Horton, 2015); the other focuses on the transformational framework as it correlates to *success factors* (characteristics in learners and learning situations that lead to or accompany success).

The work in this area is just beginning. We are finding that the more we explore, the more important this area seems to be. New scholarship focuses not only on the extent to which educational culture can be shifted to the kind that fosters success, but also on the mechanism(s) that facilitate this kind of change.

Figure 2 The Transformation of Education

Aspect	Traditional Practice	Transformed Practice
Challenge <i>The degree to which increasing the level of difficulty is used in order to grow capacity for learning and performing</i>	Enabling	Empowering
Cognitive Complexity <i>The degree to which training and doing is elevated to problem solving and research</i>	Memorizing	Problem Solving
Control <i>The locus of power/authority for the learning situation or experience</i>	Faculty-Centered	Learner-Centered
Delivery <i>The means by which information/knowledge is obtained by learners</i>	Presentation	Active Learning
Design <i>The purposeful arrangement of instructional environment, materials, and experiences to support learning</i>	Rigid	Responsive
Efficacy <i>The well-founded belief in one's capacity to change and to make a difference</i>	Doubt	Conviction
Feedback <i>Information about what was observed in a performance or work product</i>	Evaluation	Assessment
Measurement <i>The process of determining the level of quality of a performance or product</i>	Subjective Determination	Objective Determination
Ownership <i>The degree to which the learner accepts responsibility and accountability for achieving learning outcomes</i>	Directed	Self-Directed
Relationship <i>The degree of emotional investment an instructor or mentor has in his or her students or mentees</i>	Emotionally Distant	Emotionally Invested
Scope of Learning <i>The contexts across which learning occurs and its application is demonstrated</i>	Situational Understanding	Interdisciplinary Understanding
Self-Awareness <i>The degree to which reflective and self-assessment practices are used by the individual to foster the growth of his or her own learning skills across the cognitive, affective, and social domains</i>	Self-Consciousness	Self-Growth
Social Orientation <i>The investment, interdependence, and responsibility for learning throughout a community</i>	Individual	Community
Transparency <i>The degree to which stakeholders can view individual, team, or collective performances</i>	Private	Public

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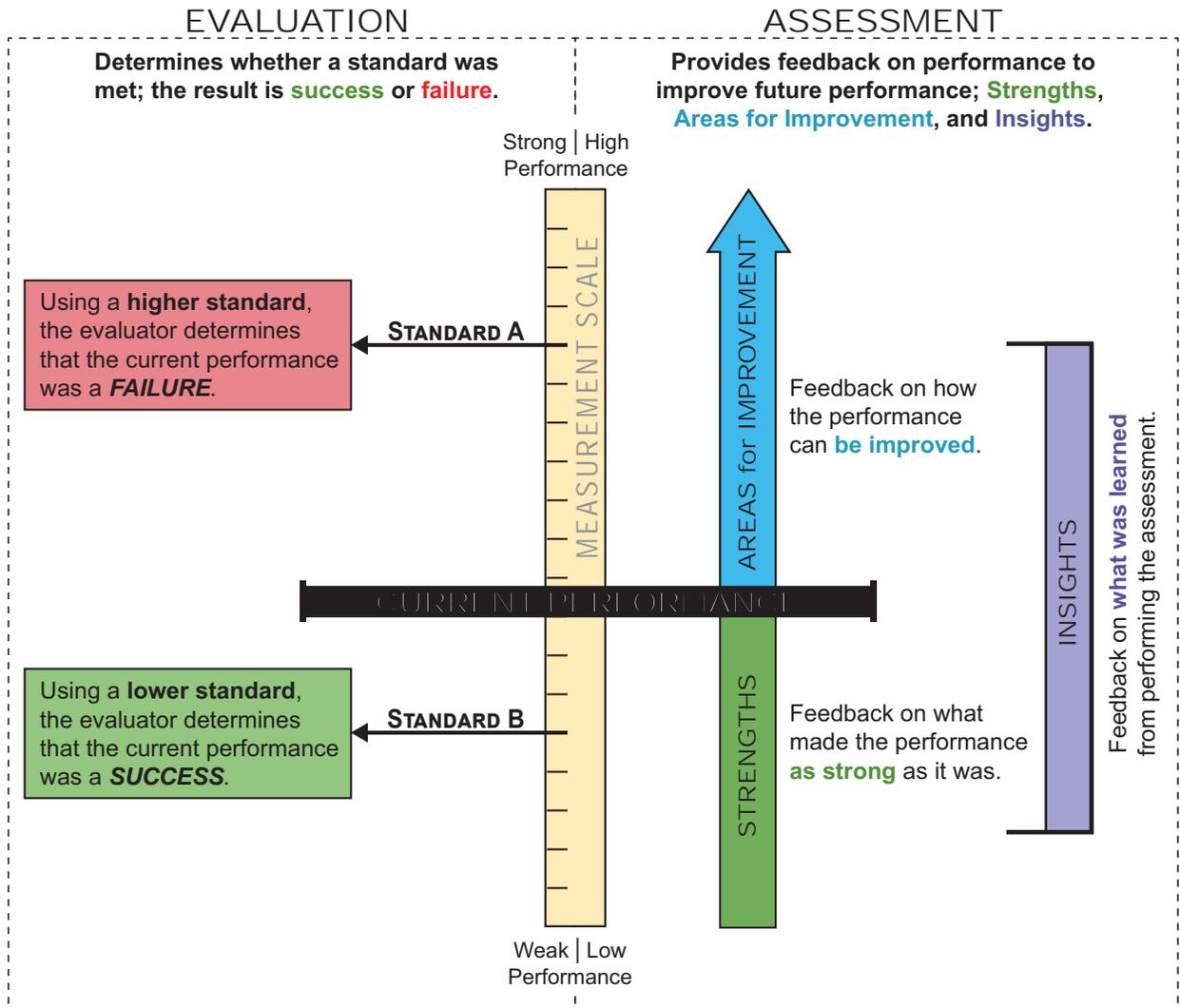
Assessment is a process used for improving quality; evaluation is a process used for judging quality. An assessment is an analysis of current performance aimed at improving future performances by clarifying the reasons behind current performance strengths, determining potential improvements and implementing action plans for making them, and gaining insights and learning from each performance.

The term *assessment* has been present in the educational lexicon for decades. Alverno College has been talking about it since 1973 (Alverno College, 1985). Trudy Banta became a central figure in the assessment movement with the publication of her book *Making a Difference: Outcomes of a Decade of Assessment in Higher Education* (Banta, 1993), and Angelo and Cross made “the first serious effort to meld assessment techniques with teaching tips” in *Classroom Assessment Techniques* (Angelo & Cross, 1988). Nevertheless, the goal of creating an assessment culture at most institutions of higher education has been elusive.

Differentiating the Processes

The terms *assessment* and *evaluation* are often used interchangeably and sometimes with variable meanings. To further confuse things, terms such as *formative* and *summative* are often added to both terms. By clearly distinguishing and differentiating the concepts of assessment and evaluation from one another, Pacific Crest eradicated a lot of ambiguity. It declared that assessment is a process for *improving* quality and is offered by a mentor whose desire it is to inspire growth while evaluation is a process for *judging* quality with consequences such as promotion and failure (Apple, 1991; see Figure 1). This

Figure 1



restored the utility of both terms, increasing the potential for meaningful dialogue or discovery. This strategic delineation helped to uncover some of the affective barriers that keep learners from embracing feedback (in short, because they are used to receiving evaluation and, as a result of that expectation, react defensively) and helped instructors develop more effective ways to frame their improvement- and growth-directed interventions.

Categorizing Assessment Feedback

The spirit and practice of assessment, as defined in Figure 1, can be found in the pilot for Pacific Crest's first Process Education Teaching Institute (Apple, 1991). The materials describe the processes of assessment and self-assessment as pivotal with respect to quality learning and teaching. At the end of this event, organizers sought feedback about the institute from participants and that feedback led to major improvements in subsequent Teaching Institutes. As helpful as that was, the ultimate value of the assessment feedback was realized when the community analyzed the feedback it had given. The analysis identified three critical components of assessment as informed by Process Education:

1. **STRENGTHS:** what makes certain aspects of the Teaching Institute experience powerful, and why (and later how)
2. **AREAS FOR IMPROVEMENT:** aspect of the Teaching Institute experience that might be improved, with recommendations (action plans) on how to do so
3. **INSIGHTS:** what was learned from the experience to increase our knowledge about activities and performances, including design, planning, delivery, and execution (lessons learned).

SII-assessment (Strengths, Improvements, and Insights) is the term coined and used in the *Faculty Guidebook* (Wasserman, 2007).

Methodical Assessment

A methodology for performing SII-assessment was first documented in the *Teaching institute handbook* (Apple, 1995) as a way to help faculty improve their skills in performing assessment. The methodology was further refined in the *Assessment Institute Handbook* (Apple & Krumsieg, 2002) and given a final polish in the *Faculty Guidebook* module *Assessment Methodology* (Apple & Baehr, 2007). See Figure 2.

Scholarship on Assessment

Beyond using professional development institutes as a crucible for implementing a shift towards a culture of assessment, the scholarship of assessment led to two major

manuscripts: *Differentiating Assessment from Evaluation as Continuous Improvement Tools* (Parker, Fleming, Beylerlein, Apple & Krumsieg, 2001) and *Keys to Improving Academic Assessment* (Utschig & Apple, 2009). The most recent edition of the *Faculty Guidebook* includes a series of modules, each of which gives educators the information and tools they need to begin benefitting from the improved educational practices and outcomes that assessment offers: *Overview of Assessment* (Baehr, 2007b), *Distinctions Between Assessment and Evaluation* (Baehr, 2007a), *Mindset for Assessment* (Jensen 2007a), *Moving Towards an Assessment Culture* (Utschig, 2007), *Performance Levels for Assessors* (Jensen, 2007b), *Assessing Assessments* (Anderson & Watson, 2007), and *Turning Evaluation into Assessment* (Watson, 2007).

Professional Development: Advancing the Practice of Assessment

As part of the ongoing effort to effectively differentiate assessment from evaluation in order to realize the full benefits of each process, many Process Education institutes included as an integral component learning activities focused on the distinction between the two (Apple & Krumsieg, 1998), up to and including the *Student Success Institute Handbook* (Apple & Krumsieg, 2007) and the *Mentoring Handbook* (Apple, 2009). In 2001, with the help of Stony Brook and Penn State, Pacific Crest designed and implemented a stand-alone Assessment Institute designed to help faculty, staff, and administrators experience the differences in effects, procedures, and outcomes between an assessment culture (where the mindset is focused on continuous quality improvement) and an evaluation culture (where the mindset is focused on rendering judgment based upon the level of quality) (Apple & Krumsieg, 2002).

Program Review vs. Program Assessment

The picture at the program level was not terribly different with respect to differentiating assessment from evaluation; while many colleges practiced program review (an evaluative practice to determine program feasibility), few practiced systematic program assessment. Even as Pacific Crest was increasingly focused on the critical role assessment plays in the ongoing process of improvement, a parallel conversation was taking place nationally, as accrediting bodies sought to help institutions effectively collect and use evidence of their students' learning as the primary indicator of current program quality and to help improve future program quality (Dan Apple, personal recollection). The time was right for a Program Assessment Institute (Apple & Krumsieg, 2001), and one of the first was held at the Ranger School of SUNY – ESF in 2001, leading directly to a model implementation of a program assessment system (Savage, 2002).

Figure 2 Assessment Methodology

Step	Explanation
1. Develop guidelines for the assessor to follow when assessing a performance.	
<i>Both assessee & assessor:</i>	<ul style="list-style-type: none"> a. Define the purpose of the performance. b. Define the purpose of the assessment. c. Determine what is appropriate to be assessed. d. Agree on what should be reported and how it should be reported (for the assessment/feedback report).
2. Design the methods used for the assessment.	
<i>Both assessee & assessor:</i>	<ul style="list-style-type: none"> a. Inventory a list of possible criteria to be used as part of the assessment. b. Choose the criteria from this list which best meet the previously established guidelines (Step 1). c. Determine an appropriate attribute (or set of attributes) for each of the chosen criteria (Step 2b) which will be used to assess the assessee's performance. d. Determine the appropriate scale for each attribute (Step 2c) which will be used to determine or measure the quality of the assessee's performance.
3. Collect information during the performance.	
<i>The assessor:</i>	<ul style="list-style-type: none"> a. Set up a system to complete and collect information pertaining to the attributes. b. Measure the collected information against the established attributes using the determined scales. c. Document the assessee's strengths, areas for improvement, and insights which will be shared with the assessee. d. Offer feedback during the performance, if appropriate and agreed upon beforehand, with the assessee.
4. Report the findings to the assessee.	
<i>The assessor:</i>	<ul style="list-style-type: none"> a. Share the assessment report with the assessee. This includes information gathered during the performance and how it relates to the criteria, along with feedback for improving future performances. b. Analyze a performance that is believed to be poor or of low quality. Determine what part is due to the information collected, the criteria chosen, and/or the performance itself.

Assessment most effectively leads to improvement when it is part of ongoing practice. This means that it must be part of the very design of the operational context it is meant to improve. This design insight led directly to the Program Design Institute, based on the Methodology for Program Design (Davis, 2007b). It is no surprise that Step 19 of this methodology is “Design a program assessment system.” Numerous programs have implemented the methodology’s design steps, among them an honor's program (University of Indianapolis), an Emerging Scholars Programs (University of Alaska – Fairbanks, College of Rural Alaska, Kuskokwim Campus), and a Learning Communities Program (St. Augustine College) (Pacific Crest, 2015).

The focus on assessment at the program level led directly to numerous additional modules in the *Faculty Guidebook*:

- *Writing a Self-Study Report* (Racine, 2007b)
- *Methodology for Designing a Program Assessment System* (Collins & Apple, 2007)
- *Writing Performance Criteria for a Program* (Nibert, 2007)
- *Identifying Performance Measures for a Program* (Parmley & Apple, 2007b)
- *Constructing a Table of Measures* (Racine, 2007a)
- *Writing an Annual Assessment Report* (Parmley & Apple, 2007c)
- *Assessing Program Assessment Systems* (Parmley & Apple, 2007a)

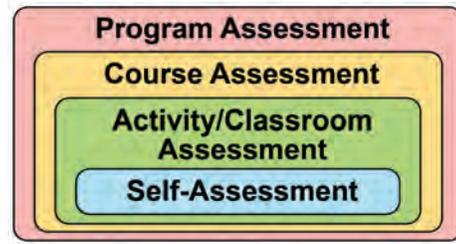
Course Evaluation vs. Course Assessment

Educators are used to grading — an evaluative process. And most courses have a course evaluation system that weights assignments or activities by percent or points, all of which contribute to the final grade, score, or percentage. But the principle of designing a system to ensure effective and ongoing improvement through assessment applies just as well to a course as to a program; in fact, there is much to be gained in aligning assessment practices at the program, course, activity, and individual level (see Figure 3). Few courses have a course assessment system — Step 19 of the Methodology for Course Design (Davis, 2007a) — the goal of which is to improve student learning, faculty facilitation, design and responsiveness of the course, and the course's materials and resources. Designing courses that featured integrated assessment became part of the professional development focus in the first Curriculum Design Institute and then the Course Design Institute (Apple & Krumsieg, 2003).

Self-Evaluation vs. Self-Assessment

Being a self-evaluator is one of the top 20 factors that put academic success at risk for learners, generally by fostering low self-esteem or depression (Horton, 2015). Students who self-evaluate rather than self-assess are “constantly self-critical, see only their mistakes and failures, and do not appreciate growth or improvement.” (For more information about the relationship between the practice of self-assessment and growth see the sections, **Self-Assessment** and **Growth Mindset**.)

Figure 3 Assessment Drives Improvement at All Levels



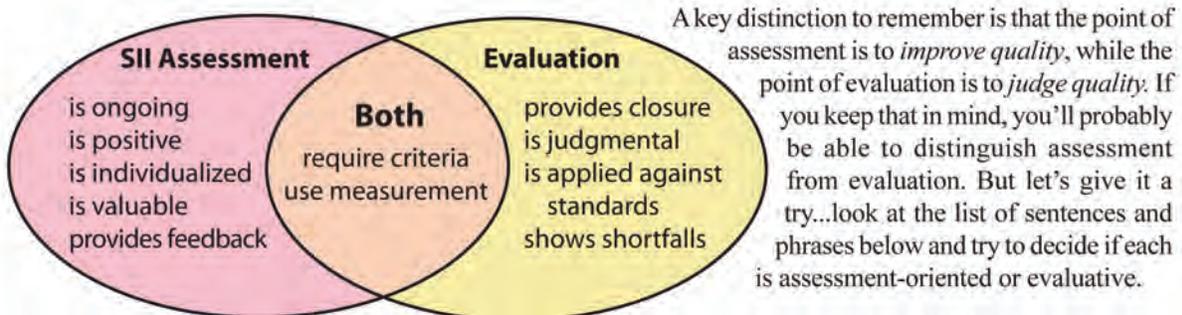
According to Dan Apple,

In 20 years of facilitating Learning to Learn Camps, little has changed with respect to incoming students in that they tend to evaluate themselves rather than self-assessing. Self-evaluation makes self-growth virtually impossible. One of the main goals of the camp is to shift their practice to self-assessment so they can begin, not only to improve, but to truly grow.

Assessment in Student Curricula

Assessment is the key to improvement and Process Education means that learners must have ownership of their own learning, so we have shared with students the practice of assessment as differentiable from evaluation in Chapter 13 of *Foundations of Learning* (3rd ed.) (Krumsieg & Baehr, 2000); upgraded again in *Foundation of Learning* (4th ed.) (Redfield & Hurley Lawrence, 2009); and in Experience 4 of *Learning to Learn: Becoming a Self-Grower* (Apple, Morgan & Hintze, 2013). These introduce students to the processes of assessment and evaluation, providing

Figure 4



Sentence/phrase	Which Is it?	Assessment	Evaluation
<i>You did better than I expected.</i>		<input type="checkbox"/>	<input type="checkbox"/>
<i>Your essay is strong and demonstrates comprehensive research.</i>		<input type="checkbox"/>	<input type="checkbox"/>
<i>Steve's draft was terrible.</i>		<input type="checkbox"/>	<input type="checkbox"/>
<i>Your draft could use additional sources.</i>		<input type="checkbox"/>	<input type="checkbox"/>
<i>...a grade of "A"</i>		<input type="checkbox"/>	<input type="checkbox"/>
<i>You missed question 7.</i>		<input type="checkbox"/>	<input type="checkbox"/>
<i>Try doing X instead of Y.</i>		<input type="checkbox"/>	<input type="checkbox"/>

examples of each, and challenging students to identify feedback as assessment- or evaluation-based (see Figure 4). Additionally, Experience 9 of *Learning to Learn: Becoming a Self-Grower* gives students the opportunity to identify evaluative statements and recast them as assessment-based in order to improve future performance. The learning kits used in Learning to Learn Camps feature either *Foundations of Learning* or *Learning to Learn: Becoming a Self-Grower*.

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An individual with a self-assessment mindset is motivated to consistently work to improve his or her own performance by using performance criteria. Self-assessment, like assessment, depends upon criteria that describe what constitutes quality in a performance, and strives to identify strengths (and how to replicate them) and areas for improvement (and how to make those improvements). Self-assessment is the most productive practice for triggering and maintaining growth; conversely, self-evaluation makes growth nearly impossible.

When Pacific Crest was Pacific Crest Software and it came to marketing technology, Pacific Crest employees conducted demonstrations in which teams of students used the software (see the **Role of Technology** section). Dan Apple shares his recollection of how that process led to an understanding of the critical nature of assessment and especially self-assessment:

In order to help faculty better understand what they were seeing when they viewed these demonstrations, the student participants were asked to reflect on their experience and for each team to share the three most important things they had learned. Almost without exception, their lists of what they had learned were in areas such as improved communication, teamwork, problem solving, critical thinking, risk-taking, self-confidence, and leadership, rather than anything about the software. By the late 1980s, student participants started asking the workshop facilitators to help them to continue to improve in the future. This led to the addition of the role of reflector in the team structures. It also led to the facilitator tasking each individual student with performing a self-assessment of their performance. Because there was no standard offered, students could not easily evaluate their performance; they were simply asked to reflect on their performance and consider how it might be improved.

Though not appreciated as such at the time, students were simultaneously looking back (reflecting) and looking forward (assessing); individuals determined their own areas for improvement and teams shared a synthesized list of individual team member strengths. Though the collaborative nature of these teams and the reporting structure they worked with may have made it difficult to observe at first, individual students were already engaging in informal self-assessment, identifying strengths and areas for improvement (see the section **Assessment vs. Evaluation**).

Defining and Describing Self-Assessment

The articulation and definition of self-assessment evolved between 1991 and 1997. The deep fundamental relationship between improvement and self-assessment was noted in the first *Teaching Institute Handbook*, in which self-assessment was identified as a key to improving the rate of learning (Apple, 1991).

Self-assessment was an integral part of *Learning Through Problem Solving* (Apple, Beyerlein & Schlesinger, 1992), and was identified as a way to build the ability to think critically about one's own learning process: "Self-assessing is about assessing your progress not only when you think you have an answer, but also as you are working toward the answer... This book challenges you to assess your progress through a series of critical thinking questions." Part of the power of self-assessment and the reason why it can lead to improved performance is this combination of focus on the process of performance (rather than end product) and metacognitive awareness. To use a simple example, if we want to make a better pizza, we don't start with a pizza; we start with the process of making the pizza... and the more aware we are of that process, the more carefully we can work to make things better.

But self-assessment was not and is not an activity that can be simply added to the traditional classroom; self-assessment is an essential aspect of a learning environment which seeks the empowerment of the student. As Apple and Lawrence explain,

Self-assessment permeates each activity and is an essential aspect of the empowerment of the student. One of the components of accepting responsibility for one's own learning (and therefore buying into lifelong learning) is the ability and desire to assess oneself. To encourage self-assessment, the facilitator needs to establish an environment where self-assessment is achievable, encouraged and valued. — Education as a Process (1994).

At this point, we have a thumbnail sketch of self-assessment that includes the following qualities:

Self-assessment

- ...improves performance
- ...is focused on process
- ...uses and builds critical thinking
- ...increases metacognitive awareness
- ...should be part of the educational environment

In 1995 Hanson and Apple synthesized existing scholarship focused on self-assessment and shared a stronger formulation, adding the idea of using a target or model performance to compare with their own (“If we are trying to improve process skills, we must ask students to examine and compare how others perform and to examine their own performance”). By comparing one’s performance against a model one benefits from the utility of performance descriptions or criteria, without explicitly using them. This is the beginning of an appreciation of levels of performance, rubrics, and how much more fully they can support self-assessment.

Hanson and Apple also clarified the parallel nature of self-assessment and critical thinking. “Individuals need to recognize what they know, need to know, how well they can do something, and what they need to do to improve” (1995). We’re still focused on strengths and areas for improvement, but instead of being focused **only** on performance, there is a dual focus that includes knowledge as well (see Figure 1).

Figure 1 Self-Assessment Step in the Learning Process Methodology

Critical Thinking (Level of Learning)	
Focused on:	Knowledge
Strengths:	What is known
Areas for Improvement:	What should be known
Strategies:	How to gain the knowledge

Self-Assessment (Growth in Learner Performance)	
Focused on:	Performance
Strengths:	How well one can do something
Areas for Improvement:	What must be done to improve
Strategies:	How to make the improvements

The authors continue: “Such assessment can be implemented very simply by asking students to identify strategies, strengths, and improvements at various stages of an activity” (Hanson & Apple, 1995). This addition of

strategies (see Figure 1) to the previous formulation or structure is the nascent form for action plans that will later be subsumed under the Areas for Improvement.

The final aspect of the synthesis of self-assessment offered by Hanson & Apple is that of the relationship of self-assessment not only to lifelong learning but to growth: “Self-assessment is one step in accepting responsibility for one’s own learning and is essential for lifelong learning and growth.”

In *Taking the Helm: Targeting Student Learning* (1996), Klopp speaks directly to all of these aspects of self-assessment:

Student empowerment, however, requires the ability of the student to self-monitor, to be able to look at oneself with as little distortion as possible. Once students have integrated the skills necessary to active learning and assessment they can move to the independent level of planning their own strategies for learning based on their self-identified preferences and goals. The more involved the learner is mentally, the more internal dialogue occurs in the student’s personal reflection time. The more students examine their own learning, the more likely they are to take control of that learning. Opportunities for self-reflection and self-assessment must be provided within the class itself so that students may be habituated to self-reflection outside of class.

Each of these pieces is still present in the current performance definition for self-assessors, with the roles of expectations, criteria, action plans, insights, and growth now explicitly acknowledged:

Self-Assessors know performance expectations and set criteria, perform critical self-examination, and then analyze their data to understand the strengths of their performances, develop transformational action plans, and articulate new discoveries and insights. They can step back and reflect critically on where they are now and where they want to be, and constantly update their goals relating to self-growth in order to become that person (Pacific Crest, 2013).

Self-Assessment and Reflection

From the beginning, the process of reflection has been used in conjunction with self-assessment. According to Desjarlais and Smith (2011), self-assessment and reflection are similar processes that have much in common. Both are:

- Structured
- Sequential

Figure 2



- Targeted
- Based on an earlier experience or performance
- Improved through analysis
- Internal
- Meaningful
- Important in improving quality
- Conducive to learning (about self or content)

But there are important differences between the two processes. Even as reflection can play a role in self-assessment and can support self-assessment as an ongoing practice, it tends to be backward-looking (we reflect on past performance) while self-assessment is forward-looking (strengths and areas for improvement are used to improve future performance). It is because of this difference that the goal of reflection is “knowing” whereas the goal of self-assessment is “growing” (Desjarlais & Smith, 2011).

Self-Assessment and Improving Learning: Learning Skills

How does self-assessment improve learning? An obvious method is to use and implement strategies or action plans targeted in the areas for improvement identified in a self-assessment. Yet there is another way to use self-assessment to improve learning by making use of the *Classification of Learning Skills for Education Enrichment and Assessment* (Apple, 1997). When learning skills are improved, the ability to learn and the performance of learning is improved; performance with a learning skill can be the focus of self-assessment, leading to improved learning. Not only was assessment identified as essential for developing and improving proficiency with skills in all domains, self-assessment is a universal process for improving learning skills (Desjarlais & Smith, 2011). The importance of assessment (or self-assessment) in improving these skills is seen by the placement of the assessment process arrows in Figure 2. Beyond assessment as a tool to improve



learning skills, the Classification itself is also useful for improving self-assessment skills, many of which are listed in the Classification; see Figure 3 for a sampling (Apple, Beyerlein, Leise, & Baehr, 2007).

Figure 3 Self-Assessment Learning Skills [from *Foundations of Learning*, 4th edition (Redfield & Hurley Lawrence, 2009)]

Developing an Assessment	<ul style="list-style-type: none"> setting criteria ensuring validity ensuring completeness creating a measurement system
Conducting an Assessment	<ul style="list-style-type: none"> introspecting reflecting applying criteria measuring
Reporting an Assessment	<ul style="list-style-type: none"> presenting feedback complimenting accepting feedback

Self-Assessment and Self-Growth (see the section Self-Growth / Growth Mindset)

Remember, learning is about increasing knowledge; growth is about improving performance (and capacity in the performer). If self-assessment is how we improve performance, then, most simply, self-assessment causes growth. A *self-grower* has an enduring interest in and proficiency with self-assessment which enables him or her to continually grow (capacity) and improve future performances (Apple, 1997; Myrvaagnes, 2007).

A Methodology and Performance Measure for Self-Assessment

As comprehensive as self-assessment is in the scholarship, we did not have a methodology for conducting self-

assessment until 2011 when Desjarlais and Smith adapted content from the *Faculty Guidebook* to create the Methodology for Self-Assessment (see Figure 4). This methodology is relatively strict and can be used to produce a formal self-assessment report, but even if a more casual self-assessment is sought, the Methodology's steps provide a kind of perception check so that casual self-assessment does not devolve into unproductive reflection or, worse, self-evaluation.

During a Developmental Math Institute, participants collaborated on the creation of a performance measure for self-assessment. The measure has been edited and is available in the *Book of Measures* (Pacific Crest, 2013).

Tools to Improve Self-Assessment

A self-assessment form was included in *Learning Assessment Journal* (Carroll & Apple, 1995), to help students analyze their strengths, produce improvements with action plans, clarify insights, determine how they helped others and were helped in turn, and to identify concepts learned, knowledge integrated, and any new discoveries. This SII model (Strengths, Areas for Improvement, Insights) builds metacognitive skills by tasking students with producing insights — discoveries made from performing the assessment — and increasing their awareness of their own experiences, a kind of reflective practice (see the **Reflection** section). The 3rd edition of the *Learning Assessment Journal* (Apple, 2000) offered a revised self-assessment form which included space for faculty to assess the student's self-assessment. This innovation was the product of much thinking and many conversations about obtaining student buy-in, creating an assessment culture, the importance of assessing self-assessments, why and how to provide criteria, and the role of peer assessment in the student development of self-assessment (Dan Apple, personal recollection). The tools available for increasing the practice and quality of self-assessment have proliferated and while many stand alone in the *Student Success Toolbox* (such as the SII Self-Assessment form; Pacific Crest, 2011), many more have been integrated into student learning curricula (see **Self-Assessment in Student Curricula** which follows).

Scholarship Focused on Self-Assessment

The thinking that led to the revised self-assessment tool as well as previous scholarship on self-assessment was formalized in several modules published in the *Faculty Guidebook* (all 2007):

- *SII Method for Assessment Reporting* (Wasserman & Beyerlein)
- *Moving Towards an Assessment Culture* (Utschig)

- *Turning Evaluation into Assessment* (Watson)
- *Practical Implementation of Self-Assessment Journals* (Miller)
- *Assessing Assessments* (Anderson & Watson)

The *International Journal of Process Education* has also featured some strong scholarship focused on self-assessment. Desjarlais and Smith's *A Comparative Analysis of Reflection and Self-Assessment* (2011) is especially valuable for the self-assessment methodology it offers, but also because it serves to inform the learning experience focused on self-assessment in *Learning to Learn: Becoming a Self-Grower* (Apple, Morgan, & Hintze, 2013). In *What is Self-Growth?* (2015), Jain, Apple, and Ellis present self-assessment as the key component of self-growth, illustrating how self-assessment relates to the other nine components of self-growth. The goal is to help faculty increase their own ability to self-assess, as well as to help their students develop this same ability. In *Identifying At-Risk Factors That Affect College Student Success* (2015), Horton points out that being a self-evaluator is one of the top 20 factors that put academic success at risk for learners, generally by fostering low self-esteem or depression. Students who self-evaluate rather than self-assess are "constantly self-critical, see only their mistakes and failures, and do not appreciate growth or improvement."

Self-Assessment in Student Curricula

The practice of self-assessment is part of the activity/experience design found in *Foundations of Learning* (4th ed.) (Redfield & Hurley Lawrence, 2009) and in *Learning to Learn: Becoming a Self-Grower* (Apple, Morgan, & Hintze, 2013). Each chapter of *Foundations of Learning* ends with a prompt for the student to complete a self-assessment. As the introduction explains,

This is your opportunity to compare the Learning Objectives with your actual outcomes for each chapter. This is not about a grade, but about improving your performance. As such, you will assess your performance by sharing and describing 1) a strength you exhibited, 2) an area in which you could improve your performance, and 3) an insight you experienced while working through that chapter.

Additionally, Chapter 13, *Assessment for Self-Improvement*, echoes Klopp (1996) on the importance of being able to "look at oneself with as little distortion as possible," in explaining the importance of being able to objectively view one's self and to separate the performance from feelings one has about that performance.

Chapter 4 of *Learning to Learn: Becoming a Self-Grower* is titled, "Self-Assessment: The Engine of Self-Growth,"

Figure 4 Self-Assessment Methodology

Step 1	Define the purpose of the performance	This first step clarifies why the endeavor triggering the assessment is worth assessing and what the assessment hopes to accomplish. With this information the self-assessor (who is also the assessee) can better determine what is important to assess (Wiggins & McTighe, 2005).
Step 2	Define the purpose of the self-assessment.	Here, the assessor establishes the outcomes for the self-assessment and restricts attention to certain aspects of the performance being assessed, if appropriate. The goal should always be personal development and improved performance.
Step 3	Develop performance criteria for the self-assessment.	Using the outcomes identified in Step 2, the assessor identifies the criteria by which to measure the success of the self-assessment. These should be understandable, measurable, realistic, and relevant to the outcomes. These criteria will help keep the assessment process focused. In most cases, there should be no more than four criteria.
Step 4	Determine attributes that indicate quality for each criterion.	In this step, the assessor breaks down each criterion into attributes that can be easily measured. If the assessment is narrowly focused, one or more of the criteria may be clear and measurable enough in itself that it will not be necessary to define its attributes.
Step 5	Determine evidence for each criterion	For each attribute or simple criterion, determine the evidence needed to perform the assessment. Evidence is important in order to judge whether the criteria are achieved successfully. The evidence should be readily accessible from the performance being assessed.
Step 6	Select the scale and range to be used in looking at each piece of evidence.	Measurement requires a scale and a range. If the evidence is carefully selected, these should be self-evident. The scale may be numerical or ordinal and should be sufficient to explain all gradations within the range. If in doubt, one should make the scale simple.
Step 7	Collect and measure the evidence.	For this step it would be helpful to have already engaged in a reflection about the performance being assessed. The reflection or play-back will highlight evidence needed to conduct the assessment. The collected evidence should be connected directly to the performance. Each piece of evidence should be rated according to its scale.
Step 8	Use the collected evidence to prepare a self-assessment report.	In writing a self-assessment report, one determines and documents strengths, areas for improvement, and insights gained from conducting the assessment (Wasserman & Beyerlein, 2007). It is thus referred to as an SII report, and it is the heart of the assessment. For each area for improvement, one should develop a short-term plan of action (what can be done immediately) as well as a long-term action plan (what can be done in the future). If previous action plans have been developed, they should now be assessed.
Step 9	Determine whether there is a need to engage in other processes.	The self-assessment report for Step 8 may identify a need to do further reflection or to engage in learning, research, design, problem solving, or other processes in order to maximize growth or to fully implement the action plans.
Step 10	Assess the quality of the self-assessment process.	Identify the strengths, areas for improvement, and insights gained as a result of this process, being careful to focus both on the self-assessment process and the product that was generated (i.e., the self-assessment report).

Figure 5

Discovery Exercise	For some typical experiences, students must determine if that experience demonstrates evaluation or self-evaluation, self-assessment, reflection, or seeking external affirmation.
Reading	“Why Assessment?, Action Plans, A Comparative Analysis of Reflection and Self-Assessment” (excerpted from the <i>International Journal of Process Education</i> , June 2011, Vol 3, Issue 1)
Rubrics	Performance Levels for Self-Assessors, Performance Levels for Action Plans
Models of Self-Assessment Tools	Self-Growth Goals worksheet, Reading Log, Learning Journal entry, Reflector’s Report
Challenge	Evaluation to Assessment worksheets (students should identify situations in which evaluation is taking place and recast the feedback as assessment-based; a minimum of 15 should focus on SELF-evaluation and SELF-assessment)
Self-Assessment	For every experience from this one forward, students are tasked with performing a self-assessment of their performance as a learner and self-grower in meeting the learning outcomes and performance criteria shared in the experience.
My Life Vision	Students are challenged to write two pages on what their world would be like if they chose to help themselves improve rather than judging themselves.

Figure 6 Performance Criteria for the Self-Growth Paper (from *Foundations of Learning*)

Criterion #1: completeness of the paper	
<i>Attributes:</i>	<ul style="list-style-type: none"> a. each component noted in the plan is included b. the paper should be a minimum of 5 pages in length c. goals for the future are included in the paper
Criterion #2: demonstrated ability to assess one’s own performance	
<i>Attributes:</i>	<ul style="list-style-type: none"> a. assessment is designed appropriately (Chapter 13) b. SII Method of Assessment is used appropriately (Chapters 7 and 13)
Criterion #3: level of thought and analysis	
<i>Attributes:</i>	<ul style="list-style-type: none"> a. assessments are evidence-driven (they rely upon evidence), using specific examples from previous assessments, writing assignments, and the <i>Life Vision Portfolio</i> b. achieves at least <i>Level 3: Guide/Coach</i> on the Levels of Assessor Performance rubric (Chapter 13) c. demonstrate at least <i>Level 2: Comprehension of Key Issues</i> on the Levels of Assessment rubric (Chapter 7)

and offers much about self-assessment. The pertinent content is outlined in Figure 5.

Both books include the self-growth paper, which is a synthesis or portfolio of the self-assessments students completed during the course. The performance criteria for the self-growth paper (see Figure 6) are fairly stringent and demonstrate not only the degree to which students have been working with self-assessment throughout the course, but the degree to which their competence in self-assessment has been demonstrated to have grown.

In addition to the use of self-assessment in student-learning curricula, *Quantitative Reasoning and Problem Solving* (Ellis, Apple, Watts, Hintze, Teeguarden, Cappetta, & Burke, 2014) includes “A Successful Performance” in each activity. This is a presentation of the performance criteria specifically phrased to describe a successful performance (itself an interesting innovation). See Figure 7 for an example from Activity 5.1, Data Generation. At the end of each activity, students complete the section, “Assessing Your Performance.” In this section, students are prompted to review the “Successful Performance” section and then

Figure 7

A Successful Performance *Successful application of your learning looks like this*

As you begin to apply what you've learned, you should have a good idea of what success looks like.

A SUCCESSFUL PERFORMANCE

When I am presented with the opportunity for collecting data, I...

- Decide on which data generation process I should select
- Develop or select appropriate tools to obtain the data
- Collect, validate, and store the data using appropriate technology

assess their performance against the expectations described there. They are asked how and why their performance was successful and how they can improve their performance, including the concrete steps they must take to do so.

Future research should attempt to measure the importance of using “A Successful Performance” or other models of performance in the self-assessment process (i.e., What is

the impact on self-growth when clear performance criteria are available as a base for self-assessment?). One possible research project for members of the Process Education community would be to discover why star performers continuously self-assess their performance, while others, though they may have demonstrated the ability to self-assess, often choose not to do so.

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Reflective practitioners want to know the why, how, and motivation behind their behaviors, decisions, and performances and will take the time needed in order to step back and process these questions to increase their meta-cognition.

Becoming a reflective practitioner is a challenging growth process because it requires increased consciousness of thoughts, feelings, and behaviors that are typically habitual, unconscious, or assumed (i.e., requiring no explanation). It is not easy to determine what experiences or challenges, contexts (e.g., learning activities, teams, organizations), or tools (e.g., designed forms, assessment rubrics) will trigger or lead to growth in reflective practice. Furthermore, if we are to experience greater or more frequent reflective insights, we as individuals must challenge both social norms and institutional roles in order to step outside the habitual and often pre-programmed roles or expectations we have as learners, educators, and administrators. One of the goals of Process Education is for reflection to become a natural meta-cognitive process that drives not only the selection of learning experiences but also the assessment and reflection that make improved quality possible for individuals, teams, and organizations.

Reflection Time

During Pacific Crest workshops, reflection time was built into the professional development process from the beginning. A journal/record was kept for each event that recorded the learning at end of each activity, at the end of each day, at the beginning of the next day, and at the end of the event. Break periods were even called *reflection time* as presented in *Teach for Learning — A Handbook for Process Education* (Pacific Crest, 1993). Chapter 3 of *Learning Through Problem Solving* is titled "Journal Writing" and focuses on improving learning through writing, "a process of recording observations and insights in private, proven to be a valuable self-assessment and learning tool" (Apple, Beyerlein & Schlesinger, 1992). At the end of each chapter, a "reflections" page prompts the learner to answer eight key questions to gain more understanding of themselves. One such prompt reads, "What personal growth occurred from this lesson? Identify an activity you will pursue to support this development."

During 1994, recorder and reflector reports were integrated into the cooperative learning model used during professional development institutes in order to aid faculty in reflecting on both the content and process they were experiencing. This practice was expanded with an *Introduction to Journal Keeping* (Kent, 1994) that included the following reflection tools:

- Skills for Life
- Daily Team Learning Activity Journal Form
- Daily Learning Journal
- Critical Reading Log
- Vocabulary Log
- Free Writing
- Collection Point
- Outside Activity
- Field Notes
- Weekly Ignorance Log
- Week in Review
- Critical Thinking Questions for Students and Teachers

In the *Learning Assessment Journal* (Carroll & Apple, 1995) a set of reflection tools was refined and structured to support a Process Education approach to improving learner performance in key processes: learning, thinking, problem solving, communication, assessing and teamwork. Added to the existing tools were refined versions of the reading log, and self-assessment form, as well as the weekly team recorder, and weekly team reflector reports. The next edition of the *Learning Assessment Journal* (2nd ed.) (Carroll & Beyerlein, 1996) again refined existing tools, upgraded the format of others, and added planner and spokesperson reports.

Incorporating Reflective Practice in a Course

The value and practice of incorporating reflective practice into a course was explored in multiple contexts in the article *The Learning Assessment Journal as a Tool for Structured Reflection in Process Education* (Carroll, Beyerlein, Ford & Apple, 1997) and led to improvements in the 3rd edition of the *Learning Assessment Journal* (Carroll & Beyerlein, 1997), which included space for providing practitioner feedback, and the addition of log of entries and glossary forms. In the *Learning Assessment Journal* (4th ed.) (Apple, 2000) the forms were upgraded again and an activity assessment form was added to the array of tools.

The *Self-Assessment Learning Journal* (Krumsteg & Miller, 2001) added some guidelines for self-learners with computers: the Learning Process Methodology, learning skills, levels of learner performance, the Information Processing Methodology, the Methodology for Learning a New Tool, the topics of assessment and evaluation, and

the Personal Development Methodology. It also provided customization of existing forms for technology, and added a new lecture/lab notes form. The *Information Technology Self-Assessment Learning Journal* (4th ed.) (Krumsieg & Miller, 2008) provided an overview of the concepts of *learning to learn* and *self-growth*; in addition to improved forms, this edition also included a self-assessment project journal and weekly assessment notes.

Scholarship focused on how to engage students in reflection using tools that can be found in the *Faculty Guidebook* (Beyerlein, Holmes & Apple, 2007). The module *Persistence Log* (Atnip, 2007) deals with how to get students to understand when and how their efforts connect to their successes. *Practical Implementation of Self-Assessment Journals* (Miller, 2007a) discusses the principals of implementing reflective practice and self-assessment. There is an awareness of how context impacts reflective practice; *Using Reading and Lecture Notes Logs to Improve Learning* (Miller, 2007b) focuses particularly on building reflective practice in large lecture courses while Hare (2007) tackles the issue of implementing reflective practice within a team structure in *Team Reflection*.

The *Student Success Toolbox* pre-market edition (Pacific Crest, 2009) again upgraded the existing forms, added content on the Classification of Learning Skills, the criteria for team roles, information about the Theory of Performance, instructions for a self-growth paper, the rubric for levels of learner performance, an activity analyzing a course syllabus, and tips for becoming an "A" student. New forms included concept mapping, addressing and avoiding errors, a learning journal, an SII performance assessment report, team assessment, performance analysis and assessment, a learning contract, mid-term assessment, and course assessment. This set of tools was expanded by providing access to items such as methodologies and rubrics that could be downloaded from a website. The *Student Success Toolbox* (1st ed.) (Pacific Crest, 2013) added a mentoring planning form, a mentoring agreement, a preparation worksheet, a weekly planner, and a course record sheet.

Reflection and Self-Assessment

During a 2001 Advanced Teaching Institute, a community of Process Education practitioners spent some time considering the relationship between self-assessment and reflection, determining how and why they differ from and support each other (Pacific Crest, 2001). Leise (2010), in his supervisory work with students studying counseling, explored the relationship between assessment and reflection in *Improving Quality of Reflecting on Performance*. He prepared a holistic rubric for assessing the quality of reflection from "unfocused observer" to "integrated reflector" (see Figure 1). He emphasized the importance of growth in selected skills across the cognitive, social, and affective domains that are

necessary for effective reflection (e.g., filtering information, being non-judgmental, and challenging oneself). He further noted that the Process Education perspective on reflection contrasts with philosophical and spiritual traditions; in the Process Education model, assessment of performance prompts reflection, and the discovery of insights from performance experiences is a significant meta-cognitive process that is essential to growth of skills. This scholarship was further advanced in the article *Comparative Analysis of Reflection and Self-Assessment* (Desjarlais & Smith, 2012). A disciplinary exploration of the importance of and methods for building metacognition within engineering practice is offered in *Reflection and Metacognition in Engineering Practice* (Davis, Leifer, McCormack, Beyerlein, Brackin & Trevisan, 2013).

Reflection, and Meta-cognition in Student Curricula

The scholarly advances made with respect to self-assessment, reflection, and meta-cognition became a cornerstone of each learning experience in *Learning to Learn—Becoming a Self-Grower* (Apple, Morgan & Hintze 2013) and informed the design of learning activities, leading to a section dedicated to reflection, "Learning to Learn Mathematics: Reflecting on and Appreciating Your Learning" in *Quantitative Reasoning and Problem Solving* (Ellis, Apple, Watts, Hintze, Teeguarden, Cappetta, & Burke, 2014) (see Figure 2).

A learning activity that is entirely focused on metacognition is "Metacognition: Thinking about My Thinking,"--Experience 11 of *Learning to Learn: Becoming a Self-Grower*. This learning experience challenges learners to identify something they have learned (by documenting it with a learning journal worksheet) and then to engage in metacognitive exploration of that learning. They use a metacognitive exploration worksheet to do each of the following: record their level of learning, explain how they determined their level of learning, list the learning skills they use when demonstrating or applying their learning, determine and share the steps they used from the Learning Process Methodology in the course of doing the learning, create an outline of how to teach what was learned to someone else, and finally create inquiry questions that will help a new learner explore more deeply or transfer their learning.

Whether the implementation of reflective practice and increased metacognition is at the level of a post-activity prompt, forms/worksheets/tools integrated into a learning activity, or practices integrated into teaching or learning at the course level, when reflection becomes a natural or familiar meta-cognitive process, the only possible result is improved learning and performance for everyone: learners, educators, individuals, teams, and organizations.

Figure 1 Holistic Rubric for Assessing the Quality of Reflection

<p>5. Integrated Reflector (<i>Reflects on transformative aspects of performance factors</i>)</p>
<ul style="list-style-type: none"> a. Immediately perceives multiple aspects of behavior in any situation that indicate potential performance growth opportunities for self and others b. Assesses multiple performance issues against multiple types of performance standards c. Uses constructs from published theory and research to enlarge the scope of performance growth potential within the context of a system d. Analyses motivation and identity growth of performers in human organizations or systems from a leadership perspective e. Articulates insights about individual, group, and systems performance that can benefit the overall quality of an organization or system
<p>4. Mindful Reflector: (<i>Uses reflection for purposes beyond individual skills growth</i>)</p>
<ul style="list-style-type: none"> a. Reliably captures the essence from an observed performance experience that should be the focus of assessment and analysis for growth b. Guides learners or mentees to assess growth in the transfer of skills needed to become broadly and deeply competent c. Designs learning activities that assist learners, mentees, or supervisees to flexibly gain applied insights from any type of relevant literature d. Uses a wide variety of critical thinking skills in focused ways to illustrate the various perspectives and insights available from the analysis of any performance e. Articulates insights that support the transfer of multiple skills to new or more challenging contexts
<p>3. Applied Reflector (<i>Uses reflection effectively for the growth of one's own skills</i>)</p>
<ul style="list-style-type: none"> a. Consistently perceives and identifies relevant observations about actual performance experiences b. Self-assesses based on accurate observations focusing on differences in quality of current versus previous performance c. Selectively incorporates knowledge from scholarly literature to gain insights about dynamic factors such as how to improve learning conditions, how to benefit from mentoring, and how to apply key insights of experts d. Analyzes alternative assumptions or conceptualizations of what influences the quality of a performance e. Combines the current quality of performance with relevant knowledge about the area of competency to articulate insights about how to continue the growth of a skill
<p>2. Descriptive Reflector: (<i>Reflection at a beginning level; moving toward growth</i>)</p>
<ul style="list-style-type: none"> a. Accurately observes/perceives relevant behavior and conditions related to one skill b. Imprecisely self-assesses because the focus is on abstractly-defined aspects of performance rather than on directly observed performance c. Relies directly on published knowledge about relatively fixed personal factors, e.g., personality or school achievement, to provide a basis for understanding observations about performance d. Evaluates performance using standards based on the expectations of others e. Articulates insights in terms of what a performer should do to meet the expectations of evaluators or other assumed standards
<p>1. Unfocused Observer: (<i>Captured by present assumptions and emotions</i>)</p>
<ul style="list-style-type: none"> a. Demonstrates inconsistent focus of perceptions and observations within a situation, even with guidance b. Uses positive, but "evaluative," descriptors such as "good" or "well done" to characterize performance in a situation c. Relies on personal opinion or impressions for validation of assumptions about current performance d. Accepts current assumptions without question; may be surprised at alternative appraisals from others e. Describes personal reactions about performance as insights

[Factors: (a) Quality of Observations, (b) Quality of Self-Assessment, (c) Quality of Background Knowledge, (d) Quality of Critical Analysis, and (e) Articulation of Insights]

Figure 2

Learning to Learn Mathematics *Reflecting on and appreciating your learning*

1. What does the saying "A picture is worth a thousand words" have to do with learning and using mathematics?
2. What is the relationship between reasoning quantitatively and interpreting a graphic?
3. Why is a skeptical approach to graphics (i.e., not automatically assuming they are true/correct) preferable for both the mathematician and scientist?

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Performance criteria are the expectations given before a performance that define the characteristics that make up a high quality performance so that performers know their target and can meet or exceed expectations.

The 1995 *Teaching institute handbook* presented the discipline of Process Education (PE) in terms of its key concepts, context, processes, and tools. Among the list of key concepts, “performance-based learning” was rated even more highly than “knowledge vs. process,” “rate of learning,” or “mentor” (Apple, 1995). Because a performance is by nature a process rather than a product, the concept of performance criteria is distinct from the concept of student learning outcomes which tend to focus on products rather than processes. For this reason, performance criteria differ from the types of criteria often set for product assessments or evaluations; performance criteria set expectations for how the performance itself is carried out rather than for its outcome.

Over the next few years the definition and implications of performance criteria within the context of Process Education expanded, especially with the conception and development of performance measures. The first PE performance measure, a rubric for active listening, emerged as a result of a set of performance criteria developed at Kirkwood Community College. As part of the process of developing this measure, a description of the performance itself was created (Figure 1) and can be found in the Kirkwood Community College Teaching Institute Journal (1997).

These performance criteria were then used for the development of the measure. The relationship between performance criteria and performance measures is illustrated in a learning object available at www.pcrest.com/LO/criteria and shown in Figure 2 (Pacific Crest, 2009).

According to Dan Apple, “Participants at faculty development events generally found the use of performance criteria to be helpful as descriptions of the performances they wanted to see from their students. As illuminating as the proffered performance criteria were, it seemed that the actual creation of performance criteria was a challenging task for many faculty.” The *Curriculum Design Handbook* (Apple 1998) offered a methodology to help faculty write performance criteria for their courses.

The targeted performances of students in a course should support the larger goals of a program; to meet that need, the *Program Assessment Institute Handbook* (Apple & Krumsieg, 2001) offered an outline of how to write performance criteria for a program. This scholarship was advanced and formalized for the *Faculty Guidebook* which contains the modules *Writing Performance Criteria for a Course* (Hinton 2007) and *Writing Performance Criteria for a Program* (Nibert 2007). An important complement to this work is the module *Writing Performance Criteria for Individuals and Teams* (Utschig, 2007; see Figure

Figure 1 Description of Listening (Performance)

Listening is the receiving and decoding of messages from others. Listening includes hearing words and sounds and noticing nonverbal signals to ascertain the meaning that others are trying to convey. It also includes the ability to recall what has been presented. The listener identifies their purpose and tries to understand the sender's purpose. Good listening results in effective feedback to the sender.

Ranked Performance Criteria List

1. Concentration: focusing on the message
2. Comprehension: interpreting meaning accurately
3. Perceptive: understanding sender's nonverbals and hidden meaning
4. Motivation: wanting to learn this new material
5. Background knowledge: relating prior information/theories to this context
6. Classifying: organizing current information into existing framework
7. Targeting: sampling key words and phrases
8. Empathy: willingness to understand underlying issues and others' values
9. Paying attention to details: inventorying important specifics
10. Compare and contrast: using prior knowledge to evaluate and differentiate ideas

Figure 2 Screenshot of the Performance, Criteria, and Measurement Learning Object

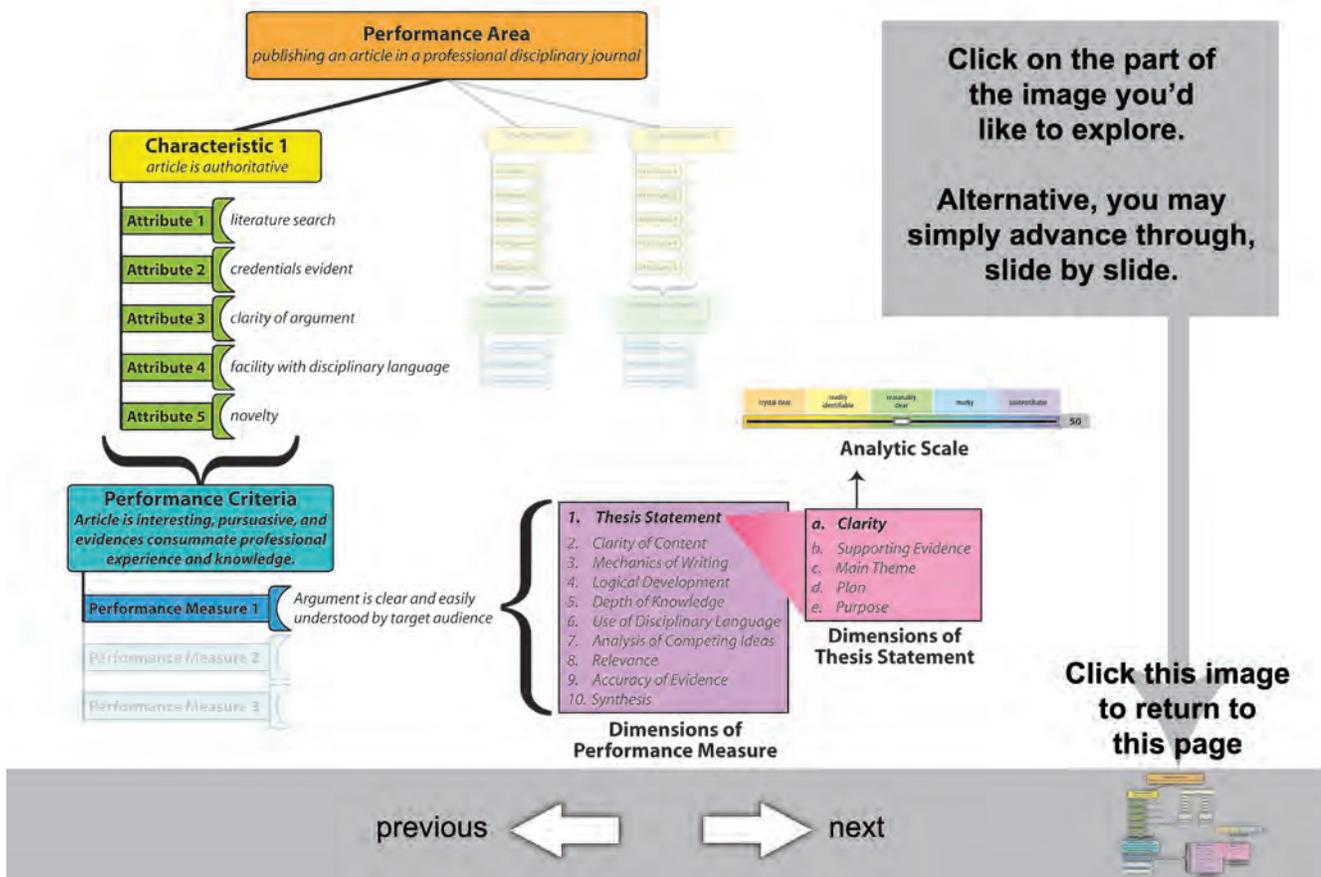


Figure 3 Method for Developing Performance Criteria for Individuals and Groups

1. Identify key stakeholders for the performance.
2. Describe the performance expected by all stakeholders, including the performer(s).
3. Brainstorm to get a list of areas of quality that can be observed within the expected performance.
4. Minimize redundancy and overlap among the areas of quality.
5. Select and describe critical areas of quality that most contribute to the desired performance.
6. Articulate connections among aspects within each area of quality in terms of how they work together to produce the desired outcomes.
7. Develop clear statements of performance by synthesizing the relationships among aspects within each area of quality.
8. Sequence the statements to form a logical set.

3), which led to the publication of sets of performance criteria for individuals in a variety of roles: learning to learn camp facilitator, district superintendent, college president, developmental educator, online educator, and transformational leader in education (Pacific Crest, 2015). Building upon this, the Performance Measures Institute and Workshop offers an activity to help faculty become proficient at drafting performance criteria. This activity uses the Methodology for Developing Performance Criteria shown in Figure 3, as well as the

Writing and Analyzing Performance Criteria Forms, shown in Figure 4.

A recent discovery about the process of writing performance criteria is that using a table to organize information before writing the criteria can make the process clearer and limit the possibility of overlap between characteristics. In Table 1, for example, characteristics representing areas of quality in the performance are represented as labels for each column, and the attributes which contribute to each characteristic are listed in the cells for each column. An

Figure 4 Writing and Analyzing Performance Criteria Forms

Table 1 Characteristics and Attributes for a Sample Performance of “Publishing an Article in a Professional Disciplinary Journal” (see also Figure 2)

Characteristics of the Performance: →	CHARACTERISTIC 1	CHARACTERISTIC 2
		<i>Article is authoritative</i>
Attributes of each characteristic	Literature search conducted	Appropriate length
	Credentials evident	Citations and references included
	Clarity of argument	End notes used and numbered as required
	Facility with disciplinary language	Tables and figures meet publication standards

attribute can only be attached to a single characteristic (i.e. appears in only one column), thus making the performance criteria mutually exclusive and non-overlapping.

There are many aspects of creating and using performance criteria that are worthy of further research and scholarship; chief among them, the resistance of so many to establish and use clear performance criteria. This resistance is seen at the classroom level (with respect to student

performance), at the department level (by tenure and promotion committees), and at the program or college level (in dealing with accreditation organizations and issues). In each case, clear performance criteria tend to clarify expectations and empower performers (students, faculty, schools) with information critical to performing successfully.

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A performance measure is a rubric, either holistic or analytic, that is designed to measure the level of performance in a well-defined performance area by identifying and integrating the factors that contribute most significantly to the performance.

Measuring performance doesn't improve performance; measurement is a neutral activity. But if we are to improve performance through assessment, being able to measure current performance is critical so that we know what aspects of the performance are already strong and in what ways the performance can be improved. Put very simply, performance criteria describe the performance target and performance measures give a reading of current performance level.

The *Knowledge Table for Process Education* (Schlesinger & Apple, 2007) identifies performance measures such as rubrics among the tools that Process Educators use to produce quality in learning, growth, programs, and institutions. While the traditional approach in education has been to develop content competency and regard that as the chief indicator of educational success, the goal in Process Education is to measure and assess real-time performances. This helps both learners and educators to record, appreciate, and potentially reproduce aspects of performance that lead to growth in capacity and improvement in specific performance areas.

An early example of a performance measure was the construction of a rubric for the cognitive skill of listening at a 1997 Teaching Institute that was formally published the following year in the *Teaching institute handbook* (Kirkwood, 1997; Apple & Krumsieg, 1998). Shortly after the 1997 Teaching Institute, a generic measure for the levels of learner performance was published in *Classification of Learning Skills for Educational Enrichment and Assessment* (Apple, 1997).

While it is certainly possible to create and use performance measures for highly complex performances such as designing (Cordon, Beyerlein, & Davis, 2007), one of the goals of Process Education is to improve the performance of **learning** which means that we are primarily focused on defining and measuring aspects of learning (Apple & Ellis, 2015). Fortuitously, learning skills — individual skills that, when improved, lead to improved learning — provide the perfect focus for such definition and performance measurement. Each learning skill can be developed from a low level to the level that individuals or teams exhibit when they excel. For example, the learning skill *attending*, defined in the *Classification of Learning Skills* as mindful focusing by a listener (Leise, Beyerlein, & Apple, 2007), is essential in any classroom but needs to be more advanced in a graduate seminar setting. In such a situation, additional skills such as filtering information, summarizing, making inferences, formulating questions, and analyzing research are all likely to be integrated with and mutually dependent on the skill of attending in order for a learner to maintain his or her connection with the discourse and content. The need to differentiate levels of performance in learning skills led to a five-level holistic rubric for defining levels of learner development in any learning skill (Figure 1). This rubric was added to each of the cognitive, social, and affective domains of learning skills as they are presented in the *Faculty Guidebook* (Beyerlein, Holmes & Apple, 2007).

Over the years, numerous groups of faculty have collaborated with Pacific Crest to create more than 60 performance measures. The majority are **holistic rubrics** (performance characteristics that are integrated into a

Figure 1 Levels of Learner Development in Any Learning Skill

Level 5 Transformative Use	The skill is expanded and integrated with other skills so that it can be applied in new contexts that inspire the emulation of others.
Level 4 Self-Reflective Use	The skill can be self-improved and adapted to unfamiliar contexts with occasional advice from a mentor.
Level 3 Consistent Performance	The skill is routinely called upon and effectively applied in multiple contexts by the user, who consciously directs the effort.
Level 2 Conscious Use	The skill can be used proactively by a learner, but its use needs to be constantly encouraged and supported by a mentor.
Level 1 Non-Conscious Use	The skill appears on a reactive basis in response to an immediate need, but without awareness of self or others.

description), though some are *analytical* (performance characteristics that are presented individually more specific/fine measurement). Eight of the most useful and polished performance measures are published in holistic form in the *Book of Measures* (Pacific Crest, 2013): professionalism, self-assessing, learning, problem solving, critical thinking, teaming, quantitative reasoning, and risk-taking. Pacific Crest shared a methodology for creating performance measures in the *Handbook for Designing and Implementing Performance Measures* (Apple & Krumsieg, 2002; see Figure 2).

The *Faculty Guidebook* (2007) includes modules that share increasing expertise on performance measures:

- *Fundamentals of Rubrics* (Bargainnier, 2007)
- *Performance Levels for Learners and Self-Growers* (Myrvaagnes, 2007)

- *Identifying Performance Measures for a Program* (Parmley & Apple, 2007)
- *Performance Levels for Assessors* (Jensen, 2007)
- *Overview of Measurement* (Burke & Bargainnier, 2007)
- *Constructing a Table of Measures* (Racine, 2007)
- *Measuring Quality in Design* (Cordon, Beyerlein, & Davis, 2007)

In addition to modules explicitly focused on measuring performance, other aspects of the scholarship in the *Faculty Guidebook* support the creation and application of performance measures. The module, *Theory of Performance* (Elger, 2007) offers a comprehensive model of performance, making it possible to analyze and appreciate that the measured level of performance is the result of the interaction of the components of that performance. The

Figure 2 Methodology for Creating Performance Measures

Step	Description
1. Build a team.	Include at least ten individuals from a minimum of seven disciplines including the sciences, applied sciences, social sciences, humanities, professional schools, and performing arts.
2. Identify a facilitator.	The facilitator who facilitates the process must be neutral to any discipline-specific bias.
3. Divide into work teams.	Each team should include three or four persons from varying disciplines.
4. Write a descriptive definition of the skill.	Each team writes a two- or three-sentence description of the specific skill for which the measure is being developed.
5. Synthesize into a descriptive paragraph.	The facilitator leads a session using the sentences from the previous step to create a paragraph that accurately and completely describes the learning skill being measured.
6. Identify a skill expert.	Identify a person who possesses an “expert” level of proficiency with the specific skill. Let the behaviors of this expert serve as a model.
7. Brainstorm factors.	Brainstorm factors which account for variability in the performance with respect to the specific learning skill.
8. Produce a top 10 list.	Reduce the list of brainstormed factors (from the previous step). Produce a new list which contains the top ten factors in rank order of importance. Match or pair up the top 10 items.
9. Identify five qualitative labels.	The labels you choose should correspond to performance levels ranging from “novice” to “expert.”
10. Develop five statements that clarify behaviors.	These statements identify behaviors associated with the different performance levels. Use the criteria and factors identified for Level 5 (expert) first, followed by Level 1 (novice), then Level 3, Level 2, and lastly Level 4.
11. Write parallel statements.	Write parallel statements for each of the five levels of performance. Modify statements according to the appropriateness of behavior for that level.
12. Test the classification levels.	Test by assessing the performance of people at each level in different contexts. Use several assessors to improve quality and help determine which behaviors can be defined in a better way.

import of this theory is that it gives performers a way to break down their performances and improve the individual components. More generally, numerous modules in the *Faculty Guidebook* model the analysis of performance that must occur before performance is measured in order to be assessed or evaluated. The *Faculty Guidebook* also offers multiple rubrics created for and by Process Educators.

One of the core values of the Academy of Process Educators is in the area of performance, using “research-based practices supported by clear criteria and measurable outcomes” (Academy of Process Educators, 2008). An example of research exemplifying this value is found in the article, Measuring Writing as a Representation of Disciplinary Knowledge (Burke, Ouellette, Milner, Leise, & Utschig, *International Journal of Process Education*, 2012). The research team collaborated to design and carry out an empirical study of the reliability and validity of a revised version of the Academy of Process Educators writing rubric, which was published earlier in the *Faculty*

Guidebook as the Analytic Rubric for Writing Quality (Burke & Nancarrow, 2007). The reliability and validity of the rubric were tested using samples of three different types of writing which were rated by four different readers. The results showed some differences in average ratings across raters but showed consistency by each rater, which indicated that the rubric could be used reliably in specific contexts. This seminal performance measurement research provides a model that can be adapted for study of the reliability and validity of other performance measures.

Process Education leads to improved performance on the part of learners and growth in their capacity to perform. As such, the acceptance and recognition of Process Education depends largely on the availability of high-quality performance measures used in a culture that does not balk at measuring performance, but embraces it as a critical part of improving performance. Only then will the magnitude of positive change and growth in learners that Process Education offers be made explicit.

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Professional development offers faculty the opportunity to experience transformational learning by discovering and experiencing, first-hand, the techniques, tools, processes, philosophy, and culture of Process Education. This helps them to elevate their practice, increasing learner success and growth in their own students.

Genesis of the Teaching Institute

Between 1985 and 1992 Pacific Crest held more than 500 workshops to support the use of its problem-solving and modeling software PC:SOLVE; these workshops focused on instructional computing and the design of learning activities (Pacific Crest, 1992). During the course of running these workshops, it became apparent that there was an acute need for engaged and innovative faculty to collaborate and share teaching and learning discoveries with others (Dan Apple, personal recollection). This was the impetus for creating the Problem Solving Across the Curriculum Conference (Kramer & Beery, 1990).

This conference was successful and it triggered animated discussions that lasted well into the night. As a result of this success, Pacific Crest partnered with the SUNY Training Center, IBM ACIS, and the FACT committee to sponsor a teacher workshop series in the spring of 1991, supporting seven different disciplines at six locations across New York State for a total of 42 workshops (SUNY Training Center, 1991). The first Pacific Crest Teaching Institute was held later that summer (Apple, 1991), its content based on lessons learned from hundreds of workshops and discussions with thousands of educators, not least the more than 20 faculty who elected to stay an extra day at the PSAC conference and collaborate on the Learning Process Model (See the **Learning Process Methodology** section).

The Pieces and Patterns

While this was only the first Teaching Institute, as has been noted in other sections of this article, so many of the critical pieces of Process Education were already in place: learning as a process, the Learning Process Model, discovery learning, learning skills, a focus on problem solving, cooperative learning, mentoring, peer coaching, and assessment (Apple, 1991). The goal of the institute is, “to help its participants to be successful change agents to help their college to increase their educational outcomes.” The Teaching Institute also focused on growing both the learning and teaching processes of faculty by having them play the role of learners. As stated in the notes for the Teaching Institute, “To illustrate what education and learning is all about, this session is organized to use (and improve) the processes that we are developing” (Apple, 1991).

The following line from the notes is perhaps more critical, at least from the perspective of a professional development program: “The facilitators are interested in modifying and evolving the teacher institute's curriculum.” This seemingly trivial sentence is actually a commitment not only to teaching the process of assessment, but also to **practicing** it: seeking continual improvement on the basis of research, collaboration, and learning. It is for this reason, more than any other, that the professional development offerings have continued to grow; the growth is based on the synergy between participants, facilitators, and mentors. The more any of us learn, the more we have to share. Every Pacific Crest institute, including the first Teaching Institute in 1991, has sought assessment feedback from participants; the current institute assessment form is available online at: <http://fs20.formsite.com/pacificcrest/form24/> (Pacific Crest, 2015b).

The Structure of the Teaching Institute: Walking the Talk

Because the principles of Process Education, particularly assessment, are consistently modeled with faculty during workshops and Teaching Institutes, assessment-based feedback from participants led to changes in subsequent institutes, with major changes integrated on a yearly basis. Two early pieces of feedback requested 1) breaking the Teaching Institute into daily workshops spread over time, and 2) bringing in faculty who were experts in Process Education who have experienced the Teaching Institute (these are now termed “Teaching Institute mentors”). As a result, during 1994/1995, the Teaching Institute was presented as a flexible four-part series of half-day workshops (Dan Apple, personal recollection). It is worthy of note that each of these “parts” is still present, in some form, in the current Teaching Institute:

- Part 1: An Introduction to Process Education
- Part 2: Designing Process Curricula
- Part 3: Implementing Process Curricula
- Part 4: Modeling Process Education with Students

From 1993 to 2000, the Teaching Institute handbook content and activities expanded:

- 1993: 54 pages (Pacific Crest)

- 1995: 100 pages (Apple)
- 1998: 180 pages (Apple & Krumsieg)
- 2000: 260 pages (Apple & Krumsieg)

Offering Specialized Content: Other Institutes

The 4-part separation of the Teaching Institute shows the ease with which the array of content offered in the Teaching Institute can be parsed out to support more specialized interests. The most popular content from the Teaching Institute tended to be that which related to designing process curricula. Just as many educators were motivated to devise learning activities to support classroom use of PC:SOLVE (see the **Activity Books** section), so too were participants in Process Education workshops and institutes often motivated to create process-oriented curricula. To support these educators, Pacific Crest held its first Curriculum Design Institute in 1995 (Dan Apple, personal recollection).

The first Advanced Teaching Institute was held in 1996 with the goal of expanding the community of research-based practitioners and their expertise. Four years later, the number of professional development institutes offered by Pacific Crest virtually exploded (see Figure 1). The *Teaching institute handbook* was divided into additional stand-alone handbooks to support requested professional development institutes, each with their own specific content and activities. Institutes created in this way include the Program Assessment Institute, the Facilitator’s Institute, and the Interactive Learning Systems Institute. Between 2000 and 2014, 18 new institutes were created, as shown in Figure 1.

From Handbooks to the *Faculty Guidebook*

As with the notes for the Teaching Institute (Apple, 1991), each time a professional development institute

was designed, a handbook was also created to fully support institute participants. Beginning in 2002, Approximately 70 members of the Academy of Process Educators collaborated to elevate the content available in the institute handbooks to the level of scholarship, and published modules 2 or 4 pages in length and collected in annual editions of the *Faculty Guidebook* (Beyerlein, Holmes, & Apple, 2007). The *Faculty Guidebook* thus represents a minimum of 16 years of Process Education scholarship and professional development experience and is now a resource used to continually upgrade institute and workshop handbooks.

A Formal Program Design

In 2008, after the completion of the 4th (and current) edition of the *Faculty Guidebook*, Pacific Crest held an Instructional Design Institute under the leadership of Steve Beyerlein, Carol Holmes, and Dan Apple. During this institute, nearly 40 members of the Academy of Process Educators participated and collaborated in designing the Pacific Crest Faculty Development Program. The newly published modules, *Methodology for Program Design* (Davis, 2007) and *Profile of a Quality Faculty Member* (Collins & Apple, 2007) were critical tools used during this process, especially when it came to determining and defining the key performance areas that the Professional Development Program would support. The final areas selected are shown in Figure 2. Since its completion, the Faculty Development Program Design document has been available on the Pacific Crest web site: http://www.pcrest.com/program/prog_design.pdf (Pacific Crest, 2008a). Figure 3 shows an excerpt from the program design document which shows how different institutes map to the performance areas.

Once the program itself was designed, the group was divided into ten teams, each responsible for using the *Methodology for Course Design* (Davis, 2007) to redesign

Figure 1 Timeline of the Pacific Crest Professional Development Program (dark lines represent a division of content and creation of a new institute from that content)

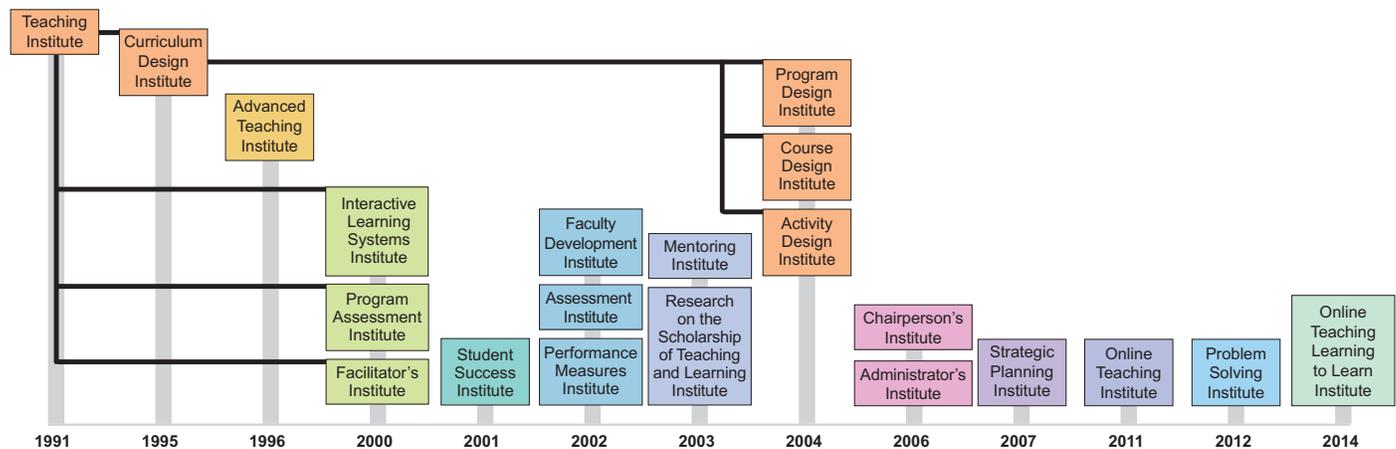


Figure 2 Key Performance Areas in the Pacific Crest Professional Development Program

Assessor Focuses on the assessee's needs; collaboratively designs an assessment process; stays focused on the chosen design through careful observation; analyzes the data for meaning; uses interactive feedback to solidify strengths; offers clear action plans; shares insights to produce significant understanding without being judgmental.

Collaborator Values the synergy of relationships and teams; plays a variety of roles effectively while helping others perform their roles effectively; compromises self for the betterment of all.

Designer Clearly defines desired results; creates precise dimensional learning outcomes; defines the activities and processes used to produce the results; identifies ways to embed assessment in order to increase quality; produces an evaluation system to assure desired results.

Evaluator Knows where value is essential; designs the appropriate times for determining whether or not value is being produced by setting clear expectations and standards; uses unbiased judgments to reward performance.

Facilitator Inventories and monitors collective needs; helps synthesize a clear set of outcomes; focuses on process rather than content; shares ownership in making decisions; and constantly strives for improved quality by strengthening the process.

Innovator Is willing to take the risk of trying new perspectives, approaches, and ways of working in order to improve educational outcomes; not only accepts that willingness to change is a key component of growth, but also embraces the idea that creativity and experimentation are positive attributes for both learners and educators.

Leader Cultivates a clear vision of a desired future and ably shares through understandable stories; develops plans others can follow and models behavior for others while conveying belief in their ability and helping them succeed in realizing this vision.

Learner Constantly seeks additional knowledge by systematically using professional development plans; leverages experts and resources; assesses his or her own learning performance; and validates his or her own learning.

Measurer Identifies critical qualities; creates performance criteria; identifies best items to measure; effectively times when and how to measure with appropriate accuracy and precision.

Mentor Enters into a defined relationship with respect for the potential of the mentee; plays the role of coach and advisor by helping establish the mentee's personal goals; identifies activities and means to grow performance to achieve the desired results within a specific time period.

Planner Identifies the people, resources, and organizational studies required to produce desired outcomes; aligns resources to support activities in pursuit of chosen outcomes; understands the importance of sequencing and timelines; appreciates the nature of explicit milestones and measurements.

Problem Solver Ably identifies and defines problems frequently not seen by others; identifies issues and clarifies assumptions necessary to solve the problem; and effectively closes the gap between expectations and reality by using previous solutions to build upon past successes.

Researcher Identifies and states quality research questions by operating from a consistent inquiry mindset; uses appropriate methods; effectively articulates findings to a community of scholars.

Teacher Uses a learner-centered approach to help learners prepare learning plans; cultivates productive learning communities; bonds with learners; and helps learners meet their intended outcomes through the use of embedded assessment.

one of the 10 most popular institutes. As with the program design document, the course design document for the Teaching Institute is available online: http://www.pcrest.com/program/CD_TI.pdf (Pacific Crest, 2008b).

Organization of the Professional Development Program

Prior to program design work, available institutes had been organized into six general areas of performance: teaching, instructional design, student success, technology, assessment, and institutional effectiveness (Pacific

Crest, 2007). That changed with work on the current edition of the *Faculty Guidebook*. Based on the model of the Compass of Higher Education (see the **Culture of Success** section), the 4th edition of the *Faculty Guidebook* was organized into sections representing the roles viewed as primary for educators in an enriched learning environment (see Figure 4).

Because professional development institutes continually push the scholarship of Process Education even as PE scholarship enriches available institutes (as well leading to new institutes and workshops), the institutes offered by

Figure 3 Mapping Between Institutes and Performance Areas

Institute	Area 1	Area 2	Area 3
Activity Design Institute	Designer	Planner	Problem Solver
Advanced Teaching Institute	Learner	Teacher	Researcher
Assessment Institute	Assessor	Measurer	Evaluator
Chairperson's Institute	Leader	Collaborator	Facilitator
Change Projects Institute	Innovator	Planner	Leader
Course Design Institute	Designer	Planner	Evaluator
Facilitator's Institute	Facilitator	Innovator	Planner
Faculty Development Institute	Innovator	Planner	Leader
Leadership Institute	Leader	Facilitator	Problem Solver
Learning to Learn Camp	Mentor	Assessor	Facilitator
Mentoring Institute	Mentor	Facilitator	Assessor
Performance Measures Institute	Measurer	Researcher	Evaluator
Program Assessment Institute	Measurer	Designer	Assessor
Program Design Institute	Designer	Collaborator	Problem Solver
Research on SoTL Institute	Researcher	Innovator	Collaborator
Strategic Planning Institute	Planner	Collaborator	Problem Solver
Student Success Institute	Mentor	Innovator	Teacher
Teaching Institute	Teacher	Learner	Collaborator

Figure 4 Primary Roles of Educators in an Enriched Learning Environment



(Rather than being a section of the *Guidebook*, the area of Professional Development is represented by the totality of scholarship in the *Faculty Guidebook*.)

Figure 5 Interest and Focus Selector (excerpted; the other four areas are also listed in the catalog)

I am interested in achieving empowerment (organizational effectiveness, faculty excellence, and improved student learning) through:

_____ *focusing on the construction of knowledge (information, understanding, application, working expertise, research) within the educational system*

Key processes: teaching, problem-solving, designing, planning, researching, learning

Institutes designed to meet your needs and interests:

- Teaching Institute, Course Design Institute, Activity Design Institute, Research on the Scholarship of Teaching and Learning Institute



Pacific Crest were broadly organized into the same five developmental areas/roles for faculty. Bringing the five roles of faculty (which are also the developmental areas of Process Education) together with the key performance areas identified in the program design allowed for full alignment between the scholarship of Process Education and the organization and categorization of the wide selection of available professional development institutes.

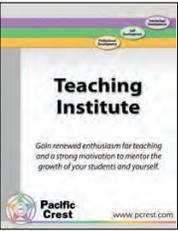
The *Faculty Development Catalog* (Pacific Crest, 2015a) “Interest and Focus” selector demonstrates this alignment and its potential for targeting and effectively meeting the developmental needs and interests of faculty. An excerpt is shown in Figure 5.

The individual institute listing within the *Faculty Development Catalog* (Pacific Crest, 2015a) also pulls the design, organization, and scholarship together, offering the

following information for each institute listed (a sample page is shown in Figure 6):

- Title
- Developmental Focus
- Length
- Overview
- Handbook Cover Image (the handbook covers are color-coded after the Compass of Higher Education so that developmental areas can be quickly seen and recognized; in this case, the Teaching Institute most supports professional, self, and intellectual development)
- Outcomes
- Sample Agenda/Institute Activities
- Performance Area

Figure 6 Teaching Institute Listing Entry from the Faculty Development Catalog

	DEVELOPMENTAL FOCUS	LENGTH
	<i>Professional, Intellectual, Self</i>	<i>3 days</i>
<p>A Teaching Institute is our foundational faculty development event. This event offers institutions or individuals interested in converting from a traditionally-oriented classroom to one that is learner and learning-centered a base for further growth and development. Attendees actively participate in a learning community that mirrors a Process Education classroom. Participants leave with renewed enthusiasm for teaching and a strong motivation to mentor the growth of their students and themselves.</p>		
<p>During a Teaching Institute, participants observe and learn the professional practices of a process educator from the perspective of a student. They experience what it feels like to analyze, learn, and apply new material. At the same time, participants are asked to routinely reflect on what it is like to be a learner in this environment. How easily does understanding come? What does it feel like to be a student in this situation? What would I do if I were a teacher in this situation? Often when teachers learn new content, they can do so without having to reflect on their own learning processes. Similarly, when teachers practice a new teaching technique, they often practice it using material with which they are comfortable. This event uses challenging content that requires participants to cognitively explore the learning process as well as the affective issues associated with learning.</p>		
OUTCOMES		
<ul style="list-style-type: none"> • Each participant experiences learning within a team environment by contributing to the achievement of a set of team learning outcomes • A wide variety of techniques and tools for teaching and student learning are used during the institute. Participants act as researchers, deciding which strategies, tools and techniques might work well (or not) in their particular learning environments. • Participants value the importance of self-assessment in the growth process and identify ways to make better use of specific assessment tools with students and themselves • Participants develop an understanding of an instructional design process that supports active learning, critical thinking, and assessment 		
SAMPLE AGENDA (INSTITUTE ACTIVITIES)		
Day 1	Welcoming and Introductions, Preparing for the Teaching Institute, Overview of Process Education, Constructing Team Objectives, Teaching the Reading Methodology, Levels of Knowledge, Forms of Knowledge (optional), Exploring the Learning Process Methodology, Engaging Learners in a Quality Learning Environment, Inventory of Learning and Teaching Tools	
Day 2	Team Reflection, Overview of Assessment (optional), Comparing Assessment and Evaluation, Facilitation Planning, Modeling a Process Education Classroom, Modeling a Problem Solving Session (alternative activity), Midterm Assessment	
Day 3	Team Meeting, Overview of Course Design, Creating a Syllabus, Analyzing an Activity Design, Creating an Activity (alternate activity), Professional Planning, Assessment of Institute	
PERFORMANCE AREAS		
Assessor Learner	Collaborator Measurer	Designer Mentor
	Evaluator Planner	Facilitator Problem Solver
	Innovator Researcher	Leader Teacher

Institutes Offered and Held

Table 1 provides an annual inventory of institutes and workshops facilitated by Pacific Crest. Contained in the table is the year a new institute was introduced, the number of times that institute has been facilitated, and the number of workshops held each year (Pacific Crest internal company records).

Just as the Teaching Institute and Curriculum Design Handbooks (Apple & Krumsieg, 2001) were divided

to support more specialized institutes, so too can any of the existing handbooks be used to support customized institutes or workshops. Figure 7 offers a listing of some of the more specialized or customized workshops offered over the years (Pacific Crest, 2015a). This list is not comprehensive; the nature of Pacific Crest's Professional Development Program and commitment to ongoing improvement through assessment and scholarly collaboration ensures that as more is learned, more is available to be shared.

Figure 7 Listing of Specialized/Customized Workshops

Developing Student Learning Skills	
Understanding the Learning Process	Teaching a Quality Reading Process
The Role of Critical Thinking in Learning	The Role of Information Processing in Learning
Improving Student Self-Assessment Skills	The Role of Language Development in Learning
Teaching Problem Solving (process and skills)	Identifying Process Learning Skills for an Activity
Developing Quality Curricula	
Creating a Knowledge Map	Designing a Guided Discovery Activity
Creating a Methodology for a Process	Identifying Learning Skills for an Activity
Designing Quality Performance Criteria	Peer Assessing the Quality of an Activity
Building Quality Concept Models	
Designing a Quality Course	
Creating Measurable Outcomes	Effectively Use of a Learning Assessment Journal
Designing a Course Assessment System	Creating a Profile for Long-Term Behaviors
Designing a Course Evaluation System	How to Increase Levels of Knowledge
Designing a Quality Syllabus	Peer Assessing the Quality of an Activity
Facilitating Institutional Change	
Designing an Annual Review Process	Creating a Teacher Portfolio System
Creating an Operational Plan	Facilitating an Educational Focus Group Session
Learning to Do Action Research	
Assessment	
Effectively Using Assessment Tools	Annual Self-study and Assessment (all levels)
Assessing Assessments with Quality	Improving Students Self-Assessment Skills
Effective Placement through Assessing	
Active Learning/Process Education	
Becoming a High Quality Teacher	Designing an Effective Peer Coaching System
Creating a Productive Learning Environment	Designing a Facilitation Plan
Modeling a Process Education Classroom	Effectively Using Cooperative Learning
Constructive Intervention Techniques	
Using a Learning Assessment Journal	

Table 1 Annual Inventory of Institutes and Workshops Facilitated by Pacific Crest

Event	YEAR																								
	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Teaching Institute	1	4	6	7	7	14	21	16	17	11	7	6	3	4	4	6	4	7	5	5	5	8	1	2	
Advanced Teaching Institute						1	1	1	3	1	2	1	1	1			1		1		1	1			
Curriculum Design					1	2	3	3	5	4				1											
Learning to Learn Camp						1	1	2	1	3	2			2	1	2	1	0	4	2	4	5	4	3	5
Program Assessment										1	5	10	2	2	3		2	1			1		1		
Interactive Learning Systems										3	2	3	2	1		1	1		1						
Facilitator's Institute									1		1	1			1	2	2	2	1				1		
Student Success											1		1			1	3	2	1	1	3	6	4	0	2
Assessment												1	1	1	1	2	2	3		3					
Faculty Development											1	1		1							1				
Performance Measures												1													
Scholarship of Teaching & Learning													2		2	1			1						
Mentoring													1	1					1						
Activity Design														1		1		1	1						1
Course Design														1		2	4			1	1	2	1		
Chairperson																1									
Administrator																1	1								
Change Projects																	2								
Strategic Planning																	4	1							
Online Teaching Institute																				1			2	4	
Problem Solving																						1	1		
Total Institutes	1	4	6	7	8	21	29	25	27	26	21	27	12	16	11	19	27	19	18	12	17	25	13	7	12
Total Workshops (1-day)					42	5	7	2	4	5	10	18	8	12	6	2	3	6	2	10	16	9	6	7	5

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Facilitation transforms the traditional roles and responsibilities of student and educator such that educators become facilitators of learning experiences where students are learners who take ownership of and responsibility for their learning.

Facilitation in Process Education

With the focus on active learning starting in the early 1990s, *Education as a Process* (Apple & Hurley-Lawrence, 1994) argued that education could be facilitated as a process with faculty taking the role of “facilitators rather than providers of information.” As the interest in and popularity of active learning grew, it became increasingly necessary to redefine *teaching* as the facilitation of learning and *mentoring* as the facilitation of growth. These processes were modeled in the Concept Map of Process Education (Duncan-Hewitt, 1995). As the *Primer for Process Education* (Apple & Duncan-Hewitt, 1995) explains,

The main goal is to empower students to become lifelong learners, both capable and eager to learn new concepts on their own. Educators become facilitators of the learning process assessing students' performance in real time to help their growth in the use of these processes.

The prominence of facilitation within Process Education was made clear in the 1995 *Teaching institute handbook* (Apple), in which the Knowledge Table for Process Ed-

ucation lists facilitation as one of the key PE processes along with assessment, constructive intervention, learning, personal development, faculty development, teamwork, management, and curriculum design.

As a direct result of workshops conducted at Stony Brook University, two major PE books were published: *An Instructor's Guide to Process Workshops* (Hanson, 1996) and *Improving the Teaching/Learning Process in General Chemistry* (Hanson & Wolfskill, 1998). Both focused on the facilitation of active learning and targeted the development of key processes.

In the 1998 *Teaching institute handbook* (Apple & Krumsieg), the facilitation section was expanded to include what had been learned through workshops, including an overview of facilitation, a facilitation methodology (Figure 1), facilitation tools, and the criteria for a quality facilitator.

The 2000 *Teaching institute handbook* (Apple & Krumsieg), provided even more information and additional tools for faculty-as-facilitators: a process map for facilitation, an outline of facilitator responsibilities, tips for facili-

Figure 1 Facilitation Methodology

1. Define the outcomes of an activity.
2. Design, review, and prepare for an activity.
3. Decide which teaching/learning processes and tools are appropriate for each activity including the roles for the learners.
4. Pre-assess before an activity. Assess the level of students' preparation.
5. Set up the activity. Make sure students have the why, learning objectives, performance criteria, resources, and general tasks for an activity. Performance criteria should be set in terms of both process and content.
6. Release the teams to pursue the activity.
7. Assess team and individual performances.
8. Provide constructive interventions based on process not content.
9. Bring all the teams back together at the conclusion of the activity.
10. Provide closure with inter-group sharing of performance. Share quality performances that others can benefit from and areas where performance needs improvement.
11. Use various forms of assessment to provide feedback to students. Make regular use of oral reflector's reports.
12. Follow up after class.

tation, insights on facilitation, and the factors influencing the quality of facilitation. That same year, Pacific Crest held its first Facilitator's Institute, supported with the *Facilitator's Institute Handbook* (Apple & Krumsieg, 2001). This standalone handbook offered a collection of all the facilitation expertise from the Teaching Institute handbooks but also included information on creating a facilitation plan, how to peer coach an individual's facilitation session, and a profile of a quality facilitator.

The scholarship and learning to this point was gathered and expanded upon during the *Faculty Guidebook* project, leading to the publication of numerous modules (all 2007):

- *Overview of Facilitation* (Smith)
- *Profile of a Quality Facilitator* (Smith)
- *Facilitation Methodology* (Smith & Apple)
- *Identifying Learner Needs* (Minderhout)
- *Constructive Intervention* (Leise & Smith)
- *Constructive Intervention Techniques* (Smith & Leise)
- *Facilitation Tools* (Minderhout & Smith)
- *Creating a Facilitation Plan* (Minderhout)
- *Annotated Bibliography — Facilitation* (Smith)

Shifting and Transforming Practice: Educator to Facilitator

In *Taking the Helm* (1996) Klopp elaborates on the differences in practice and dynamics between a faculty member as instructor and a faculty member as facilitator. She also speaks directly to the not inconsiderable risk faculty may face when shifting practice from educator (as “sage on the stage”) to facilitator (as “guide on the side”):

It is a risk to change the way we teach because that implies that how we have taught in the past needed to be changed for some reason. That, in turn, challenges the worth of many years, even decades, of teaching practices. It also challenges our need for control. Going from a teacher-centered classroom to a student-centered classroom means sharing the "power," sometimes even giving over the power almost completely (as in collaborative learning), and we may be very uncomfortable about losing that control.

While the change in practice is something Process Education has encouraged from the first call to shift ownership of the learning process to the student (Apple, 1991), the extent to which the change could be viewed as a risk was not fully appreciated until the work on The

Table 1 Aspects of the Transformation of Education Related to Facilitation

Aspect	Traditional Practice Characteristics	Transformed Practice Characteristics
Control	Faculty-Centered <i>Has the mindset of an expert. Is concerned with instructional efficiency. Asks, "Have I covered the syllabus?" Values dictation over facilitation.</i>	Learner-Centered <i>Believes learner engagement is critical for learning success. Concerned with instructional effectiveness. Views self as a facilitator of learning who creates independent learners. Asks, "Have I helped my students achieve the learning objectives?" Designs course/teaching to respond to student needs. Values facilitation over dictation.</i>
Delivery	Presentation <i>Prefers a lecture format and dissemination of information. Believes that students/learners are empty vessels or blank slates, and that they should passively and meekly absorb knowledge. "Sage on the stage"</i>	Active Learning <i>Believes that curiosity motivates learning and that discovery is education. Sees the educator as a facilitator or "guide on the side." Believes that students should actively learn by doing.</i>
Ownership	Directed <i>Believes that learners require prompting and monitoring in order to initiate and persist. Assumes extrinsic motivation is best/necessary. Micro-manages (not allowing others to demonstrate ownership). Assumes that students are passive (refuse to demonstrate ownership).</i>	Self-Directed <i>Knows that students can demonstrate initiative and persistence without prompting. Believes students can learn to self-monitor and self-regulate. Works to help students become self-growers who are intrinsically motivated to learn.</i>

Transformation of Education (Hintze, Beyerlein, Apple, & Holmes, 2011). Through its lens, we see that shifting practice from educator to facilitator goes deeper than merely changing practice or doing things differently, as Klopp so eloquently noted; it may well be at the heart of the way of being for an educator, involving **transforming** no fewer than three aspects of the educational context and dynamic: control, delivery, and ownership (see Table 1).

Advancing and Supporting Facilitation

There are several ways to support faculty who are willing to step into the role of facilitator. The Transformation of Education offers tips for transforming practice (from educator to facilitator) and Klopp notes that faculty can encourage and support one another in shifting practice (1996). An additional strategy is the use of facilitation plans and facilitator guides. These support the shift not only to facilitation, but to the development of facilitators who are already comfortable in their role. While it is assumed that many facilitators will want to draw up their own facilitation plans (Minderhout, 2007a), Pacific Crest has found that there is much benefit in providing additional support to facilitators in the form of facilitator guides. The first facilitator guide was created with the help of Baker College to support their newly designed math course, taught mostly by adjunct instructors (Baker

College, 2003). Since then many additional facilitator guides have been created, perhaps most notably the *Instructor's Guide to Process-Oriented Guided-Inquiry Learning* (Hanson, 2006) and the *Learning to Learn Camp Facilitator's Guide: Training the Trainer* (Pacific Crest, 2013); see Figure 2.

Pacific Crest has created facilitator guides for a variety of curricula with the help of invaluable facilitator feedback. One example of high-quality curricula-based facilitator support that is well worth examining is *Learning to Learn: Becoming a Self-Grower Facilitation Guide* (Pacific Crest, 2014) (Figure 3).

We have found that the Facilitator's Institute provides an exceptionally useful environment when it comes to advancing the practice of facilitation so that it leads to transformational learning in the classroom. A wide variety of topics and challenges are addressed at a Facilitator's Institute (see Figure 4), giving faculty an opportunity to practice and improve their facilitation skills (Apple & Krumsieg, 2001).

Faculty who are comfortable meeting these challenges are empowered as facilitators and are able to successfully transfer ownership of the learning process to students, working to help them become intrinsically motivated to learn and grow.

Figure 2 Sample Facilitator Guides (*Learning to Learn Camp Facilitator's Guide: Training the Trainer* and *Instructor's Guide to Process Oriented Guided Inquiry Learning*)

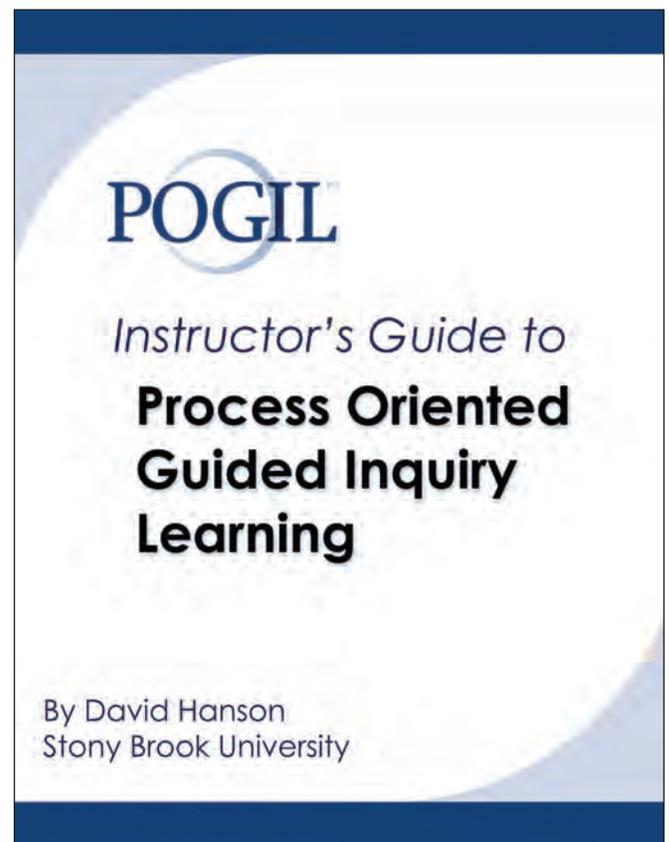
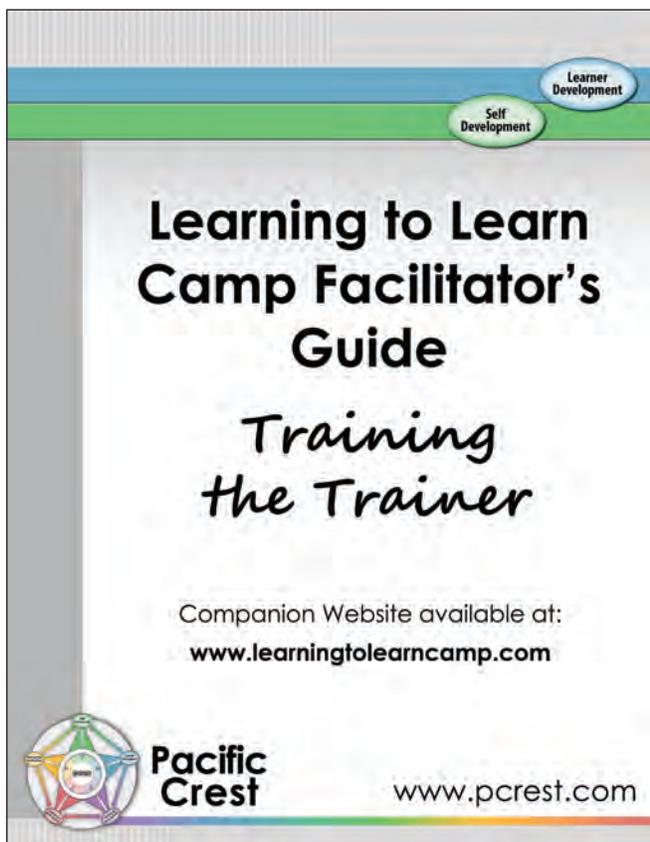


Figure 3 Contents of *Learning to Learn: Becoming a Self-Grower Facilitation Guide*

Section 1: Instructor Orientation and Introduction

Overview	About the Facilitation Plans	Pitfalls on the Road to Success
Long-Term Behaviors	Resources	Professional Development
Learning Outcomes	Creating a Learning Environment	Ten Best Practices 6 Teaching Techniques
Experience Design	Profile of a Quality Learner	

Section 2: Facilitation Plans

This section contains full facilitation plans for all 15 experiences in the book plus the two supplemental online experiences. Each facilitation plan contains the following components:

Experience Outcomes	What students who complete the experience will be able to do or demonstrate knowing
On My Own (<i>This is the work that students do before class: reading, an exploration activity, and questions to answer. The in-class activity builds upon this learning.</i>)	
Instructor Preparation	Readings to read, tools to practice with, questions to think about, quizzes to attempt <i>Notes on Preparation</i> (for facilitator notes)
In My Class (<i>This in-class learning is active and collaborative. It builds on what students learned on their own and prepares them for the post-class part of the experience.</i>)	
Assess Readiness (and time allotted)	Suggested tasks and strategies
Activity Tools & Supplies	List of tools, forms, reports and where they're found in the text
Team Roles	Recommended team roles that should be used for the in-class activity
Class Experience & Group Work (and time allotted)	Recommended tasks and strategies for facilitating the activity
Assessment points	Aspects of student performance that can be assessed as they complete the activity, including questions to ask of them.
<i>Notes on Class Experience & Group Work</i> (for facilitator notes)	
Closure (and time allotted)	<i>Notes on Closure</i> (for facilitator notes)
My Learning & Growth (<i>In this portion of the experience, students practice and apply what they've learned before and in class.</i>)	
Reconciliation & Data	What evidence demonstrates that outcomes were met? Use data from group work to document. Instructor Assessment of Class Period
Answer Keys	
<ul style="list-style-type: none"> • Exploration Questions (Sample high-quality student answers are provided, along with the criteria that answers should meet, such as "Student answers need to include similarities and differences between reading for enjoyment and reading for school.") • Critical Thinking Questions (Sample high-quality student answers are provided, along with the criteria that answers should meet.) • Reading Quiz answers • Blank Reading Quiz 	

Figure 4 Topics Addressed During a Facilitator's Institute

- Valuing characteristics of a quality facilitator
- Establishing clear outcomes for an event
- Pre-assessing participant expertise and needs
- Identifying and solving key problems/issues
- Designing work groups
- Facilitating discussions
- Learning how to ask questions
- Using a Facilitation Methodology
- Handling facilitators' worst nightmares
- Facilitating a group from a failure
- Challenging performance
- Achieving closure
- Using real-time reflection within a process
- Facilitating change in a culture
- Facilitating a hostile group
- Addressing the needs of a group of skeptics
- Rephrasing effectively
- Taking feedback non-defensively
- Managing/leading mentors and co-facilitators

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Mentors facilitate learner growth and development by challenging performance through a variety of constructive intervention techniques. Equally as important, a mentor assesses not only performance, but a learner's own self-assessments. This helps the learner become increasingly able to self-mentor, facilitating his or her own growth.

The concept of mentoring as the **facilitation of growth** was first articulated in *Introduction to Problem Solving Using PC:SOLVE* (Apple, 1990) in which the primary focus was helping students improve their ability to solve problems. This definition was expanded in *Learning through Problem Solving* (Apple, Beyerlein & Schlesinger, 1992) to include mentor interventions intended to improve "Skills for Life." In 1995 a concept map of mentoring was developed which framed systematic and purposeful interventions as the means by which learner growth is facilitated (Duncan-Hewitt).

Learning to Learn Camps have always recruited faculty members to be coaches (mentors) of learning teams (Pacific Crest, 2015). As described for the Learning to Learn Camp at St. Augustine College, special sessions before and during the camp are organized to train these

mentors (Knowles, 1995). The mentoring experiences of the Learning to Learn Camps informed the model of mentoring and led to a strengthened version, published as the Process Map for Mentoring (Duncan-Hewitt, 1999; see Figure 1).

This model was expanded in the *Teaching institute handbook* (Apple & Krumsieg, 2000) and included the following:

- Definition of mentoring
- Mentoring process
- Mentoring methodology
- Characteristics of a quality mentor
- Insights on effective mentoring

Figure 1 Process Map for Mentoring

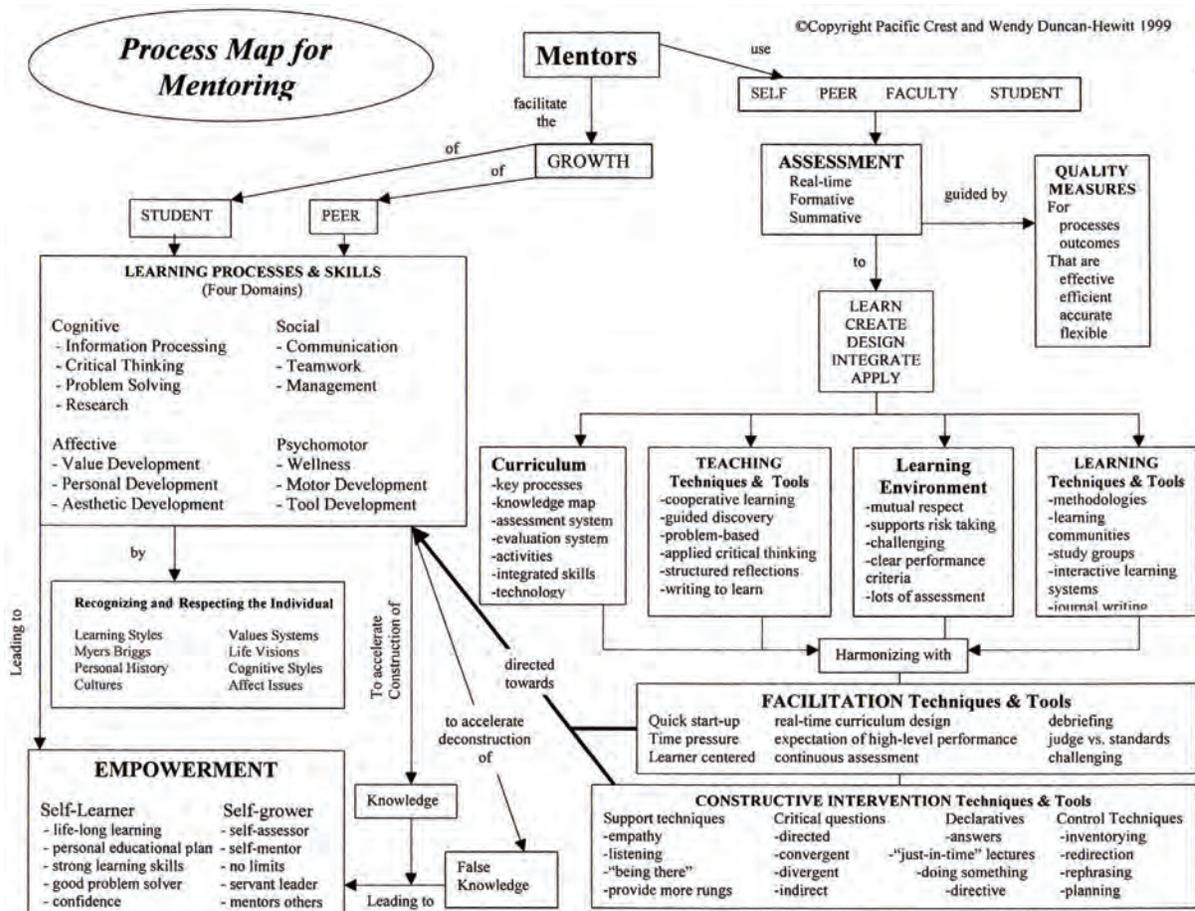


Figure 2 The Mentoring Methodology

Relationship Phase	Step
Establishing	1. A need for mentoring is recognized by the mentee.
	2. The mentee selects an appropriate mentor.
	3. The mentor clarifies goals with the mentee.
	4. The mentor and mentee put together a quality plan.
	5. Both mentor and mentee make a commitment to follow through with the plan.
	6. The mentor and mentee design an assessment plan.
Maintenance	7. The mentor and mentee implement the plan (including the assessment plan).
	8. The mentor monitors the progress of the mentee, providing appropriate support & challenge.
	9. The mentee and mentor celebrate growth at key points.
	10. The mentor and mentee celebrate final success.
Closure	11. The relationship between the mentor and mentee is changed.

The *Student Success Institute Handbook* (Apple, 2001) supplied additional mentoring resources that highlighted the critical role mentoring plays in increasing student success. These included the profile of a quality mentor and an improved mentoring methodology (see Figure 2).

The first stand-alone *Mentoring Handbook* was a direct result of collaboration between faculty at the University of Idaho and Pacific Crest. In 2003, the University of Idaho received a 3-year National Science Foundation grant to create an enriched learning environment (ELE) model for the college of engineering. A second goal of this larger project was to create a mentor training program, organized in tiers, for undergraduate engineering majors (University of Idaho, 2002). Many of the faculty involved in the ELE project attended a Pacific Crest Mentoring Workshop held in August 2003 that shared the resources that were currently available. As a result of the assembled expertise and passion, a *Mentoring Handbook* was produced for internal use at the University of Idaho and within Pacific Crest’s mentoring institutes (Pacific Crest, 2003).

Mentoring and the Faculty Guidebook

Steve Beyerlein, organizer of the Mentoring Workshop and professor of mechanical engineering at the University of Idaho, was the project director for the first edition of the *Faculty Guidebook*. Beyerlein describes the *Guidebook*, as “a resource for faculty members in any discipline who wish to improve their classroom performance, mentor junior colleagues, and foster graduate student mentoring” (University of Idaho, 2004). The emphasis placed on

mentoring is no coincidence; no fewer than 10 modules in the current *Faculty Guidebook* speak directly to the role of mentor and the process of mentoring. Perhaps the most important is the *Profile of a Quality Faculty Member* (Collins & Apple, 2007), which sets the expectation that a critical role of a high-quality faculty member is that of a **mentor** who should meet the following criteria:

- Challenges mentees to define their own learning objectives, performance expectations, and action plans so that they can realize their personal and professional development outcomes
- Consistently models the behaviors and values of his or her own discipline
- Employs timely, effective interventions related to learning skills that stimulate growth in mentee performance

Modules that speak to mentoring in general include:

- *Overview of Mentoring* (Leise, 2007b)
- *Annotated Bibliography — Mentoring* (Harms, 2007a)

Mentoring and its relationship with growth and personal development:

- *Annual Professional Growth Plan* (Hurd, 2007a)
- *Self-Growth Plans for Faculty Members* (Hurd, 2007b)
- *Becoming a Self-Grower* (Leise, 2007a)

Table 1

On My Own (<i>This is the work that students do before class.</i>)
<p>Discovery Exercise: Analyze the impact that people other than parents have had on the student’s growth and development (use a Mentoring Gifts Worksheet)</p> <p>Exploration Questions: about the characteristics of mentors, their roles, and motivation</p> <p>Readings:</p> <ul style="list-style-type: none"> • Overview of Mentoring (excerpted from the <i>Faculty Guidebook</i> module) • More on Mentoring • Key Concepts • Mentoring Methodology • Performance Levels for Mentoring
In My Class (<i>This in-class learning is active and collaborative.</i>)
<p>Students do the following:</p> <ul style="list-style-type: none"> • Share stories of mentors they’ve had from On My Own • Perform an analysis of a Mentoring Case Study • Answer Critical Thinking Questions about the steps in the mentoring process, the role of self-assessment in the mentoring process, how to make sure that commitment is shared between mentor and mentee, etc.
My Learning & Growth (<i>After class students practice and apply what they’ve learned.</i>)
<p>Preparation</p> <ol style="list-style-type: none"> 1. Assess a transformational (powerfully positive) mentoring relationship in which the mentee was either yourself or someone you know and with whom you can speak about the mentoring experience. Use the Mentoring Scoring and Assessment worksheet to record and assess that experience. 2. Assess a mentoring relationship that was not effective in which the mentee was either yourself or someone you know and with whom you can speak about the mentoring experience. Use the Mentoring Scoring and Assessment worksheet to record and assess that experience. <p>Challenge: Establish two powerful mentoring relationships for the next three to six months using the Mentoring Agreement and Mentoring Planning worksheet.</p> <p>My Life Vision: Prompt to write about friends who have had a positive mentor-type influence on the student.</p>

- *Personal Development Methodology* (Leise, 2007c)
- Mentoring and its relationship with assessment:
- *Assessing Assessments* (Anderson & Watson, 2007)
- Mentoring as coaching:
- *Peer Coaching* (Cordon, 2007)
 - *Life Coaching: The Heart of Advising* (Harms, 2007b)
- Mentoring and constructive intervention:
- *Accelerator Model* (Morgan & Apple, 2007)
 - *Constructive Intervention* (Leise & Smith, 2007)
 - *Constructive Intervention Techniques* (Smith & Leise, 2007)
- The current *Mentoring Institute Handbook* (Apple, 2009) integrated all of these resources into a single professional development handbook, which also includes a number of activities to help faculty appreciate and become comfortable in the role of mentor. These activities include:
- What Makes Mentoring Relationships Special?
 - Speed Mentoring
 - Boundaries of a Mentoring Relationship
 - Personal Development and Mentoring
 - Mentor Self-Assessment
 - Tough Love
 - Constructive Intervention
 - Mentoring with a Vision
 - Celebrating Success
 - Structured Reflection: Ready to Mentor

Mentoring in Student Curricula

While the vast majority of mentoring resources are written for and offered to faculty, the student resource, *Learning to Learn: Becoming a Self-Grower* (Apple, Morgan, & Hintze, 2013), contains an exercise entitled, “Choosing and Using Mentors Effectively.” This is because lack of mentoring is a major risk factor for academic success. As Horton (2015) explains,

Mentoring is critical for at-risk students, particularly those who (a) come from low income families, (b) are first-generation college students, (c) are members of minority groups, particularly Latinos and African-Americans, and (d) are confronted with life circumstances that create barriers to their success. McGlynn researched the lives of children who had multiple barriers to overcome in order to achieve success. She found that children who were “resilient” (having beaten all the odds against them) had people in their lives that took them under their wings and nurtured them.

Choosing and Using Mentors Effectively is an attempt to address this risk factor by helping students appreciate

the difference a mentor can make, think through how to work with a mentor, and then identify a mentor to begin working with. This learning experience offers the readings, challenges, and tools shown in Table 1.

Because of the centrality of mentoring to the process of growth, both the Mentoring Agreement and Mentoring Planning worksheet (see Figure 3) are required parts of the Self-Growth paper that students are required to write at the end of the course. These worksheets are also available in the *Student Success Toolbox* (Pacific Crest, 2011).

Looking Forward

The relationship of measurement to the mentoring process, especially the use of holistic and analytical rubrics to help the mentee self-measure, self-analyze, and then self-mentor, is an area of current research where we believe practice can be improved significantly as performance measures are developed, both in quantity and quality. Another area for future focus is the role that professional development can play in helping those educators who have some experience as mentors, but who have not yet evolved the skills necessary to mentor effectively.

Figure 3 Mentoring Agreement and Mentoring Planning (Available in *Learning to Learn: Becoming a Self-Grower* and the *Student Success Toolbox*).

<div style="text-align: center;">Mentoring Agreement</div> <p>We voluntarily enter into a mentoring relationship from which we both expect to benefit. We want this to be a successful relationship, leading to increased growth and performance. We have agreed upon the following terms for our relationship.</p> <p>Objectives (what we intend to achieve)</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Confidentiality</p> <p>Any sensitive issues that we discuss will be held in confidence. Issues which are off-limits in this relationship include:</p> <p>_____</p> <p>Frequency of Meetings</p> <p>We intend to meet at least _____ time(s) each _____. If either party cannot attend a previously scheduled meeting, we agree to notify one another in advance.</p> <p>Duration</p> <p>We will continue our mentoring relationship as long as we both feel comfortable and that we are meeting our objectives or until: _____</p> <p>No-Fault Termination</p> <p>We are committed to open and honest communication in our relationship. We will discuss and resolve any conflicts as they arise. If, however, either of us needs to terminate the relationship for any reason, we agree to abide by one another's decision.</p> <p>Mentor: _____ Mentee: _____</p> <p>Date: _____ Date: _____</p>	<div style="text-align: center;">Mentoring Planning</div> <p>Name: _____ Date: _____</p> <p>Need for Mentoring (Areas for Growth)</p> <p>_____</p> <p>_____</p> <p>Who have you selected as a mentor?</p> <p>Why?</p> <p>_____</p> <p>What is your relationship to this person?</p> <p>_____</p> <p>How will you approach this person about the possibility of a mentoring relationship?</p> <p>_____</p> <p>What are your goals? (What do you want to accomplish with the mentoring relationship?)</p> <p>_____</p> <p>_____</p> <p>How will you know you're making progress? (What is your assessment plan?)</p> <p>_____</p> <hr/> <p>How often will you meet with your mentor?</p> <p>_____</p> <p>How will you celebrate growth and improvement?</p> <p>_____</p> <hr/> <p>How will you celebrate final success?</p> <p>_____</p> <p>How will you end the mentoring relationship?</p> <p>_____</p>
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Learning and teaching practices continue to evolve through action research by educational innovators who test and share their best practices.

High quality learning and teaching practices are advanced through the sharing of research-based best practices. While “research” may sometimes imply expensive high-level studies that assiduously follow strict scientific principles, as often as not, research-based **best practices** tend to come as a result of action research, where a single individual or a small group of practitioners “analyze data available to them in order to improve their own practice” (Rigsby, 2005). While many other practices are presented elsewhere in this article, a few examples of research-based best practices in Process Education are presented in this section.

- Cooperative Learning (see also the **Learning Communities** section)
- Active Learning (see also **Learning to Learn**)
- Relevance of Learning Activities
- Elevating Learning to Problem Solving (see also **Problem Solving**)
- Validation of Learning
- Triggering of Prior Knowledge (see also the **Learning Process Methodology**)
- Concept Maps as a Learning Tool and Activity

Cooperative Learning (also see the **Learning Communities** section)

The jury has long been in: cooperative learning works. According to Prince in *Does Active Learning Work? A Review of the Research* (2004),

...there is broad empirical support for the central premise of cooperative learning, that cooperation is more effective than competition for promoting a range of positive learning outcomes. These results include enhanced academic achievement and a number of attitudinal outcomes. In addition, cooperative learning provides a natural environment in which to enhance interpersonal skills and there are rational arguments and evidence to show the effectiveness of cooperation in this regard.

Though the professionals at Pacific Crest did not invent cooperative learning, they were quick to adapt and apply the practice when they noticed its efficacy. Dan Apple recalls,

In 1985 when we were running POINT FIVE workshops, there were often a limited number of computers, so the workshop facilitators often paired two faculty members on a single computer. We observed that faculty moved more quickly and effectively through the workshop content when they worked in pairs than when they worked alone because in pairs, they taught each other. In student demonstrations, the results were much more positive when students worked in teams of three or four than in pairs. (See the **Learning Communities** section.)

Pacific Crest published a paper on cooperative learning (Duncan-Hewitt, Mount & Apple, 1994) and shortly thereafter published, the *Handbook on Cooperative Learning* (Duncan-Hewitt, Mount & Apple, 1996). Sinclair Community College contributed the design of Team Role Markers (1998) which are now used in Professional Development Institutes and Learning to Learn Camps.

The scholarship on cooperative learning was extended with the publication of modules in the *Faculty Guidebook: Cooperative Learning* (Van Der Karr & Burke, 2007), *Designing Teams and Assigning Roles* (Smith, 2007a), and *Team Reflection* (Hare, 2007).

Beyond the *Faculty Guidebook*, the Transformation of Education (Hintze, Beyerlein, Apple, & Holmes, 2011) aspect, “social orientation” contrasts the “individual” orientation with the “community” orientation, offering tips for moving toward more cooperative practice:

- Have students assess one another’s individual work. The boost of having another student identify strengths and assist in improvement makes collaboration more attractive.
- The use of formal team roles can help bridge the gap between individual efforts and team results.
- Allowing teams to compete shifts competition/identity from an individual to the group. Shared win = celebration; shared loss = commiseration.

As noted in the **Learning Communities** section, cooperative learning is integrated into both *Foundations of Learning* (4th ed.) (Redfield & Hurley-Lawrence, 2009) and *Learning to Learn: Becoming a Self-Grower* (Apple, Morgan & Hintze, 2013). Additionally, team roles are used in *Foundations of Biochemistry* (4th ed.) (Loertscher, Minderhout, & Frato, 2015). The introduction to the

instructor explains, “These materials were written using a process-oriented guided-inquiry learning (POGIL) model and are expected to be used in structured small groups with instructor facilitation.” A typical first step of a learning activity plan is for a team manager to assign the roles of spokesperson, recorder, and reflector.

The *Student Success Toolbox* (Pacific Crest, 2011) offers numerous tools to support the use of cooperative learning practices in any classroom:

Rubrics: Performing in a Team

Forms: Team Assessment Report (with a completed sample), Planner Report, Recorder Report, Weekly Recorder Report, Reflector Report, Weekly Reflector Report, Spokesperson Report

Methodologies: Teamwork Methodology

Other: Team Roles (including performance criteria for: Captain, Recorder, Spokesperson, Reflector, Technology Specialist, Optimist, Planner, Timekeeper, Critical Thinking, Conflict Resolver, Spy), Profile of a Strong Team Player

Active Learning (see also Learning to Learn)

“All genuine learning is active, not passive.
It is a process of discovery in which
the student is the main agent, not the teacher.”
M. J. Adler (1982)

The key ideas shared at the first Teaching Institute in 1991 focused on teaching students how to learn (Apple, 1991); this is the definition of *active learning*, according to Bonwell & Eison (1991): the responsibility of learning lies with the learner.

The best practice, in this case, is described by the Transformation of Education (Hintze, Beyerlein, Apple & Holmes, 2011) aspect, “delivery,” which defines *active learning* as the opposite of “presentation.” In usual terms, this takes place in a lecture-style context, in which there is a teacher who dispenses learning, knowledge, information, or wisdom to a student. Because of this traditionally defined context, we are used to thinking of “learning” as the receiving end of “teaching.” But in an **active learning** environment, the learner drives the learning process.

If the learner is responsible for learning and actively engages in doing so, then instead of “teaching,” the educator must shift to a role of supporting the learner and facilitating the process of learning. In the role of facilitator, the focus is on process rather than content (see the **Facilitation** section). Several modules in the *Faculty*

Guidebook speak directly to this changed role: *Overview of Facilitation* (Smith, 2007b), *Facilitation Methodology* (Smith & Apple, 2007), *Constructive Intervention* (Leise & Smith, 2007), *Constructive Intervention Techniques* (Smith & Leise, 2007), and *Profile of a Quality Facilitator* (Smith, 2007c). Beyond the *Faculty Guidebook*, pertinent scholarship in Process Education includes *Transforming Large Introductory Classes into Active Learning Environments* (Duffrin, Dawes, Hanson, Miyazaki, & Wolfskill, 1998-1999).

A well-known and very popular active learning approach is POGIL (Process-Oriented Guided-Inquiry Learning). In POGIL classrooms or activities, though the responsibility for learning still resides with the learner, the active learning is group-based, with learning teams working to discover and construct knowledge (Hanson & Moog, 2007). Whether active learning is performed by an individual or group, the key is that the learner actively seeks out understanding, engaging in some kind of learning process or cycle. In a POGIL activity, the learning process consists of three stages: exploration, concept invention/formation, and application (Abraham, 2005). These three stages correspond to Steps 9, 10, and 11 in the Learning Process Methodology (see the **Learning Process Methodology** section):

9 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 Transfer/Application

Transfer knowledge to different contexts; apply knowledge in new situations

Because Process Education **is** active learning, all Process Education curricula are, by definition and design, active learning curricula, created to support active learning classroom practices. The only difference is with respect to non-disciplinary curricula, such as *Foundations of Learning* (Redfield & Hurley Lawrence, 2009) and *Learning to Learn: Becoming a Self-Grower* (Apple, Morgan & Hintze 2013). Not only are these books designed to support active learning; the issue of shifting responsibility to the learner is explicitly addressed. The following is excerpted from the introduction to *Foundations of Learning*:

With this book, you become the master of your learning experience and the person in charge of your own learning. It might help to think of yourself as an “athlete of learning.” As a student, you are in training to strengthen and hone your ability to learn... You’re not on your

own; you have professors and instructors who act as coaches to facilitate your growth and improvement. But the bottom line is that just as no one else can exercise for a runner, no one else can do your training for you.

Relevance of Learning Activities

One of the lessons of active learning is that meaningful learning requires active engagement on the part of a learner. If a learner is curious about and interested in a topic, he or she is motivated to learn and is that much more active and engaged. Learning becomes enjoyable and meaningful. Who among us does not recall approaching a learning situation with skepticism, feeling that this is what others want us to learn, for their own reasons, with little regard for our interests or other demands on our time? “Why should I bother?” or “What’s in it for me?” are fair, if not terribly polite questions. The key is relevance. If a topic is relevant to a learner, it matters. As educators, we know that what we teach does matter, but knowing this is not enough if we want active and engaged learners. We have to show them that relevance. We have to show why they should bother and what’s in it for them.

Why?

The first step of the Learning Process Methodology is to consider the question of why the learning is relevant; a learner should begin by identifying and explaining their reasons for learning. The Learning Process Methodology informs the Activity Design Methodology (because a learning activity is useless unless it supports the learning process), and Step 4 of that methodology is, “Create the ‘Why’ for the activity” (Leise, Beyerlein, & Apple, 2007). As explained in the *Activity Design Handbook* (Pacific Crest, 2008),

This section should put the activity in context for the learner by addressing three questions:

- What will the student learn? (clarifies the title and further defines the content of the activity)
- Why is it relevant to the subject? (defines the general importance of the activity and describes how it fits into the course)
- Why is it relevant to the learner? (provides justification for the activity from the perspective of the individual learner)

While all Process Education learning activities contain a “Why?” statement, an interesting variation on this practice is found in *Foundations of Organic Chemistry* (Bucholtz, 2015), where, instead of a prompt of “Why?”, that section is titled, “Who Gives a Darn?” Ehren Bucholtz, the book’s author, explains:

Students often see the material of a typical day to be esoteric, and don’t really understand why this material is useful to learn. Therefore, the start of each activity in the workbook presents a new problem; presented as a “Who Gives a Darn?” question. Students then work through an activity that is based on POGIL principles that addresses the learning objectives of the day. At the end of the activity, the “Who Gives a Darn?” question is presented once again, and students are guided through the thinking to solve the problem using the knowledge and skills gained in the activity.

See Figures 1 and 2 for an example.

Real-World Problems and Problem-Based Learning

In addition to a compelling “Why?” statement, the use of real-world problems and problem-based learning (instructional methodology that challenges students to seek solutions to real-world problems; Duncan-Hewitt, 2007) are other strategies to make learning more relevant. Reviewing Figures 1 and 2, we see that they comprise an excellent example of using a real-world problem. Not only is global warming seemingly omnipresent in the media, it is as much a real-world problem as it is possible to have in that the potential impacts will be noticed by and will affect everyone. *Solving Real Problems in Chemistry* (Goodwin, Slusher, Gilbert & Hanson, 2009) is another example of curriculum that is designed to use real-world problems to increase student performance in solving problems. Various activities challenge students to

- Determine whether a homeopathic medicine is a placebo
- Calculate the fuel value, cost, economic value, and environmental value of various fuels (wood, coal, liquid propane gas)
- Determine the time of death for a corpse found at the side of the road
- Calculate where to build an aluminum plant based on the average residential price for energy
- Predict the useful lifetime for instrumentation used on Mars

While neither *Foundations of Organic Chemistry* nor *Solving Real Problem with Chemistry* use Problem-Based Learning in its strictest definition (i.e., students are not asked to develop a problem statement nor must they determine the information and resources they will need to solve the problem), they do share with PBL that, “appropriately designed, the problems engage students’ curiosity so that they are motivated to explore the subject beyond simple solutions” (Duncan-Hewitt, 2007).

Figure 1 *Foundations of Organic Chemistry* Activity 36 Who Gives a Darn? Introduction

Who Gives a Darn?

The global climate has changed dramatically in the last 100 years, coinciding with the industrial revolution. During the industrial revolution, coal fired plants brought civilization generation of electricity. Coal is still one of the most common sources for generating electricity. Unfortunately, the billions of tons of coal burned every year, also contributes to the dramatic increase of carbon dioxide found in the atmosphere. Prior to the industrial revolution, the amount of CO₂ in the atmosphere was generally 200 to 250 parts per million, but now that amount is closer to 400 parts per million. During this time frame the average temperature of the Earth has increased about 1°C.

The balance between heating and cooling the planet is shared between two major types of light energy. As the sun shines on the earth, ultraviolet light penetrates the atmosphere warming the planet. This light energy is released back into space via infrared radiation from the earth.

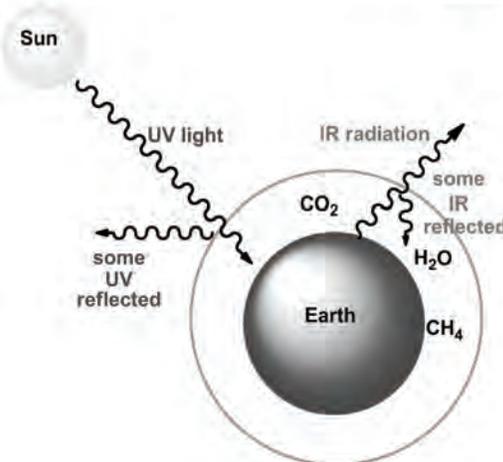
The Earth's temperature is predicted to continue to increase if the amount of carbon dioxide in the atmosphere continues to rise. While 1°C change may not seem like much, it has already resulted in much more violent weather patterns as well as increases in sea level. What is it about carbon dioxide in the atmosphere that disrupts the cooling of the Earth?

Figure 2 *Foundations of Organic Chemistry* Activity 36 Who Gives a Darn? Conclusion

Who Gives a Darn? I Do!

The balance between heating and cooling the planet is shared between two major types of light energy. As the sun shines on the earth, ultraviolet light penetrates the atmosphere warming the planet. This light energy is released back into space via infrared radiation from the earth. Molecules in the atmosphere act as insulation trapping some of the infrared radiation, and help to maintain the Earth's temperature. This has been simplified by calling it the greenhouse effect.

The Earth's temperature is predicted to continue to increase if the amount of carbon dioxide, water vapor and methane in the atmosphere continues to rise. Using what you have learned today about IR spectroscopy, explain this phenomenon.



The diagram illustrates the greenhouse effect. On the left, the Sun emits wavy arrows labeled 'UV light' towards the Earth. One arrow is labeled 'some UV reflected' and points away from the Earth. The Earth is shown as a sphere with a central core labeled 'Earth'. The atmosphere is represented by a larger circle around the Earth, containing labels for 'CO₂', 'H₂O', and 'CH₄'. From the Earth's surface, wavy arrows labeled 'IR radiation' point upwards. One arrow is labeled 'some IR reflected' and points away from the Earth. Another arrow is labeled 'IR radiation' and points towards the atmosphere. A third arrow is labeled 'some IR reflected' and points back towards the Earth's surface, indicating that greenhouse gases trap heat.

In both *Foundations of Learning* (Redfield & Hurley-Lawrence, 2009) and *Learning to Learn: Becoming a Self-Grower* (Apple, Morgan & Hintze 2013), students are challenged to solve their own problems, issues, and challenges. While the problems elected by an individual student to work toward solving may not be universal, for that student, no other problem is more real or potentially more motivating.

Elevating Learning to Problem Solving (see also **Problem Solving**)

The best practice here is seen in the Transformation of Education (Hintze, Beyerlein, Apple, & Holmes, 2011) aspect, “cognitive complexity,” the degree to which training and doing is elevated to problem solving and research. For

this aspect, “memorizing” represents the historical tendency, while “problem solving” is the preferred alternative.

As Smith explains in *Setting High Expectations* (2007d),

When facilitators set high expectations they are communicating that they think that students are capable of significantly improved performance. In other words, if their teachers believe in them, students are more likely to believe in themselves.

The implication for learning activities is that they should sufficiently challenge students. Integrating critical thinking questions into activities helps students shift from memorizing to understanding and constructing meaning (Hanson, 2007), especially when those questions are sequenced to guide inquiry through multiple levels

Figure 3 The First Three Levels of Learner Knowledge and Critical Thinking Questions

Level I Information	<p>Directed Questions</p> <p><i>The answers can be found by examining the model presented in the activity, using the information resources listed, or by drawing on personal experience and prior knowledge and activities. Such questions have a definite answer and build the foundation for more challenging questions.</i></p>		
	What is...?	Who were the main...?	Can you list the three ...?
	Where is...?	Which one...?	Who was...?
	When did...?	Can you recall...?	
	What facts or ideas show...?	Can you select...?	
Level II Conceptual Understanding	<p>Convergent Questions</p> <p><i>Build Level 2 knowledge and help students elevate their knowledge to Level 3. Students need to organize, interpret, analyze, and synthesize. They may have more than one correct answer, and the level of difficulty progresses within a sequence of questions. A good convergent question makes important connections, links concepts together, leads to better understanding, and requires that students reach conclusions.</i></p>		
	How did... happen?	How would you state or interpret in your own words...?	
	How would you compare or contrast...?	What is the main idea of...?	
	How would you describe...?	Which statements support...?	
	How would you summarize...?	Can you explain what is happening...?	
	How would you show an understanding of...?	What is meant by...?	
Level III Application	<p>Divergent Questions</p> <p><i>Divergent questions send students in new and interesting directions. They often have no right or wrong answer, but require students to ponder, explore, generalize, and expand their current knowledge. Divergent questions require the highest level of thinking and produce outcomes and conclusions that vary among learning teams and individuals. They help identify holes in knowledge and test understanding by challenging the knowledge structure that was built.</i></p>		
	How would you use...?	What other way would you plan to...?	
	What examples can you find to...?	How would you apply what you learned to develop...?	
	What would result if...?	How would you structure an argument to show...?	
	Can you make use of the knowledge to...?	What elements would you choose to change...?	
	What approach would you use to...?	What questions would you ask in an interview with...?	

of learner knowledge (Hanson, 2007). Figure 3 pulls together the pertinent Levels of Learner Knowledge with information about how each level corresponds to the sequencing of critical thinking questions.

The **Problem Solving** section discusses the use of problems in curricula to elevate learning to the level of problem solving. From the perspective of scholarship, this elevation was the focus of the Problem Solving Across the Curriculum Conferences (Kramer & Beery, 1990), as well as *Learning Through Problem Solving* (Apple, Beyerlein & Schlesinger, 1992), *Foundations of Problem Solving* (Myrvaagnes, 1997), and *Developing Working Expertise (Level Four Knowledge)* (Nygren, 2007).

Validation of Learning

A key facet of learning to learn is that learners must develop the ability to validate their own learning; they must be able to **know** that they have learned. This idea is

explored in the *Faculty Guidebook* module *Self-Validation of One's Learning* (Armstrong, 2007) and implemented practically in *Foundations of Mathematics* with a section called "Identify and Correct the Errors" (Fremeau 2005). As the sample problem from this section in Chapter 3 makes clear, this innovation asked students not only to demonstrate that they had learned by showing the "correct process" but to validate that learning (see Figure 4).

Validation is included as a critical aspect of learning to learn in other active learning curricula published by Pacific Crest (see Figure 5):

Additionally, students at any of the quantitative Learning to Learn Camps (e.g., Algebra Learning to Learn Camp), are required to validate each answer as part of the process of showing their work in order to receive credit for having the correct answer.

Figure 4

Worked Solution <i>What is Wrong Here?</i>	Identify Errors or Validate	Correct Process	Validation
<p>1) $6 - 4\frac{1}{3}$</p> $\begin{array}{r} 6 \\ -4\frac{1}{3} \\ \hline 2\frac{1}{3} \end{array}$	<p><i>Just brought down the 1/3.</i></p> <p><i>Did not borrow from the whole number 6 to subtract the 1/3.</i></p>	$6 = 5\frac{3}{3}$ $\begin{array}{r} 5\frac{3}{3} \\ -4\frac{1}{3} \\ \hline 1\frac{2}{3} \end{array}$ <div style="border: 1px solid black; padding: 5px; display: inline-block;"> <p>Answer: $1\frac{2}{3}$</p> </div>	$\begin{array}{r} 1\frac{2}{3} \\ +4\frac{1}{3} \\ \hline 5\frac{3}{3} = 5 + 1 \\ = \textcircled{6} \checkmark \end{array}$

Figure 5

Book	Validation Innovation
<p><i>Foundations of Mathematics</i> (Fremeau, 2005) <i>Foundations of Algebra</i> (Ellis, Teeguarden, Apple, & Hintze, 2013)</p>	Identify and Correct the Error (see figure 4)
<p><i>Solving Real Problems in Chemistry</i> (Goodwin, Slusher, Gilbert, & Hanson, 2009; Goodwin, Hanson, & Wolfskill, 2012)</p>	A “Got It” section gives students an opportunity to validate the learning they have done during the activity by solving an additional problem
<p><i>Foundations of Learning</i> (4th ed.) (Redfield & Hurley Lawrence, 2009)</p>	The Learning Process Methodology includes Step 13: “Validation of Learning”
<p><i>Quantitative Reasoning and Problem Solving</i> (Ellis, Apple, Watts, Hintze, Teeguarden, Cappetta, & Burke, 2014)</p>	<p>A “Troubleshooting” section gives students an opportunity similar to that found in Identify and Correct the Error, except that there is only one problem offered and it is much more extensive, requiring that students potentially validate multiple aspects of the problem.</p> <p>A “Hardest Problem” section challenges students to create the hardest problem they can, using what they have learned in that activity. This helps them to validate that they have learned by successfully transferring their learning to a new context.</p>

**Clear Expectations:
Defining and Describing the Target**
(see also Performance Criteria)

“The first step is, of course, seeing that goal or target. After all, the better you can see a target, the greater your chances of hitting it.”

–*Foundations of Learning* (4th ed.)
(Redfield & Hurley Lawrence, 2009)

While much about performance criteria is covered in the **Performance Criteria** section, a best practice is to keep in mind that, in the terms of the quote above, we have to see the target in order to have a hope of hitting it. This is why Step 5 of the Learning Process Methodology is “Performance Criteria: Determine specific desired outcomes used to measure and gauge performance” (Leise, Beyerlein & Apple, 2007). If we don’t know what the outcome or end is supposed to look like, how can we

determine whether our learning performance is finished, let alone whether we have learned?

Simply telling students that we expect high-quality performance from them isn’t nearly enough; they need to know what constitutes such a performance – what that looks like. For this reason, exemplars and models are invaluable. Additionally, having an exemplar to refer to makes it much easier to write performance criteria; after all, those criteria simply describe the kind of and level of performance we’re seeking. This holds true across academic levels, from the program level, to the level of a course, and finally down to the level of individuals and teams (see Figure 6). In each instance, where the methodology recommends brainstorming, being able to look to a clear example of the level of performance being sought not only helps the individual writing the criteria, but it gives a performer an example of the ideal performance to use as a model or exemplar.

Figure 6 The Step for Identifying the Target Performance from the Appropriate Methodology for Writing Performance Criteria (for a Program, for a Course, for Individuals/Teams)

Program Level
Brainstorm a list of your program's future qualities; characteristics and descriptors that reflect what the program will be about, especially those that represent quality (Nibert, 2007).
Course Level
Brainstorm qualities that describe top performing students (Hinton, 2007).
Individuals/Teams Level
Describe the performance expected by all stakeholders, including the performer(s). Brainstorm to get a list of areas of quality that can be observed within the expected performance (Utschig, 2007).

Providing clear expectations through performance criteria at the activity, course, and program levels allows for the synergy of faculty and students to align their efforts to meet the designed expectations (Hinton, 2007).

This practice of providing clear expectations through performance criteria and modeling is seen in *Foundations of Learning* (Redfield & Hurley-Lawrence, 2009). In the first chapter, the Performance Levels for Self-Growers is presented as a rubric. Five sample students are described

immediately afterward, with each student talking about their performance at that level (see Figure 7).

Triggering of Prior Knowledge (see also the **Learning Process Methodology**)

While Step 3 of the Learning Process Methodology says that a learner must “identify necessary skills and background knowledge needed to perform the learning,” (Leise, Beyerlein & Apple, 2007), as noted in the Learning Process Methodology section, brain-based research recommends that prior knowledge be activated when a learning activity is started in order to increase comprehension (see especially Maguire, Firth, and Morris, 1999).

Quantitative Reasoning and Problem Solving does this with an activity section called "What Do You Already Know?" which triggers students to explore both the potential richness and boundaries of their prior knowledge (Ellis, Apple, Watts, Hintze, Teeguarden, Cappetta & Burke, 2014). *Learning to Learn: Becoming a Self-Grower* (Apple, Morgan & Hintze, 2013) is also designed to trigger prior knowledge through the use of a discovery exercise and exploration questions. The discovery exercise is more immersive and experiential while the exploration questions prompt the learner to begin thinking more analytically about their experience and current understanding. Figure 8 shows the discovery exercise and exploration questions for Experience 13: Choosing and Using Mentors Effectively.

Figure 7 Performance Descriptions in a Rubric and Student Models/Examples for Each Level

RUBRIC

Table 1.2 Continuum of Performance Levels

	Knowledge	Social Interactions	Attitude	Abilities
Level 5 <i>Star Performers</i>	Can construct and modify models; valued and respected by experts in the field	Create movements and organizations that often become self-perpetuating	Control their destiny; also can control their emotions in challenging situations	Have highly developed learning and research abilities that enable them to excel
Level 4 <i>Self-Starters</i>	Are able to add to the knowledge in their discipline	Use relationships effectively to attain success for themselves and others	Seek greater challenges and responsibilities to perform at a higher level; push the boundaries of their own performance.	Able to cultivate new abilities in unfamiliar areas
Level 3 <i>Responsive Individuals</i>	Use their problem-solving, learning, and thinking skills to improve their performance and get higher-quality results	Are positive people whom others enjoy and want to have on their teams	React to challenges with improved performance rather than complaints; feeling good about their accomplishments	Are able to learn from how other people function in a particular area
Level 2 <i>Content Individuals</i>	Are satisfied with their modest levels of effort in gaining knowledge	Interact freely with family and friends, but do not seek more diverse contacts and more challenging relationships	Feel like a cog in the machinery; doing little more than what is asked; feeling their contributions are not very significant	Have enough critical thinking and analytic abilities to perform some problem-solving
Level 1 <i>Static Individuals</i>	Try to minimize or avoid the effort needed to gain knowledge	Limit their social interactions to like-minded individuals who complain about what they are not getting out of life	Feel that whatever they do will have little impact; that most things are not worth the effort	Must have explicitly defined rules, procedures and policies; need to be prompted to finish something

Level 5 Star Performer Paula
I'm still only an undergraduate, but my decision to study pre-med is clearly the right choice. While I was doing research on community health clinics for an honors course, I got involved in organizing a local community health education initiative. I've applied for several grants for the project and it looks like the funding will come through. I've been asked to speak at a national conference on community health and while I'm a bit nervous about addressing such a large group, the important thing is that the project is getting the attention it deserves and that I can help it continue to grow.

Level 4 Self-Starters Sam
I'm meeting with a couple of other international business majors about a paper we wrote that's been accepted for *The Journal of Global Business*. Paul, my mentor, has helped put me in touch with some other people who are working on some of the same business problems I am. My research paper still needs some reference checking, so I've got to go!

Level 3 Responsive Rene
I finally made it to the Dean's List! This semester is a real challenge (I'm an information technology major and my economics class just doesn't make a lot of sense to me), but I've started a couple of study groups. We all enjoy getting together and not just for the pizza; it's amazing how much we learn from each other.

Level 2 Content Connie
I like my classes, but really can't wait for Spring Break...some friends and I are going to Florida. How cool is that?! And I figure that as long as I pull mostly C's in my classes, I'll be able to get a job after I graduate. That's what matters, right?

Level 1 Static Steve
I have a great band, an OK part-time job, and tons of friends. Who needs more than that at 18? But my parents pushed the college thing, so I'm here. Yeah, I sort of like some of my classes, when I show up. My parents are not thrilled with my grades this semester—but I'm just not that into it.

Concept Maps as a Learning Tool and Activity

Note that the exploration questions are **not** critical thinking questions. They are preparatory to reading or working with a model and are intended purely to trigger prior knowledge and help students become more metacognitively aware as they begin the reading assignment contained in the pre-activity. Exploration questions are now being used in the Online Teaching Institute to help faculty learners in the same way.

As a final example, *Foundations of Organic Chemistry* (Bucholtz, 2015) shows an instructor making the shift from listing knowledge prerequisites to triggering prior knowledge. The book's author, Ehren Bucholtz, realized that his students didn't know what to do with a listing of prerequisite knowledge as shown in Figure 9; they simply ignored it, as it wasn't a task—it wasn't performance based. The listing of information wasn't triggering their prior knowledge. When Bucholtz upgraded the book from the pre-market to the 1st edition (pending publication), he rewrote the prerequisite knowledge section as performance tasks, also letting students know where to go to review content in those cases when they did they not have the prior knowledge required to complete the task. Figure 10 shows the new version of the prerequisite knowledge for this same activity.

Concept maps (see Figure 11 for a simple example) are a useful learning tool and, for promoting knowledge retention and transfer, an effective (and possibly preferred) learning activity is to create concept maps. According to Nesbit and Adesope, authors of a large-scale meta-analysis of concept map studies,

The meta-analysis found that, in comparison with activities such as reading text passages, attending lectures, and participating in class discussions, concept mapping activities are more effective for attaining knowledge retention and transfer. Concept mapping was found to benefit learners across a broad range of educational levels, subject areas, and settings. (2006)

Concept mapping is listed as an appropriate in-class type of learning activity in *Overview of Learning Activities* (Wasserman, Davis & Astrab, 2007) and has been increasingly featured as part of activities or experiences in curricula from Pacific Crest.

In *Learning to Learn: Becoming a Self-Grower* (Apple, Morgan & Hintze, 2013), Experience 11: Metacognition: Thinking About My Thinking, students are given two mod-

Figure 8

DISCOVERY EXERCISE	Think about your personal history and identify the three individuals in your life, other than parents or guardians, who have most helped you to become the person that you want to be. For each of these individuals, determine the three areas where they helped you to grow or develop and how they did that (through what types of action or activity). Also determine the characteristics the individual had that enabled them to help facilitate your growth.
EXPLORATION QUESTIONS	<ol style="list-style-type: none"> 1. What are the key roles of a mentor? 2. What are critical characteristics of quality mentors? 3. Why would someone mentor someone else? 4. How do you get someone that you know to mentor you? 5. What are the responsibilities of the mentee in the mentoring process?

Figure 9 Simple Listing of Prerequisite Knowledge (*Foundations of Organic Chemistry*, Pre-Market Edition)

Prerequisite Knowledge 	
Gen Chem	<input type="checkbox"/> The nucleus of an atom is a minor component of its size with most atomic volume due to electron repulsion
Activity 8	<input type="checkbox"/> Non-covalent interactions affect physical properties
Activity 10	<input type="checkbox"/> Approximate bond angles in a molecule are based on VSEPR theory <input type="checkbox"/> Hybridization of atomic orbitals determines bond angles within a molecule
Activity 11	<input type="checkbox"/> IUPAC systematic names are used to identify straight, branched, or cyclic alkanes, alkyl halides, and alcohols

As useful as concept mapping and concept maps are in the context of student curricula and learning, their potential efficacy as tools for communication have been explored with respect to the information not only within the Transformation of Education but also in the relationship of the aspects to the larger scholarship and practices of Process Education. In *Concept Maps for Linking Aspects in the Transformation of Education* (Beyerlein, Burke & Hintze, 2012a), three Transformation of Education concept maps were created to serve as models for exploration and learning. The authors explain,

Once the maps were created, educator ways of being and common teaching and learning toolkits became obvious from each map. The set of

concept maps is customized for instructors, rather than learners, to help them better visualize their personal teaching/learning practices and their local teaching/learning culture on the continuum from traditional to transformational environments.

A learning object is available showing not only the concept maps but the methodology used to create them (Novak & Cañas, 2008): <http://www.transformation-of-education.com/conceptmaps/> (Beyerlein, Burke & Hintze, 2012b).

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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, the Learning Process Methodology 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 was 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 experience gained through classroom practice were integrated into *Teach for Learning: A Handbook for Process Education* (Pacific Crest, 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
<i>Stage 1: Preparing to Learn</i>	
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.
<i>Stage 2: Performing a Learning Activity</i>	
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.
<i>Stage 3: Assessing and Building New Knowledge</i>	
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 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	<i>numerator</i> — the top portion of the fraction <i>denominator</i> — the bottom portion of the fraction <i>multiplicative identity</i> — multiplying by 1 leaves a number unchanged <i>reciprocal</i> — 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	
<p>Q1. What is a half of a half of a pizza (one half divided in two)? $1/4$</p> <p>Q2. How do you calculate this mathematically? $\frac{1}{2} \div 2 = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$</p> <p>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: $\frac{2}{3} \div 3 = \frac{2}{3} \times \frac{1}{3} = \frac{2}{9}$</p>	

also appeared in the *1995 Teaching institute handbook* (Apple) as a way to help faculty understand and improve their skills with respect to design of learning activities, facilitating student learning experiences, and improving student learning through the practice of assessment and mentoring. 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) and 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 LPM was used to create an activity design methodology aligned with a course design methodology. These methodologies were used to develop activity books modeled after 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. For example, a 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 LPM 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 2 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 by someone else. 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 3. See the section **Research-Based Best Practices** for more on activating prior knowledge.

Figure 3 Activity 2.3, Evaluating a Formula in *Quantitative Reasoning and Problem Solving*

Tapping into your existing knowledge

What Do You Already Know?

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.

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A methodology is a model of the abstract generalization of a specific process created by an expert to assist novices on their way to becoming experts in the performance of that process.

The Importance of Process

Our understanding of the importance of process and its quality was significantly advanced by the work of W. Edwards Deming, which formed the basis for the total quality management (TQM) movement in the 1980s (Deming, 2015). In working with higher education, Pacific Crest initially focused on improving the processes of teaching, learning, design, and assessment (Kramer & Beery, 1990) and soon realized that when it comes to modeling and improving educational processes, methodologies were critical. The first methodology published by Pacific Crest was the Problem Solving Methodology (PSM), published in *Introduction to Problem Solving Using PC:SOLVE* (Apple, 1990); this was aimed at teaching students how to use a methodical process when working to solve problems.

The next and probably most far-reaching methodology formally published was the Learning Process Methodology (LPM). It began as “The Learning Process Model,” published in *Learning Through Problem Solving* (Apple, Beyerlein & Schlesinger, 1992), and was an intermediate step in the development of the full LPM published in the pre-market edition of *Foundations of Learning* (Pacific Crest, 1995). See the section **Learning Process Methodology** for more information.

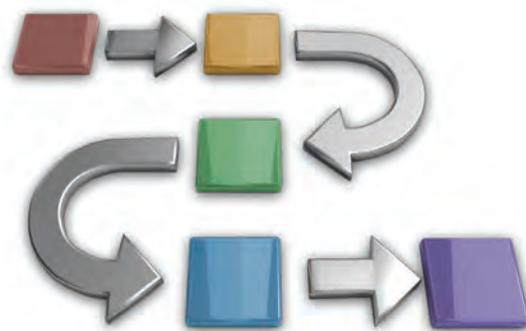
The Collection Grows

An additional set of process methodologies were introduced in the next edition of *Foundations of Learning* (Krumsieg & Baehr, 1996): these were writing, information processing, assessment, personal development, communication, teamwork, reading, and management. The process used to create these different methodologies was formalized as a methodology for creating methodologies; this appeared in the *1995 Teaching institute handbook* (Apple). Also available in that handbook was the first iteration of a methodology for designing learning activities. The *1998 Teaching institute handbook* (Apple & Krumsieg) offered additional methodologies: course design, facilitation, and creating a productive learning environment. The *2000 Teaching institute handbook* (Apple & Krumsieg) introduced methodologies for mentoring, constructing knowledge tables, and carrying out evaluations. The *Faculty Guidebook* project (2003 through 2007) saw the upgrade and publication of a series of methodologies listed in the following order of development:

- *Methodology for Course Design* (Davis, 2007a)
- *Methodology for Creating a Quality Learning Environment* (Apple & Smith, 2007b)
- *Methodology for Designing a Program Assessment System* (Collins & Apple, 2007)
- *Elevating Knowledge from Level 1 to Level 3* (Nygren, 2007)
- *Facilitation Methodology* (Smith & Apple, 2007)
- *Learning Processes Through Methodologies* (Leise & Beyerlein, 2007)
- *Methodology for Program Design* (Davis, 2007)
- *Assessment Methodology* (Apple & Baehr, 2007)
- *Designing Process-Oriented Guided-Inquiry Activities* (Hanson, 2007)
- *Teamwork Methodology* (Smith, Baehr & Krumsieg, 2006)
- *Personal Development Methodology* (Leise, 2007)

During the process of converting the Learning to Learn Camp into the course curriculum, *Learning to Learn: Becoming a Self-Grower* (Apple, Morgan & Hintze, 2013), it became obvious that an additional methodology was needed: that of preparing for a performance. The Preparation Methodology was created and appears in the context of Experience 9, “Performing when Being Evaluated.” This same course conversion also saw the upgrade of the Reading Methodology in order to more fully support the process of reading for learning.

In addition to being useful for teaching general processes, methodologies can also be used to help students learn to use more specific processes within the context of a course: *Foundations of Mathematics* (Fremeau, 2006) incorporated 27 methodologies modeling course content



processes such as rounding a whole number and solving problems with proportions; *Foundations of Algebra: Active Learning Workbook* (Ellis & Apple, 2012) included 22 methodologies; and *Quantitative Reasoning and Problem Solving* (Ellis, Apple, Watts, Hintze, Teeguarden, Cappetta, & Burke, 2014) contained 30 methodologies. For example, Figure 1 shows the Data Analysis Methodology. While methodologies are extremely effective in learning,

internalizing, and generalizing process knowledge, the fact is that not only are methodologies rarely presented in student curricula without accompanying modeling of the use of the methodology; students are also challenged to step through the methodology themselves, in a problem that is similar to the modeled use. See Figure 2 for an example from *Foundations of Algebra: Active Learning Textbook* (Ellis, Teeguarden, Apple & Hintze, 2013).

Figure 1 Data Analysis Methodology

Step	Explanation
1. Clarify the data	What does each variable and row represent? Are there issues of quality such as errors or missing data? What are the values being measured? What are the relevant units? Are there any outliers that were removed? Is bias a problem?
2. Clarify the context	Who is asking for the analysis, what is the agenda, and what are the types of results that they want or expect to see? Identify the objectives (3 to 5) and always consider possible reasons for bias in the reporting of this data.
3. Develop inquiry questions	Identify three to five key questions central to the inquiry to clarify what results you want to produce. What are the fundamental questions that you hope to answer? What characteristics of the data set are you looking to identify?
4. Produce relevant graphs	Choose to construct a collection of histograms, box plots, pie charts, or bar graphs to help answer the original research question.
5. Identify data analysis tool	Select spreadsheet, stat package, modeling language, database, or specialized software.
6. Transform the data	Make structural changes in your table to facilitate better view, perspective, and understanding of what the data is representing.
7. Produce a preliminary analysis	Perform the basic descriptive statistics to go along with the graphs produced.
8. Identify data shortcomings	What are the concerns associated with using this data, are there agendas for people producing the data, concerns about the data collected, and data that has not been included?
9. Report findings and generate new questions	Summarize the top 3 to 4 findings that you can make with confidence. Also add 3 to 5 new issues or questions that need to be addressed based upon the findings.
10. Find additional data	Go back to the original source for the data and see if they have additional data that can supplement to answer some of the advanced questions.
11. Identify findings	Identify the top 3 to 5 findings that are most significant related to the initial objectives and determine the outline you will use to present your findings.
12. Perform an additional analysis	What are the key questions in the presentation that are currently unanswered and what are the statistical tools used to answer these questions?
13. Generalize the implications	What can we say about implications outside our current context of analysis? Determine whether it is fair to generalize the results to a wider population.
14. Produce an analytical report	Report the findings of the data analysis, documenting and justifying your process, techniques, and conclusions, including any issues or concerns, or ideas for future investigation.
15. Lessons learned	In the process of analyzing your data, assess your performance, identifying what you did well and why, what can you improve upon, and what you learned.

Figure 2 Presentation of a Methodology with Modeled Use and “Your Turn” for Student Practice

Methodology		2.3
Solving a System of Linear Equations in Two Variables by Substitution		
<p>The purpose of this methodology, which we refer to as the <i>substitution method</i>, is to solve a system of two equations in two variables by using the Substitution Principle twice.</p> <p><i>Limitation/ Caution:</i> When you solve one of the equations for one variable in terms of the other, you should not substitute the result back into that same equation.</p>		
Solve the system:	Example 1 $\begin{cases} x + 2y = -3 \\ 3x - 5y = 13 \end{cases}$	Your Turn $\begin{cases} -3x + 4y = 17 \\ x + 5y = 7 \end{cases}$
Steps	Discussion	
1 Select a variable and an equation	Select a variable for the first substitution and an equation to use to determine an expression for the selected variable.	
<div style="display: flex; align-items: center;"> <div style="background-color: #ADD8E6; padding: 5px; writing-mode: vertical-rl; transform: rotate(180deg); margin-right: 10px;">Ex 1</div> <div style="text-align: center;"> $\begin{cases} x + 2y = -3 \\ 3x - 5y = 13 \end{cases}$ <p>Select x and the first equation (we choose this equation because x has a coefficient of 1 and can easily be solved for).</p> </div> <div style="background-color: #ADD8E6; padding: 5px; writing-mode: vertical-rl; transform: rotate(180deg); margin-left: 10px;">Your Turn</div> </div>		
2 Solve one of the equations	Solve the selected literal equation for the selected variable.	
<div style="display: flex; align-items: center;"> <div style="background-color: #ADD8E6; padding: 5px; writing-mode: vertical-rl; transform: rotate(180deg); margin-right: 10px;">Ex 1</div> <div style="text-align: center;"> $\begin{aligned} x + 2y &= -3 \\ x &= -3 - 2y \end{aligned}$ </div> <div style="background-color: #ADD8E6; padding: 5px; writing-mode: vertical-rl; transform: rotate(180deg); margin-left: 10px;">Your Turn</div> </div>		
3 Substitute expression	Substitute the expression for the variable solved for in Step 2 into the other equation.	
<div style="display: flex; align-items: center;"> <div style="background-color: #ADD8E6; padding: 5px; writing-mode: vertical-rl; transform: rotate(180deg); margin-right: 10px;">Ex 1</div> <div style="text-align: center;"> $\begin{aligned} 3x - 5y &= 13 \\ 3(-3 - 2y) - 5y &= 13 \end{aligned}$ </div> <div style="background-color: #ADD8E6; padding: 5px; writing-mode: vertical-rl; transform: rotate(180deg); margin-left: 10px;">Your Turn</div> </div>		

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Problem Solving is a content-independent process of identifying and defining a gap between expectations and perceptions in a given situation, and then developing the means to minimize this gap to satisfy that situation's key stakeholders.

Defining and Teaching Problem Solving

In his book, *How to Solve It* (1945), Mathematician and educator George Pólya framed problem solving as a methodical and teachable process. His approach consisted of four broad steps:

1. Understand the problem.
2. Devise a plan for solving it.
3. Carry out the plan.
4. Review/extend the work.

Pólya went into much greater detail for each step, and his work and conception of problem solving as a general process still resonates with educators who strive to teach problem solving within their classrooms. Few would dispute the claim that problem solving is a skill that the majority of students lack. Scholars from McMaster's University spent 25 years surveying the need for students to develop problem solving skills, how problem solving is taught (even asking whether it **can** be taught), the methods used, and what works (as well as what doesn't). According to the authors,

(O)ur research showed that: 1) there is an identified, subject-independent skill set called problem solving, and 2) that students do not develop the skill in a four-year program by having teachers display how they solve problems, by giving out sample solutions, by using open-ended problems or by having peers show their problem solving. (Woods, Hrymak, Marshall, Wood, Crowe, Hoffman, et al., 1997)

Problems in Teaching and Learning the Problem Solving Process

Approximately midway between the publication of Pólya's work and the project report from McMaster's is where we find Pacific Crest Software offering the software packages Point Five and PC:SOLVE. Both were systems created to help learners solve problems (see the **Role of Technology** section). After marketing Point Five for approximately six months, an important discovery was made: clients who used the software reported that they wished they had gained the level of problem solving expertise that the software helped them develop while they were still undergraduate or graduate students. Dan Apple, president of Pacific Crest recalls,

That's why we offered workshops on the problem solving process...the more workshops we held, the clearer it became that POINT FIVE and the problem solving skills it supported and built needed to be integrated into collegiate quantitative courses. By 1990, more than 500 colleges and universities had purchased a site license for PC:SOLVE (the upgraded version of Point Five), all in quantitative programs. In every case, the primary reason faculty had integrated PC:SOLVE into their courses was to target the problem solving process. (personal recollection)

Sharing his own skills in solving large-scale public systems problems (Apple, 1980), Apple developed *An Introduction to Problem Solving Using PC:SOLVE* (1990) to teach students how to identify, define, and solve problems by using the Problem Solving Methodology (PSM), which represented an amalgamation of research, practice, and personal expertise (the current version of this methodology is shown in Figure 1). In doing so, he learned that putting a methodology into the hands of students, though helpful, wasn't enough; students needed to learn how to use the methodology, and faculty faced the very real struggle of how to teach problem solving from within the context of their discipline in a way that worked. The McMaster summary of teaching practices in problem solving strongly suggested that something else was needed to improve students' problem solving performance. The Problem Solving Across the Curriculum Conferences (1990-1996) helped faculty share scholarship and practices in learning and problem solving, thereby creating that "something else."

Learning and Problem Solving: Interdependency

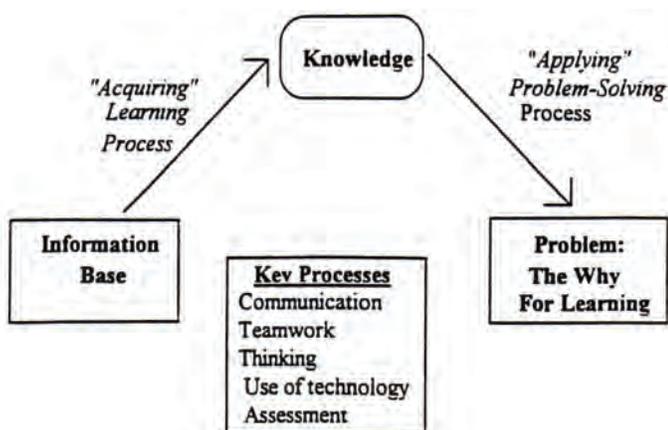
As noted in the **Learning Process Methodology** section, publication of *Learning Through Problem Solving* (Apple, Beyerlein & Schlesinger, 1992) was a formal result of the collaboration by faculty who had attended the 1990 conference. *Learning through Problem Solving* offered the Learning Process Model (a model of the learning process) and the Problem Solving Methodology (a model of the problem solving process). The relationship between these two processes is more than close; they are actually interdependent. The model in Figure 2 was presented in *Education as a Process* (Apple & Hurley-Lawrence, 1994), demonstrating that learning is the process of constructing

Figure 1 Problem Solving Methodology

Step	Explanation
1 Define the problem	Identify the gap between expectations and perceptions and clearly state the problem.
2 Identify key issues	Determine important issues associated with the problem.
3 Collect data and information	Collect and assess available information relevant to the problem; determine what information is missing.
4 Identify assumption	Clarify what assumptions are being made concerning the problem.
5 Break the problem apart	Separate the problem into smaller sub-problems.
6 Model sub-problems	Generate solutions for each sub-problem.
7 Integrate solutions	Integrate the solutions from sub-problems into the main problem.
8 Test and validate	Validate the solution; assess the quality of the solution.
9 Generalize the solution	Determine how to generalize the problem solution for use in other situations.
10 Communicate the solution	Present the solution in oral and/or written form along with documentation of the process

knowledge **in order to solve given problems**. Learning produces transferable knowledge (acquisition process) while problem solving is the sophisticated usage of this knowledge in a specific situation (application process).

Figure 2



Process Education Scholarship and Tools

Once we appreciate that learning and problem solving are wholly interdependent processes, we understand that nearly every aspect of Process Education is involved, to a greater or lesser extent, with problem solving. For example, every methodology can be reframed as an expression of the Problem Solving Methodology (see Figure 2), contextualized for an area of performance: the Communication Methodology allows us to solve the problem of miscommunication; the Reading Methodology allows us to solve the problem of inattentive or poor

reading; the Personal Development Methodology allows us to solve the problem of personal stagnation or lack of growth. The critical point is that problem solving, even when accomplished by applying a methodology, is the **application** of knowledge gained through learning. As such, it should not be surprising that the degree or level of knowledge required before a learner can successfully solve problems is “Level III Application” knowledge according to the *Levels of Learner Knowledge* (Bobrowski, 2007). Bobrowski states, this is where,

...the learner has the skill to apply and transfer the particular item of knowledge to different situations and contexts, can recognize new contexts and situations to skillfully make use of this knowledge, and has taken the time to generalize the knowledge to determine ways to apply it, testing boundaries and linkages to other information. In other words, a learner with Level III knowledge is able to solve problems.

It is for this reason that problem solving is Step 12 of the Learning Process Methodology (see the **Learning Process Methodology** section). During the problem solving step, Leise, Beyerlein, and Apple (2007) suggest that, “To enhance application of knowledge related to the learning objective, challenge yourself to solve more complex types of problems that are closer to those worked on by experts in the field.” What if a learner attempts to solve problems without having developed Level III knowledge? As demonstrated in *An Evaluation System that Distinguishes Among Levels of Learning in*

Engineering and Technology (Apple, Nygren, Williams, & Litynski 2002), without the requisite level of transferable knowledge, problem solving is elevated to research — a much more difficult challenge.

While much of the scholarship in the *Faculty Guidebook* is as pertinent to the topic of problem solving as it is to learning, several modules stand out as addressing problem solving and the teaching of problem solving skills from a more global perspective. These include *Overview of Problem Solving* (Morgan & Williams, 2007), *Problem-Based Learning* (Duncan-Hewitt, 2007), *Developing Working Expertise (Level 4 Knowledge)* (Nygren, 2007), and *Distinguishing Between Problem Solving, Design and Research* (Cordon & Williams, 2007).

Activity Design and Problem Solving

Problem solving is not only the process of applying knowledge gained through learning; it is a way of demonstrating understanding at the level of application/problem. That's why a challenge to solve problems is an important part of a high-quality learning activity (and thus the design of learning activities or curricula). Step 17 in the Activity Design Template (see the **Activity Design** section; Pacific Crest, 2008) is, "Problems to be addressed." This step is explained in *Designing Process-Oriented Guided-Inquiry Activities*:

These problems present new situations that require students to transfer, synthesize, and integrate what they have learned. The purpose is to move them to the problem-solving level of knowledge. The problems often have a real-world context, contain superfluous or missing information, have multiple parts, do not contain overt clues about the concepts needed to arrive at a solution, and may not have a right answer. (Hanson, 2007)

For this reason, the vast majority of Process Education curricula offer problems to solve, learning challenges, or opportunities to demonstrate one's understanding. Examples include,

- *Learning to Learn: Becoming a Self-Grower*: Problems to solve are presented at the end of every learning experience (Apple, Morgan, & Hintze, 2013).
- *Quantitative Reasoning and Problem Solving*: Problem solving projects are presented for each chapter (Ellis, Apple, Watts, Hintze, Teeguarden, Cappetta, & Burke, 2014).
- *Foundations of Chemistry*: Many activities contain problems that, "require learners to synthesize ideas,

transfer their learning to new contexts, and demonstrate their problem-solving skills" (Hanson, 2009).

Problem Solving in Curricula

The Problem Solving Methodology

Foundations of Problem Solving (Myrvaagnes, Brooks, Carroll, Smith, & Wolf, 1999) took the problem solving content from *Learning Through Problem Solving* and expanded it, including profiles (problem solvers, systems thinker, mathematical thinker, learner, and self-grower) as well as methodologies (10 in addition to the Problem Solving Methodology). The goal of the additional content was to support growth in quantitative reasoning as well as problem solving. By this time, the Problem Solving Methodology (as published in *Foundations of Problem Solving*) was the 10-step version used today and shown in Figure 1.

The *Student Success Toolbox* (Pacific Crest, 2011) offers numerous tools to support problem solving in the classroom, both for quantitative as well as qualitative contexts. The Problem Solving Methodology is well-represented among the set of resources and tools:

- Holistic Rubric for Problem Solving
- Problem Solving Methodology (see Figure 2)
- Example of the Problem Solving Methodology
- Applying the Problem Solving Methodology (blank form)
- Addressing & Avoiding Errors form
- Profile of a Strong Problem Solver
- Learning Skills for Problem Solving

The Problem Solving Methodology appears in Chapter 5 of *Foundations of Learning* (Redfield & Hurley Lawrence, 2009), "Problem Solving Skills." This chapter offers many of the tools also found in the *Student Success Toolbox* (Pacific Crest, 2011), but they are contextualized with student examples and models. Even as students see the Problem Solving Methodology at work, they are challenged to identify a problem in their own life (personal or academic) and to solve it by applying the methodology. Sample problems in *Foundations of Learning* range from the purely qualitative (needing to meet someone, being unsure of the exact location of the agreed meeting place, and being unable to reach the other person by phone) to strongly quantitative problems (three students sharing a two-bedroom apartment and needing to determine equitable ways to assign rooms and split the rent).

Experience 6, "Methodologies: Unlocking Process Knowledge" in *Learning to Learn: Becoming a Self-*

can be used to improve problem solving skills, the fundamental nature of the relationship between learning and problem solving means that problem solving informs every aspect of Process Education, not only its curricula, but its contexts, tools, and practices.

And conversely, studying and elevating practices in every aspect of Process Education has the potential to improve the teaching and performance of problem solving.

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Activity books contain disciplinary-focused learning activities of use both in and outside the classroom to help students become more active and engaged 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 understanding 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" discussion 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*

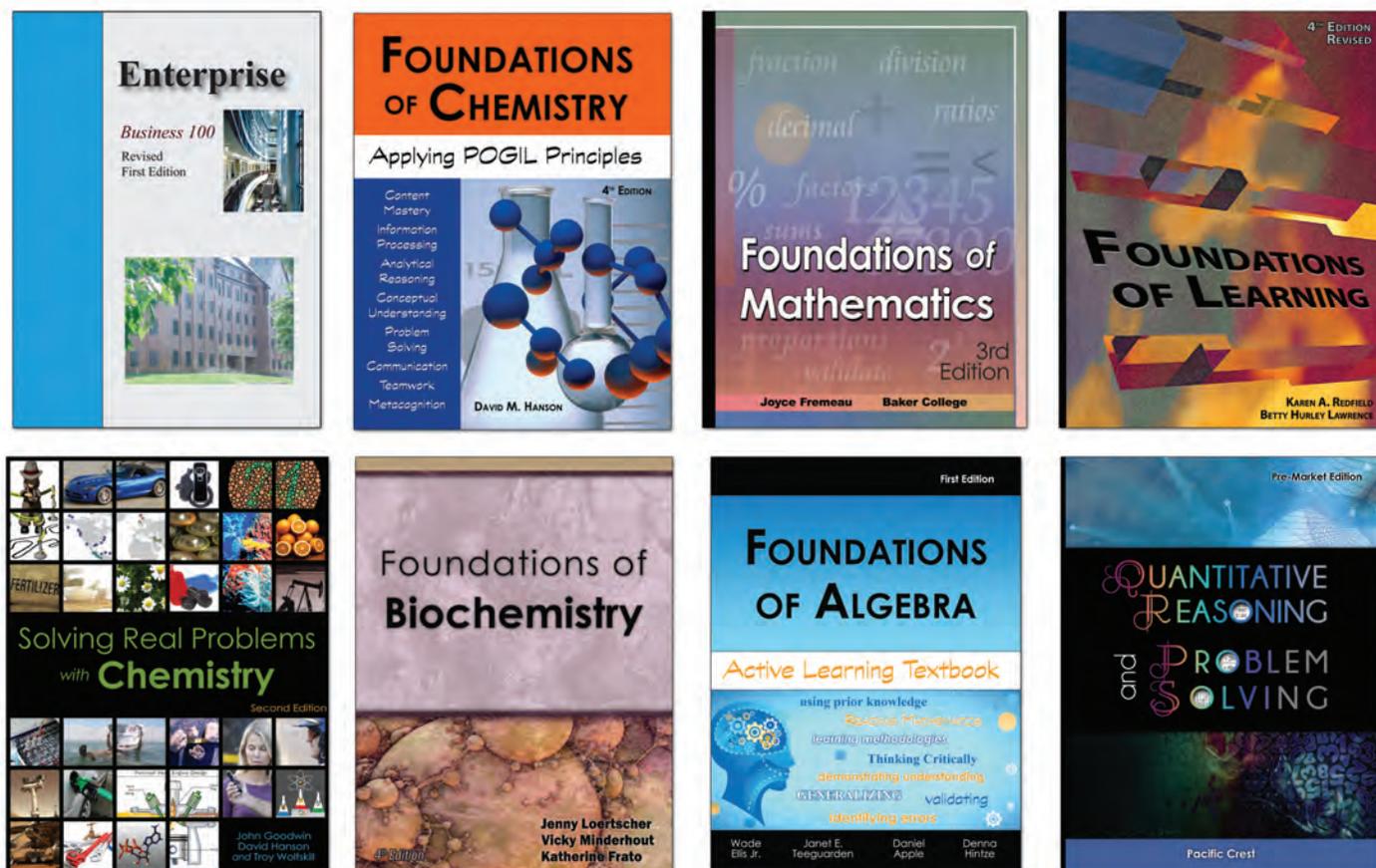
Pre-activity	In-class activity	Post-activity
<i>On My Own</i>	<i>In My Class</i>	<i>My Learning & Growth</i>
Purpose Objectives Discovery Exercise Readings Resources Exploration Questions Am I Ready for Class?	Why Learning Objectives Performance Criteria Plan Resources Models Critical Thinking Questions 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)



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The Classification of Learning Skills contains more than 250 transferable skills organized into cognitive, social, affective, and psychomotor domains. They are called learning skills because as these skills improve, so does learning performance.

In 1991 the Secretary's Commission on Achieving Necessary Skills (SCANS) report, sponsored by the U.S. Department of Labor examined the demands of the workplace and defined the skills needed for employment, ultimately identifying five areas of competency: Resources, Interpersonal, Information, Systems, and Technology, and a tripartite foundation of **basic skills**, higher order **thinking skills**, and **personal qualities**.

The skills that made up this foundation led to the inclusion of 26 learning skills in the first *Teaching institute handbook* (Apple, 1991; see Figure 1). In 1992 at the Teaching Institute held at Valparaiso University, a team of 40 faculty members added 34 more skills to the original 26, making a master list of 60 skills that had the potential to enhance learning performance. Later, a condensed list of "44 Skills for Life," organized into seven categories, was published in *Learning Through Problem Solving* (Apple, Beyerlein & Schlesinger, 1992). This "Skills for Life" list was again modified in *Teach for Learning - A Handbook of Process Education* (Pacific Crest, 1993) using eight categories.

Over the next few years, with the help of Teaching Institute participants, especially those in the Advanced Teaching Institutes, Pacific Crest continued to expand and organize this list of learning skills. With publication of the Taxonomy of Process Education in *Foundations of Learning* (Krumsieg & Baehr, 1996), the learning skills were organized into domains (cognitive, social, affective, and psychomotor), using a hierarchical scheme in each domain. The Taxonomy offered a total of 189 learning skills, organized each into one of the four domains (e.g.,

social), 14 process areas (e.g., communication), and 45 cluster areas (e.g., creating a message). The following year *The Classification of Learning Skills for Educational Enrichment and Assessment* (Apple, 1997) was published, in which 286 learning skills were organized into four domains, 13 process areas, and 50 cluster areas. This time *language development* was added to the *Classification* as the foundational skill area and *assessment skills* were added at the top of the hierarchy. In 1999 a revised expanded edition of the Classification of Learning Skills was presented in *Foundations of Learning* (2nd ed.) (Krumsieg & Baehr), this time with 292 learning skills organized into four domains, 15 process areas, and 50 cluster areas.

Learning Skills and the Faculty Guidebook

In 2004 the Classification of Learning Skills was updated again and presented to the engineering community with a focus on how to use learning skills from the cognitive domain in activity design, facilitation, and assessment (Beyerlein, Cordon, Davis, Leise, Apple). This scholarship overlapped with four years of refinement of the Classification of Learning Skills, as documented in the *Faculty Guidebook* modules *Classification of Learning Skills* (Apple, Beyerlein, Leise, & Baehr, 2007), *Cognitive Domain* (Davis, Beyerlein, Leise, & Apple, 2007), *Social Domain* (Leise, Beyerlein, & Apple, 2007), and *Affective Domain* (Duncan-Hewitt, Leise, & Hall, 2007). These modules present the rules and logic for including a learning skill in the Classification, along with the description of the levels of learner development for any given learning skill (see Figure 2). In this most recent iteration of the

Figure 1 Learning Skills in the First *Teaching institute handbook*

1. Observation	10. Reading	18. Analysis
2. Thinking	11. Use of time	19. Visualizing an idea
3. Prediction	12. Estimation	20. Discovering a concept
4. Setting goals and objectives	13. Understanding your value system and that of others	21. Experimentation
5. Modeling	14. Writing	22. Self-assessment
6. Synthesizing concepts	15. Using math tools	23. Decision making
7. Transferring concepts	16. Teamwork	24. Vocabulary
8. Articulating concepts	17. Understanding systems	25. Memorizing
9. Listening		26. Focusing

Classification of Learning Skills, we find the following (see also Figure 3):

- Cognitive domain:
5 process areas, 21 cluster areas, 94 learning skills
- Social domain:
5 process areas, 18 cluster areas, 86 learning skills
- Affective domain:
5 process areas, 16 cluster areas, 76 learning skills

Figure 2 Levels of Learner Development in Any Learning Skill

Level 5 Transformative Use	The skill is expanded and integrated with other skills so that it can be applied in new contexts that inspire the emulation of others.
Level 4 Self-Reflective Use	The skill can be self-improved and adapted to unfamiliar contexts with occasional advice from a mentor.
Level 3 Consistent Performance	The skill is routinely called upon and effectively applied in multiple contexts by the user, who consciously directs the effort.
Level 2 Conscious Use	The skill can be used proactively by a learner, but its use needs to be constantly encouraged and supported by a mentor.
Level 1 Non-Conscious Use	The skill appears on a reactive basis in response to an immediate need, but without awareness of self or others.

Learning Skills in Student Curricula

Foundations of Learning (4th ed.) (Redfield & Hurley Lawrence, 2009) integrates learning skills as part of every activity in the book as a way of improving students' learning performances. In addition, the learning skills are presented

in the context of the Theory of Performance (Elger, 2007) and students are challenged to identify five learning skills they want to develop and which they are willing to work on during the course to improve their learning performance. The Classification of Learning Skills itself is included as Appendix B in the book. *Learning to Learn - Becoming a Self-Grower* (Apple, Morgan, & Hintze, 2013) similarly integrates the Classification of Learning Skills into each learning experience, also prompting students to periodically assess their work in improving their selected learning skills.

Life Enrichment Skills

Leise (2011) arrived at a related set of skills called the Classification of Life Enrichment Skills which complement the Classification of Learning Skills in that they “are valuable for educators in their work to facilitate growth for learners with varied ways of being, developmental challenges, and life problems.” While the life enrichment skills are eminently useful, they are broader than learning skills in that they tend to integrate across multiple domains of learning skills and they do not exist within any hierarchical structure. An excerpt of life enrichment skills from the theme, “Developing Identity” is available in Figure 4.

Looking Forward

For all the work done with learning skills, there is still much to do: the psychomotor domain needs to be completed so that it offers as much richness and potential as the other domains; the roles that language development and assessment play as foundational and culminating skills need to be considered and developed further; and finally, we hope to one day offer a performance measure for each learning skill to help in its development and in measuring its growth.

Figure 3 The Current Classification of Learning Skills

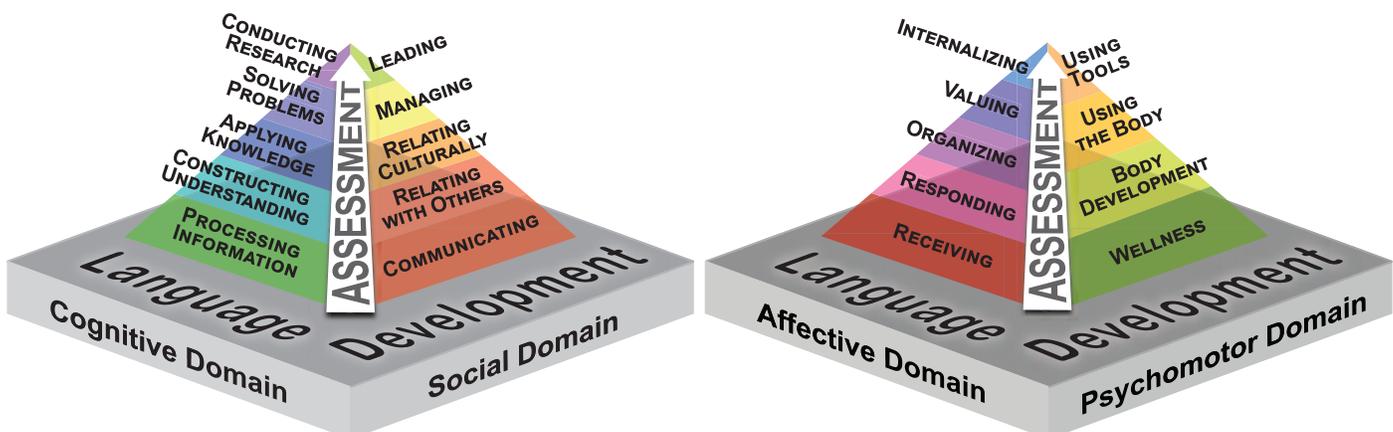


Figure 4 Life Enrichment Skills in the Theme Area “Developing Identity”

DEVELOPING IDENTITY	
Skill Clusters	Specific Skills
1. Establishing Identity	<ul style="list-style-type: none"> • Differentiating self from others—recognizing similarities and differences from others • Expanding self-concept—increasing awareness of multiple factors relevant to self • Increasing self-esteem—increasing confidence in self • Clarifying interests—discovering what is engaging • Becoming consistent with personal values—refining internal congruence • Striving for growth—moving toward an ideal self
2. Self-Regulating	<ul style="list-style-type: none"> • Monitoring internal reactions—noticing differences in effects of experiences • Generalizing self-control strategies—consciously maintaining control of personal reactions • Rationalizing unavoidable conflicts of conscience—moving on from irresolvable situations • Anticipating negative events—preparing to adjust affectively through imagination • Taking account of the influences of others—adjusting to social factors • Caring for self in stressful contexts—managing self-care in a consistent manner • Applying an assessment mindset—gaining performance insights from any feedback
3. Expanding Interpersonal Skills	<ul style="list-style-type: none"> • Enjoying social activities—engaging with others in play and recreation • Valuing others—avoiding exploitation and negative social comparisons • Exploring trust—learning who is dependable in ethical decision making • Learning from ethically ambiguous experiences—establishing values in real contexts • Being assertive—differentiating stubbornness and passivity from social effectiveness • Collaborating—working with others to achieve goals
4. Developing Motivational Control	<ul style="list-style-type: none"> • Persisting—maintaining focus despite disruptions and barriers • Articulating factors in past successes—recognizing how past challenges were managed • Monitoring progress with goals—recognizing when to change methods • Being flexible in strategies—changing methods in thoughtful ways to overcome barriers • Using strengths—selecting strategies based on self-knowledge from past performances • Generalizing from past successes—predicting how to increase the probability of future performances

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Technology can improve learning through the use of: software tools, the Internet (as a resource or laboratory), learning objects (systematically designed learning resources to enhance the learning process), and learning systems (systematically designed systems that facilitate the holistic development of learners with expanded opportunities, mechanisms, and means for enhanced learning).

Learning Objects, Learning Systems, and Online Learning

Pacific Crest Software, Inc. (later, Pacific Crest, Inc.) began its corporate life as a technology company offering among its catalog of products the modeling and problem-solving software Point Five and PC:SOLVE.

Point Five was an “interactive mathematical scratchpad that supports calculations, statistical analysis, modeling, graphics, and applications development” (Aarons, 1986). PC:SOLVE was a modeling language consisting of seven tools for use in problem solving: a mathematical toolbox, a relational data management tool, a graphing system, a modeling language, a report writing tool, a statistical analysis system, and a high-level programming language (Beyerlein, Ford, & Apple, 1993)

In the course of providing customer support to our end users, it became clear that many professionals who used these systems regretted not having had the same software resource to help them become more effective problem solvers when they were in college. Pacific Crest then decided to put our technology, teacher training, and resources to use in supporting higher education by helping those in educational settings improve learning and problem solving. Within five years, Pacific Crest built a large population of technology users (over 500 site-licensed colleges) who then built libraries of learning objects and learning systems for use in statistics, physics, calculus, and quantitative methods courses (Pacific Crest, 1992).

While so much of what we do is web- and browser-based, it is critical to recall that prior to 1990, all Internet browsers were text-only (Berners-Lee, 2015). In conjunction with the rapid evolution of the Internet and other technologies, the strictly text-based online learning systems of the 1990s gave way to more sophisticated course management systems (CMS). In response to the evolution of CMS technology, Pacific Crest offered the *Interactive Learning Systems Booklet* (Apple, 2000) to coach authors and designers in building learning systems that implemented and/or supported the principles of Process Education; this also included an analytical rubric for rating interactive learning systems (Apple, 2001). Shortly thereafter, Pacific Crest took the next step and created the Interactive Learning Systems Institute to help faculty and professional staff in

Point Five: A New Way Of Looking at Numbers

Better than spreadsheets for some scientific, statistical uses.

By RICHARD AARONS

The spreadsheet enabled millions of managers, academics, and engineers to look at numbers in an entirely new and efficient way. Now a product that holds promise of marking yet another milestone in the way we use PCs to examine numbers has been introduced by Pacific Crest Software: Point Five.

What Point Five does is easier than described, but basically it's an interactive mathematical scratchpad that supports calculations, statistical analysis, modeling, graphics, and applications development.

BASIC has an interactive calculator mode; for instance, you type: "31.5 * 4" and BASIC answers "252". Point Five works in a similar fashion but is vastly more powerful. It supports 150 functions—financial, statistical, graphical, matrix, and sensitivity—as well as handling basic data manipulation.

According to Dan Apple, president and founder of Pacific Crest Software: "We created Point Five to overcome users' frustrations with the cumbersome mechanics, limited functionality, and confusing structure of conventional programs. We wanted a tool that would be fast, flexible, and responsive—a tool that lets users structure a problem one way, take a look at the results, and then restructure it quickly for a different type of analysis.

The illustration shows the Point Five screen. The lower portion is the scratchpad, where formulas are entered and edited. Answers appear on the top

screen, scrolling up from the screen back.

Matrix Analysis

Point Five variables can represent a single data element or a two-dimensional table of data elements. A table variable can be used anywhere a single data element can be used, so a matrix of data can be manipulated with a single command or in a function or procedure. Obviously, matrix analysis is one of Point Five's strong features.

In a typical application, a user creates and loads variables, then manipulates these variables with constants or producer interest results that are posted above the scratchpad. The user always has an audit trail and can go back to edit an earlier expression.

A block of work can be marked as an application or subroutine to be used again in the current worksheet, transported to other Point Five worksheets.

Point Five makes use of the function keys for calling help screens, invoking the editor, and making full and partial copies to disk. It also uses several Alt-key combinations for word processing—copy, block-copy, and view-and-move; commands.

(These commands are used to move formulas around just as they are used to move words to phrases in a word-processing environment.)

On-disk Help

Point Five's on-disk help is good but not so great sensitive. If you can define your help needs at the command level (for example, seeking help for a specific statistical function), Point Five will take you directly to the appropriate help page. Otherwise, you are prompted to step through a series of point-and-click menus to get to the page you need.

Documentation comes in three parts and is excellent: it is well written, has good graphics, and—most important—offers thorough explanations of Point Five functions. A full-page tutorial, which can take 2 or 3 hours to complete, demonstrates Point Five's major features. There is also a lesson file on the distribution disk.

An important element of the documentation is a 100-page reference manual. Its first section covers Point Five's operational features, while the bulk of the manual is devoted to an in-depth explanation of each of the 150 functions.

Room for Improvement

While the core of Point Five is a good package, some of the peripheral features need help. The graphics portion is not as powerful as some of standard programs; the use of color is nil outside of graphics, and there's no way to import or export files to and from 1.25 worksheets. However, Point Five can read and write ASCII and DIF formats.

During our review, PC Magazine showed Point Five to three technical types—a technical writer who spends hours daily cranking numbers for reports, an aviation sales engineer, and a law enforcement statistician. All work with spreadsheets daily. They played with Point Five's material for about an hour and then tried their own applications.

Each of the three found Point Five has an improvement about it that makes on-the-fly calculations (the old paper-and-pencil method) much easier than they were. In the spreadsheet environment, the inferior statistical panel also proved that while Point Five does not pose a direct threat to Lotus's 1-2-3 and other spreadsheets, in the future, serious spreadsheet users may turn to Point Five for every-day analysis.

PACIFIC FILE

Point Five
Pacific Crest Software Inc.
887 NW Grant Ave.
Corvallis, OR 97330
(503) 754-1067
Last Price: \$195
Requires: 256K RAM, two floppy disk drives. Supports 800/80287 coprocessor.

to Share a fast, efficient calculating environment that supports mathematical variables and provides 150 math, scientific, statistical, and financial functions. A new way of looking at numbers, for some applications, better than a spreadsheet. Not easy to match.

Circle 489 on Reader Service Card

PC MAGAZINE • AUGUST 1988

higher education develop this same expertise with learning systems technology (Apple & Krumsieg, 2002).

Inspired by this work, Wolfskill and Hanson at Stony Brook University obtained grants to develop the LUCID system for learning and assessment (Learning and Understanding Through Computer-Based Interactive Discovery), publishing the results of their work in the article, *LUCID — A New Model for Computer-Assisted Learning* (Wolfskill & Hanson, 2001).

Building interactively upon the work of Wolfskill and Hanson, Apple and Krumsieg produced the specifications and methodologies for designing quality online courses (including hybrid or blended courses) and effective interactive learning systems, published in the *Interactive Learning System Handbook* (2002). In 2013, Stony Brook University expanded its use of the LUCID system to apply to all of its 1,500+ general chemistry students; it built a learning laboratory capable of accommodating 192 learners working simultaneously in groups of 3 (Stony Brook University, 2015; see Figure 1). It is worth noting that this lab looks very similar to the lab described in the article, Developing a Laboratory for Process Education (Evans, 1998).

Institutes Online

Since the 1990s, Pacific Crest has offered a variety of professional development institutes at physical campuses throughout the United States, bringing faculty together for intensive workshops focused on different aspects of Process Education. In 2011, a version of the Teaching Institute was first made available online and presented at the 2012 Process Education conference in a poster session titled, *The Teaching Institute from Pacific Crest: Taking it Online* (Hintze, 2012; see Figure 2).

In 2014, Pacific Crest adapted *Learning to Learn: Becoming a Self-Grower* (Apple, Morgan, & Hintze, 2013) as an online course, offering a version for students as well as a version for instructors or mentors to work with as part of the training for a learning to learn camp. Another version of this same online course was created and first used in 2014 to help train faculty to facilitate the improvement of learning and academic performance in students who were on academic probation or at risk for dismissal.

The current Online Teaching Institute (Pacific Crest, 2015; see Figure 3) is web-based, runs on a Moodle platform, and makes use of interactive discussion forums, interactive forms, image map navigation, online quizzes, and linked and embedded readings. It challenges participants to explore how technology affects the practices of Process

Education (e.g., in one activity, participants are asked to envision and describe online adaptations of more familiar face-to-face learning interventions); it also challenges them to explore new and different tools in order to improve their ability to plan, collaborate, report, and learn (Pacific Crest, 2015). While the virtual environment may be more inviting and user-friendly than what was first offered nearly 23 years ago, the goal of any interactive learning system used to deliver a Process Education-based learning experience remains exactly the same: to design and use technology so that it best implements and/or supports the principles of Process Education.

Figure 1 The Active Learning Classroom, Frey Hall (© 2016 Troy Wolfskill)



Figure 2

Announcements

The Analytic Rubric for Disciplinary Writing Assessment is available for use during this Teaching Institute. [Click to view or use.](#)
Results files: [HTML](#) or [CSV](#)

eFGB usernames & passwords (by team):

Team	1	2	3	4	5	6
Username	ctul1	ctul2	ctul3	ctul4	ctul5	ctul6
Password	ctul1	ctul2	ctul3	ctul4	ctul5	ctul6

Revised Course Schedule (5/18/12)

WEEK	ACTIVITY	WEEK	ACTIVITY	WEEK	ACTIVITY
WEEK 1	1. Preparing for a Teaching Institute	WEEK 3	7. Levels of Learning and Elevating Learning	WEEK 5	13. Facilitating Online Learning
	2. Transformation of Education		8. Learning Skills		15. Productive Learning Environments
	3. Process Education				
WEEK 2	4. Teams and Cooperative Learning	WEEK 4	10. Introduction to Assessment	WEEK 6	17. College-wide Educational Philosophy
	6. Team Reflection		11. Comparing Assessment & Evaluation		

Figure 3

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The activity design methodology provides the critical steps for systematically constructing a learning experience that supports the learning cycle (Learning Process Methodology) so that learners can effectively meet the intended learning objectives and performance criteria in an efficient manner.

A Methodology for Designing Learning Activities

The community of practitioners involved in the Problem Solving Across the Curriculum (PSAC) conference was interested in active learning and therefore engaged in the development of activity books — a common practice in the early 1990s (Kramer & Beery, 1990). In the development of their learning activities, this community incorporated the use of PC:SOLVE, a modeling language consisting of tools for use in problem solving. This was a strategy for improving student understanding of key concepts in a course, such as those seen in *Calculus with Analytical Geometry* (Swokowski, 1990).

Following the development of the Learning Process Model (Apple, 1991), these Process Education learning activities were comprised of standard components: models, critical thinking questions, and application challenges (Apple, Beyerlein & Ford, 1993). The first formal Activity Design Methodology, was published in the 1995 *Teaching institute handbook* (Apple); it closely followed the Learning Process Methodology and offered 14 steps for creating high-quality learning activities:

1. Identify the focus
2. Create the model
3. Assign a title
4. Write a “why” statement
5. Identify learning objectives
6. Write performance criteria
7. Create critical thinking questions
8. Identify resources and information
9. Create a glossary
10. Write a plan for completing the activity (meeting the learning objectives)
11. Create skill exercises
12. Develop an assessment component for the activity
13. Create problem-solving exercises
14. Provide a research project

The same handbook also provided information on how to write three types of critical thinking questions (directed, convergent, and divergent) and included an activity template that modeled the organization and presentation

of a learning activity. That model is still the basic structure used today in a wide range of Process Education activity books.

Learning Activities and Levels of Learning

The research pioneered by Bloom, Engelhart, Furst, Hill, and Krathwohl (1956), focused on levels of learning and informed the 1998 *Teaching institute handbook* (Apple & Krumsieg) and emphasized that activities needed to be designed so that learners achieve each level of knowledge before moving on to construct the next level:

- Level 1: **INFORMATIONAL** The learner can talk about a concept, process, tool, or context in words and can regurgitate definitions or descriptions.
- Level 2: **KNOWLEDGE** The learner is able to construct a certain degree of comprehension about a concept, process, tool, or context.
- Level 3: **KNOWLEDGE SKILL** The learner has the skill to apply and transfer the particular item of knowledge to different situations and contexts.
- Level 4: **PROBLEM SOLUTION** The learner has the ability to integrate the knowledge skill with his/her other knowledge skills to produce a generalized problem solution.
- Level 5: **NEW KNOWLEDGE** The learner, who is now defined as a researcher, can develop knowledge to a new level of understanding. Through the use of lateral thinking, the researcher makes new linkages among concepts and problem solutions which have not been seen before.

This research was expanded during the Advanced Teaching Institute held at Madison Area Technical College in 2000, where the methodology for elevating knowledge from Level 1 to Level 3 was designed (Pacific Crest, 2000). This methodology was formalized and published in the *Faculty Guidebook* module *Elevating Knowledge from Level 1 to Level 3* (Nygren, 2007b) and is shared in Figure 1.

Making the relationship between activity design and levels of learning even more explicit, *An Evaluation System that Distinguishes Among Levels of Learning in Engineering and Technology* (Apple, Nygren, Williams, & Litynski,

2002) helpfully presents the levels of learning as they specifically relate to the components of a learning activity, with special emphasis of how to structure problem-solving challenges that elevate learner knowledge to Level 4.

A Handbook and the Guidebook

A major milestone for Process Education was the creation of an *Activity Design Institute Handbook* that formalized and brought together the Learning Process Methodology, levels of learning, and a 21-step comprehensive Activity Design Template for faculty that can also be used as a methodology for designing Process Education learning activities (Apple & Krumsieg, 2007; see Figure 2).

The scholarship behind the *Activity Design Handbook* contributed to and leveraged from the *Faculty Guidebook* project, which included several modules directly related to activity design. Table 1 correlates these modules with the steps in the Activity Design Template. Of global interest to the design of learning activities are *Overview of Learning Activities* (Wasserman, Davis, & Astrab, 2007) and *Designing Process-Oriented Guided-Inquiry Activities* (Hanson, 2007a). The module, *Assessing Learning Activities* (Loertscher & Minderhout, 2007) provides critical information and two useful tools that allow faculty to assess not only the **design** of an activity, but also its **impact** in the classroom. Also useful for measuring the effectiveness of an activity is *Elevating Knowledge from Level 1 to Level 3* which, in addition to providing the methodology for constructing knowledge, also includes the table, “Levels of Knowledge Across Knowledge Forms,” which provides descriptions of what a learner should be capable of doing at each level of learning.

Evolution of the Process

Over the past decade, improvements in available technology, the proliferation of open source content and software, and the common practice of bundling learning

activities with additional resources have made it easier than ever to enliven and enrich learning activities. The design process itself hasn’t changed; what has changed is what constitutes the contents and implementation of specific steps in the Activity Design Template/Methodology:

4. Learning Model/Instrument
11. Pre-Activity
13. Information and Resources
18. Technology

Learning models can now include interactive animations, such as the interactive simulation of Hooke's Law offered on the resources site for *Foundations of Organic Chemistry* (Bucholtz, 2015; the model is available on the secure course site, but is also available at <https://phet.colorado.edu/en/simulation/mass-spring-lab>), and flash animation of Gel Filtration Chromatography for *Foundations of Biochemistry* (Loertscher, Minderhout, & Frato, 2015; https://www.gelifesciences.com/gehcls_images/GELS/Related%20Content/Files/1314774443672/litdoc29091645_20140915112231.swf).

Foundations of Mathematics (Freneau, 2006) was the first activity book to integrate pre-activities as a way to help students prepare for in-class activities. *Foundations of Learning* (4th ed.) (Redfield & Hurley Lawrence, 2009) modeled how that content can fully support the learning process by providing a package of reading to be done prior to the classroom activity. In *Learning to Learn: Becoming a Self-Grower* (Apple, Morgan, & Hintze, 2013), the learning activity was expanded into a learning experience consisting of three activities to be done: before class, during class, and after class. This strategy was used as a way to make the most effective possible use of learner time.

In *Quantitative Reasoning and Problem Solving* (Ellis, Apple, Watts, Hintze, Teegarden, Cappetta, & Burke, 2014), learning activities took advantage of web-based learning objects, information and resource websites, real-

Figure 1 Methodology for Elevating Knowledge

1. Establish and solidify an informational base (Level 1).
2. Identify the cornerstones for the knowledge. Knowledge is built upon a foundation of prior knowledge (Level 2).
3. Identify the key inquiry questions for comprehension and key issues for constructing the knowledge (Level 2).
4. With the framework in place, test the conditions of the structure; use critical thinking to explore the assumptions or logic of the knowledge model (Level 2).
5. Transfer and apply the knowledge to a familiar context to enrich understanding (low Level 3).
6. Transfer and apply the knowledge to another context that is similar (low Level 3).
7. Transfer and apply the knowledge to a context that is some distance from the original context (Level 3).
8. Transfer and apply the knowledge in a totally unfamiliar context with the teacher acting as consultant (Level 3).
9. Independently make a generalization of the new knowledge (Level 4).

Figure 2 Activity Design Template for Faculty

1. Identify purpose	9. Key Critical Thinking Questions
2. Title	• Directed
3. Type of Knowledge Item	• Convergent
• Concepts • Process • Tool	• Divergent
• Context • Way of Being	10. Plan/Tasks for Execution of Activity
4. Create Learning Model / Instrument for the Knowledge Item	11. Pre-Activity
• Interactive Model (Concept)	12. Sequencing Critical Thinking Questions
• Methodology (Process)	13. Information and Resources Needed
• Template (Tool)	14. Prior Knowledge Required
• Story/Case Study (Context)	15. Glossary
• Profile (Way of Being)	• Previous Terms • New Terms
5. Why? (What?, Big Picture, Relevance)	16. Skill Exercises
6. Learning Objectives	17. Problems to Be Addressed
7. Performance Criteria with attributes	18. Technology to Be Used
8. Learning Skills	19. Validation/Reflection of Learning
• Cognitive • Social	20. Self-Assessment
• Affective • Psychomotor	21. Closure

Table 1 Steps from the Activity Design Template Correlated with *Guidebook* Modules Pertinent to Activity Design

Step	Faculty Guidebook Module
3. Type of Knowledge Item	Forms of Knowledge and Knowledge Tables (Quarless, 2007)
4. Create the Learning Model / Instrument for the Knowledge Item	Methodology for Creating Methodologies (Smith & Apple, 2007)
9. Key Critical Thinking Questions	Writing Critical Thinking Questions (Hanson, 2007)
12. Sequencing Critical Thinking Questions	Bloom's Taxonomy — Expanding its Meaning (Bobrowski, 2007) Elevating Knowledge from Level 1 to Level 3 (Nygren, 2007b)
17. Problems to Be Addressed	Developing Working Expertise (Level 4 Knowledge) (Nygren, 2007a) Overview of Problem Solving (Morgan & Williams, 2007)
18. Technology to Be Used	Overview of Effective Learning Tools (Nancarrow, 2007)
19. Validation/Reflection of Learning	Self-Validation of One's Learning (Armstrong)

world examples and data, and web-based or common software tools in order to create a textbook that is 50 percent online. This is not technology for the sake of technology; while the “bells and whistles” available to activity designers may be exciting and serve to effectively

capture learner interest (a good thing), the actual benefit of technology integrated in a learning activity must be measured with respect to how well that technology supports the learning cycle and how fully it can help learners realize an activity's learning objectives.

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The Course Design Methodology (CDM) is a set of steps used to produce a course, including the target/goals, means of achieving them, and a system for measuring performance so that the course’s intended learning and growth outcomes are achieved.

Shifting Focus: From Technology to Course Design

As a software company in the 1980s, one of Pacific Crest’s primary goals was to help faculty enhance classroom learning with the use of technology; “...to help schools improve educational outcomes by improving the process by which students learn” (Pacific Crest Software, 1992). To justify the use of technology we needed to provide evidence that more significant learning occurred in a course that incorporated the technology compared with a course that did not. It was clear that technology could be used to improve student problem solving skills (see article section, **Role of Technology**); but justifying its inclusion in a course required us to answer the question, “What are the components of a course that produce not only significant learning, but also **evidence** of that learning?” In short, technology was only part of the answer; if the overarching goal was to improve educational outcomes by improving the process by which students learn, then a far larger and more critical issue was to determine what comprised an optimally designed course.

In the process of designing the structure and content of a course that not only produces significant learning but also evidence of that learning, the Course Design Methodology was developed (see Figure 1).

Origin and Refinement of Steps in the Course Design Methodology

Many steps in the development or refinement of the CDM evolved the design process to its current state. As will become obvious, the course design process was heavily influenced by other research areas of Process Education; scholarship focused on a variety of topics which led to the addition of new steps, the revision of existing steps, or the connection of steps within the methodology.

In 1993, Beyerlein, Ford, and Apple outlined the course design process in their paper, *Using a Learning Process Model to Enhance Learning with Technology*. They noted that the Learning Process Model contains steps for identifying prerequisites (pre-assessment), selecting key

Figure 1 Course Design Methodology

ANALYSIS	DEVELOPMENT
<i>Learning-Outcome Driven Instructional Design</i>	<i>Construction and Selection (con’t)</i>
1 Construct professional behaviors.	12 Allocate time across the themes.
2 Identify course intentions.	13 Sequence the activities across the term.
3 Construct measurable learning outcomes.	14 Create individual activities from a prioritized list.
4 Construct a knowledge table.	15 Enhance activities by using technology.
DESIGN	16 Ask peers to review the activities you create.
<i>Activities/Knowledge to Support Learning Outcomes</i>	17 Produce key performance criteria.
5 Choose themes.	18 Locate or build key performance measures.
6 Create the appropriate methodologies.	19 Design a course assessment system.
7 Identify a set of activities.	20 Design a course evaluation system.
8 Identify a set of specific learning skills for the course.	21 Design a course syllabus.
DEVELOPMENT	IMPLEMENTATION
<i>Construction and Selection</i>	<i>Facilitating Learning</i>
9 Identify activity preference types.	EVALUATION AND ASSESSMENT
10 Match the activity types with the chosen activities.	<i>Instruction that Learns from Itself</i>
11 Choose the in-class and out-of-class activities.	

concepts, producing a concept map, building concept models, constructing skill exercises, and integrating problem solving projects. The model was integrated into *Teach for Learning — A Handbook for Process Education* (Pacific Crest, 1993) and was used in Pacific Crest's Teaching Institutes to help faculty create learning opportunities (courses and activities) that strongly supported the learning process.

It is important to note that the learning process was not assumed to be implicit nor was it considered to be a function wholly in service to disciplinary content. Nearly from the beginning, the assumption was made that, as students became more accomplished learners, their performance as learners in and with any disciplinary context would likewise improve (see article section, **Learning to Learn**). A respect for process, specifically the learning process, is therefore maintained even as a disciplinary context for that process is supported through learning activities, course materials, or program curricula.

At the course level, the selection of the most important concepts became the basis for **constructing a knowledge table** (CDM Step 4), and many of the steps of the Learning Process Model were critical to the evolution of the **activity design process** (Step 14).

During the Teaching Institutes in 1993, concept maps were used as tools to help faculty **sequence learning activities** (Step 13). The handbook for these Teaching Institutes also offered an assessment guide to help faculty measure progress in learning by “think(ing) about **assessment of students’ learning processes in a more organized way**” (Step 19) (Pacific Crest, 1993). In 1995, Step 14, **create individual activities from a prioritized list**, was advanced with the creation of a methodology for designing process-learning activities, where the forms of knowledge were also identified as a way to **categorize knowledge items** (Step 4) (Pacific Crest).

Taking Cues from Curriculum Design

The Course Design Methodology was significantly advanced with materials and experiences from the Curriculum Design Institutes (Apple & Krumsieg, 2001; see also the article section, **Professional Development**); the process of designing high quality curricula is very similar to that of designing a high quality course, especially with re-

spect to design specifications and supporting activities that achieve learning outcomes.

We discovered that transformational learning requires behavioral change, and as we clarified this we developed Step 1 of the CDM: **construct professional behaviors**. The identification of course learning objectives became part of Step 2: **identify course intentions**. The development of a methodology to **define learning outcomes** became the foundation of Step 3. The structure and presentation of the **knowledge table** (Step 4) became more refined and the identification of **key themes** for the curricula became the equivalent step for a course design (Step 5). As the methodology for creating methodologies was developed, this thinking supported the creation of a variety of curricular activities and also supported Step 6 of the CDM: **create appropriate methodologies**. Step 7: **identify a set of activities** is based on defining a course as consisting of learning activities. Step 8: **identify a set of specific learning skills** evolved from comfortably blending the learning process with disciplinary content and carefully selecting the 15 most appropriate **learning skills** from the Classification of Learning Skills. Step 9 came from the idea that a curriculum or course should offer a **variety of types of learning activities** and that these activities correlate to general content and types of knowledge.

We found that it is helpful to construct an activities table to better organize and structure the content of a curriculum or a course and to thereby more easily **match an activity’s content with activity types**, determine which activities work best **inside or outside of class**, **allocate time across themes**, i.e., align each activity to a specific theme, and to appropriately **sequence the activities (Steps 10, 11, 12, and 13)**. Step 8 was also more fully supported and represented in the activities table by including three **learning skills** (of the 15 previously chosen) to intentionally develop during each activity. Figure 2 shows how these steps of the CDM correlate to the structure of a sample activities table.

Deliberate Focus on Courses

The Course Design Methodology was completed in order to fully support a *Course Design Institute* (Apple, Krumsieg & Beyerlein, 2006). The steps mentioned to this point give us a strong course with identified learning outcomes and purpose-built activities. Obviously lacking are the criteria

Figure 2 Sample Activities Table (excerpted from *Foundations of Learning Curricula/Course*)

Activity	Type & Venue	Knowledge Table Items	Theme	Learning Skills	Purpose
1.1 Building Learning Communities	Collaborative Learning (In-class)	Tool: Interview response Form Context: Educational goals	Collaboration	taking an interest in others, attending, recording	Create an interactive learning environment that is responsive to student needs
1.2 Analyzing a Course Syllabus	Guided Discovery (Outside class)	Tool: Syllabus Context: Educational goals	Personal & professional development	clarifying expectations, inquiring, prioritizing	Develop shared understanding of course expectations and procedures
2.1 Creating your Life Vision Portfolio	Portfolio Building (Outside class)	Process: Planning a portfolio Tool: Life Vision Portfolio worksheet	Personal & professional development	prioritizing, committing to future, defining purpose	Create an organizational structure for creating and maintaining a vision portfolio

Table 1 Faculty Guidebook Modules and Other Scholarship Correlated with Steps in the Course Design Methodology

Methodology Step	Scholarship	
	<input type="checkbox"/> Faculty Guidebook Modules (all 2007)	<input type="checkbox"/> Other
Overview	<i>Overview of Instructional Design</i> (Davis) <i>Methodology for Course Design</i> (Davis)	
1. Construct professional behaviors.	<i>Long-term Behaviors</i> (Ellis)	
3. Construct learning outcomes.	<i>Learning Outcomes</i> (Beyerlein, Davis & Apple)	
	How Universal are Capstone Design Course Outcomes? (Beyerlein, Davis, Thompson, Gentili & McKenzie, 2003)	
	Deriving Design Course Learning Outcomes from a Professional Profile (Davis, Beyerlein & Davis, 2005)	
4. Construct a knowledge table.	<i>Forms of Knowledge and Knowledge Tables</i> (Quarless)	
	Development of Knowledge Tables and Learning Outcomes for the Introductory Course in Transportation Engineering (Bill, et al., 2011)	
6. Create appropriate methodologies.	<i>Methodology for Creating Methodologies</i> (Smith & Apple)	
8. Identify specific skills for the course.	<i>Classification of Learning Skills</i> (Apple, Beyerlein, Leise & Baehr)	
	Improving the Professional Skills of Engineering Graduate Students through Capstone Project Mentoring in IEWorks (Odom, Gerbus, Cordon, Beyerlein & Rink, 2002)	
	Integrated Design Engineering Assessment and Learning System: Piloting Teamwork and Professional Skills Development Instructional Materials (Trevisan, et al., 2012)	
9. Identify activity preference types.	<i>Overview of Learning Activities</i> (Wasserman, Davis & Astrab)	
13. Sequence the activities.	Methodology for Selection, Sequencing, and Deployment of Activities in a Capstone Design Course Using the TIDEE Web-based Assessment System (McCormack, et al., 2009)	
14. Create individual activities.	<i>Designing Process-Oriented Guided-Inquiry Activities</i> (Hanson)	
	<i>Writing Critical Thinking Questions</i> (Hanson)	
16. Ask peers to review the activities.	<i>Assessing Learning Activities</i> (Loertscher & Minderhout)	
17. Produce key performance criteria.	<i>Writing Performance Criteria for a Course</i> (Hinton)	
18. Locate/build performance measures.	<i>Fundamentals of Rubrics</i> (Bargainnier)	
	Creating and Using a Performance Measure for the Engineering Design Process (Beyerlein, et al., 2003)	
19. Design a course assessment system.	Assessment Framework for Capstone Design Courses (Beyerlein, Davis, Trevisan, Thompson & Harrison, 2006)	
	Assessing Professional Skill Development in Capstone Design Courses (McCormack, et al., 2011)	
20. Design a course evaluation system	<i>Course Grading Systems</i> (Lawrence, 2007)	

and measures we need to include if we want to provide the “evidence of learning” that was identified as being part and parcel of a high quality course. What had been a methodology for **creating performance criteria** for a course formally became Step 17, and Step 18 emerged from the identification and **creation of performance measures**

as a way to determine whether learning outcomes and performance criteria were being met.

The finishing touches consisted of adding steps in order to,

- Determine if each activity could be **strengthened with the use of technology** (Step 15)

- Reap the benefits of **peer assessment of activities** before implementation (Step 16)
- Enable performance in the course to be constantly improved through the design and implementation of a **course assessment system** (Step 19)
- Meet any evaluation-based needs (grading and grades) through the design and implementation of a **course evaluation system** (Step 20)
- Trigger creation of a **course syllabus** (presentation of selected aspects of the course design to students) (Step 21)

The *Course Design Handbook* (Apple, Krumsieg & Beyerlein, 2006) provides an example of each of the steps as well as a presentation model of an activities table.

Scholarship on Course Design

Section 2.4 of the *Faculty Guidebook* is titled, “Instructional Design” and between the modules in this section and modules elsewhere in the book, there are many that further support or advance the course design process (Beyerlein, Holmes & Apple, 2007). These are correlated with steps in the CDM in Table 1. In addition to what is avail-

able in the *Faculty Guidebook*, there is much scholarship to support the course design process; numerous articles are also shown in Table 1.

While courses are usually designed for a specific context, foundations and capstone courses are transferable across disciplines. The design of processes for each of these are discussed in additional modules: *Designing a Foundations Course* (Newgren, 2007) and *Creating a Capstone Course* (El-Sayed & Beyerlein, 2007). A strong example of a course design document generated through the application of the Course Design Methodology is available for *Foundations of Learning* (4th ed.) (Redfield & Hurley Lawrence, 2009) at www.pcrest2.com/fol4/cd.htm

Lessons are still being learned about how to strengthen each of these steps to improve course quality in order to make possible both increased learning as well as stronger evidence of that learning. Additionally, many of the steps in the Course Design Methodology have become the focus of research in their own right, especially transformational learning, learning outcomes, performance criteria, learning activities, learning skills, performance measures, assessment systems, and methodologies.

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The Academy of Process Educators is a professional learning community that promotes engagement, support, and collaboration among educators who are focused on transformational change in education based on Process Education principles.

Getting to the Beginning

During the second annual Problem Solving Across the Curriculum (PSAC) conference in 1991, there were several discussions about formalizing collaboration among the participating institutions. That same year, as part of the first Teaching Institute, an evening was set aside to discuss the possibility of starting a non-profit corporation for inter-institution collaboration, the Institute for Innovation in Instruction. While there was a push to recruit members during the 1992 PSAC conference, (Beery & Beyerlein, 1992), the effort did not come to fruition. The desire for increased collaboration remained, however, and the idea continued to percolate within the PSAC community through the rest of the 1990s (Dan Apple, personal recollection).

In June of 2000, Stony Brook University hosted and led a Faculty Development Consortium Exploratory Meeting on their New York Campus in which 17 colleges participated (Stony Brook University, 2000a). The participants collaborated on and published a white paper outlining a Faculty Development Consortium (Stony Brook University, 2000b). This white paper was used for the next meeting of the Consortium in the Adirondacks in January 2001 (Stony Brook University, 2001). The effort focused on gaining commitment from institutions to write and submit a five-year grant to meet the following objectives:

1. Help new faculty members in higher education become very effective in teaching, mentoring, researching, and serving their communities.
2. Improve the mentoring skills of faculty and staff to facilitate the successful transfer of first-year and transfer students from previous educational environments into their institution and culture.
3. Develop the faculty development skills of a team of faculty from the Consortium who wanted to serve higher education by facilitating change at member institutions.

The Consortium was never formalized, but it did lead to additional discussions about a Process Education-driven Science, Mathematics, Engineering, Technology (SMET) Consortium (Western Michigan University, 2002).

The Association of Research-Based Practitioners in Process Education

In 2003, focus shifted to a major scholarship project: The *Faculty Guidebook*. Between 2003 and 2007, under the leadership of Steve Beyerlein and Carol Holmes, four editions of the *Faculty Guidebook* were produced (Beyerlein, Holmes, & Apple, 2007), with many of the individuals who had been involved with PSAC and the Consortium authoring and collaborating on *Guidebook* modules. A face-to-face authoring event occurred annually during semester breaks in January and it was through these collaborations that the desire to have a formal community of Process Educators was rekindled.

The community was initially formed when participating faculty members shared scholarship during a conference at Elmhurst College, June 28–29, 2004 (ARBPPE, 2004) under the guise of the Association of Research-Based Practitioners in Process Education (ARBPPE; see Figure 1). A planning meeting followed at Elmhurst, in December 2004, and the Association held a Process Education Research Conference in July, 2005 at Madison Area Technical College (MATC) in Madison, Wisconsin. This conference established a blueprint for the combination of active learning plenary and workshop sessions which has characterized all Process Education conferences since then.

The First Process Education Conference

Institutions and individuals who were interested in creating a more formal community of Process Educators met on February 11–12, 2007 at MATC and planned the first Process Education conference to take place July 11–13, 2007 at the University of the District of Columbia. The conference theme was to be *Student Success Through Faculty Success*. The program cover is shown in Figure 2.

During the two days following this conference, participants developed the initial Academy bylaws and strategic plan; they agreed on the structure and the name of the organization, and determined a six-month action plan, culminating in a January 2008 meeting at Brevard Community College in Florida. Joann Horton and Jackie El-Sayed spearheaded this effort.

The Strategic Plan 2007–2012 (Academy of Process Educators, 2008) was adopted at this meeting; it outlined the core values, vision, and mission of the Academy and set out the following goals:

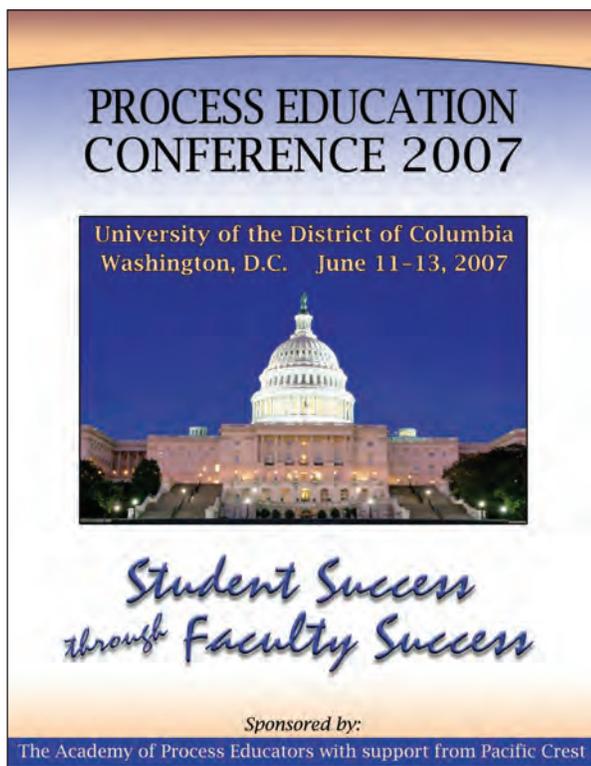
1. To publish an international journal on Process Education
2. To consistently deliver an increasingly meaningful annual conference with proceedings
3. To be a meaningful professional development forum for collaboration and educational innovation
4. To have an effective leadership team in place to guide operations
5. To implement the strategic plan on a consistent basis
6. To recruit, engage, support, and renew Academy members
7. To establish resources for the academy to be financially self-sufficient.

The participants also finalized the bylaws which set up a board of directors, specified their duties, and identified a slate of officers to be elected at the summer 2008 conference.

Figure 1 Logo for the Association of Research-Based Practitioners in Process Education (ARBPPE)



Figure 2



Kathy Burke agreed to work on the incorporation of the Academy in the State of New York (incorporation date: February 15, 2008), and set up a bank account in Cortland, New York. Pacific Crest helped offset the startup costs through a \$5,000 grant. Additional funding came from an individual membership fee of \$50, and the summer conference registration fee, thus ensuring the financial solvency of the organization.

The International Journal of Process Education (IJPE)

At the meeting at Brevard, Jackie El-Sayed agreed to become the editor of the *International Journal of Process Education* and plans were made to publish the inaugural edition of the journal in two years' time, at the 2009 Conference. As of 2015 the *Journal* has published 47 articles, and under the current leadership of Kathy Burke, will be publishing its eighth annual volume in 2016 (Academy of Process Educators, n.d.).



Early Conferences

The second annual Process Education Conference was held July 16–18, 2008 at Hinds Community College, Raymond, Mississippi with the theme: *Striving for Quality: Aligning and Implementing Continuous Improvement in Higher Education* (see Figure 3).

During the business meeting part of the conference, bylaws and the slate of officers were approved (Academy of Process Educators, 2012a; Academy of Process Educators, 2015a). Highlights of this conference included the inaugural Hall of Innovation, where members could showcase exciting practices in a poster session, and a day-long kick-off POGIL workshop. Future conferences have

Figure 3



Figure 4



continued the practice of showcasing the Hall of Innovation and holding kick-off workshops (generally much shorter than a full day). At the conclusion of the conference, the Academy held a two-day meeting during which plans were made for publishing the first edition of the *IJPE*. Treasurer Peter Smith agreed to work on obtaining 501(c)3 status (non-profit). Webmaster Denna Hintze was tasked with securing the domain name www.processeducation.org and setting up the Academy website which was accomplished in September, 2008.

The 2009 annual conference was held July 8–10 at Gaston College in Dallas, North Carolina, with the theme: *Measuring Success in Higher Education* (Academy of Process Educators, 2009; see Figure 4). At the Academy business meeting, the inaugural edition of the *International Journal of Process Education* (Academy of Process Educators, June 2009) was celebrated and a new board of directors was elected. Peter Smith was given a surprise Outstanding Service Award for his work in preparing and submitting the paperwork for the Academy 501(c)3 status, the application for which was approved by the IRS on August 30, 2009. The Academy held a follow-up meeting on July 11 when they discussed plans for the next conference, the next issue of the *IJPE*, and the

projected 2010 research agenda. They also approved an Academy brochure (see Figure 5). In October 2009, Peter Smith set up the Academy PayPal account, Denna Hintze set up the member area on the website, and the Academy published its first newsletter.

The 2010 conference was to be held at the St. Louis College of Pharmacy, so the board held a planning meeting there on January 8–10 to plan for the conference and revise the strategic plan. Through the work of past president Cy Leise, the wording of this plan was finalized and approved by the board at its February phone meeting (Academy of Process Educators, 2010b). In March, the Academy board approved an agreement with Pacific Crest, giving the company six free annual membership/conference registrations in appreciation for their continual support as evidenced by the generous start-up grant and reduced Pacific Crest Professional Development institute fees and e-FGB licenses for individual Academy members (Academy of Process Educators, 2010c).

The 2010 conference was held June 27–29 in St. Louis, MO, with the theme: *Preparing Today's Students to Solve Tomorrow's Problems* (Academy of Process Educators, 2010a; Figure 6). Highlights of this conference were the two keynote presenters, Larry Michaelson and Don Saari, and a visit to the Gateway Arch National Monument. The

Figure 5

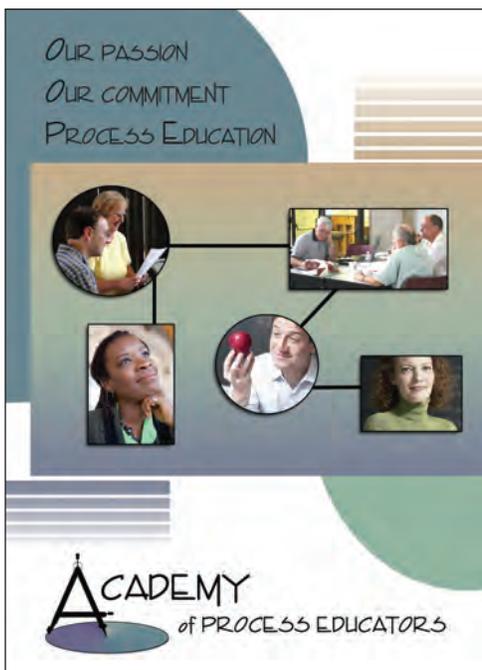


Figure 6



Figure 7



second edition of the *International Journal of Process Education* was distributed to the attendees.

The board of directors had originally been set up with three at-large members, each with a three-year term, but it soon became evident that more Academy members needed to be involved in governance. At the January 7–8, 2011 winter meeting at Kirkwood Community College in Iowa, the at-large board membership was expanded to four members, each with two-year terms. Also, because the positions of treasurer and finance officer had been limited to one term in the original bylaws, the board recommended that this restriction be removed to preserve continuity in these essential offices. Finally, it was decided to allow the audit committee to meet during rather than before the conference. These changes were approved by email ballot before the summer conference. On February 18, 2011, webmaster Denna Hintze, set up the Academy forum to facilitate communication among Academy members. This forum has been particularly helpful in planning the summer conferences since that time (see Figure 7).

The 2011 conference was held June 27–29 at Kirkwood, with the theme: *Facilitating Transformational Learning* (Academy of Process Educators, 2011; see Figure 8). A highlight was the ability to stay on campus in the same facility as the meetings. The third edition of the *International Journal of Process Education* was published for the conference.

Since 2011, the Academy has continued to meet twice a year. At the winter meetings much attention was paid to assessing potential *International Journal of Process Education* articles.

January 6–7, 2012	Georgia Tech
January 2–5, 2013	Georgia Tech
January 10–12, 2014	Valparaiso University
January 2–4, 2015	Virginia State University
January 8–10, 2016	North Carolina Central University

At the 2012 meeting, the strategic plan was revised to include local Academy chapters (Academy of Process Educators, 2012c) and the idea for an institutional membership was explored, through which up to 50 members of an academic institution could gain membership for a flat \$350 fee. This was approved at the 2012 conference. Kathy Burke, Cy Leise, and Tris Utschig also introduced the first draft of the writing rubric at this meeting. This rubric was refined over the next three years and has become the assessment instrument for the *International Journal of Process Education* (Burke, Ouellette, Miller, Leise, & Utschig, 2012).

Conferences and Innovations Since 2011

The Process Education Conferences since 2011 are listed in Figure 9.

In the ten years of the Academy of Process Educators, the number of members has increased from 49 to more than 300 allowing ever more exciting opportunities for professional collaboration. The Academy has continued to innovate practice even as it upholds the value of collaboration. A recent innovation (introduced during the 2014–15 academic year) was a series of webinars integrating Academy members into Masila Mutisya's Professional Development course. The webinars allowed interested Academy members to log in remotely and participate in interactive activities (Beyerlein, Burke, Mutisya, & Cordon, 2014). This experience was very successful and there are plans to repeat it.

Current Academy activities are focused on planning an expanded Process Education Conference in 2016 to celebrate 10 years of the Academy and 25 years of Process Education. Planned special features of this conference include a series of symposia addressing key issues in Process Education, more than two dozen invited workshops from members who have helped shape Process Education and the Academy in significant ways, and a full day devoted to research in order to foster scholarship and grant writing related to Process Education.

Figure 8

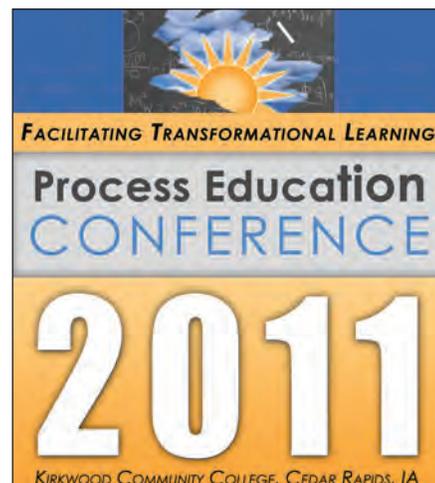
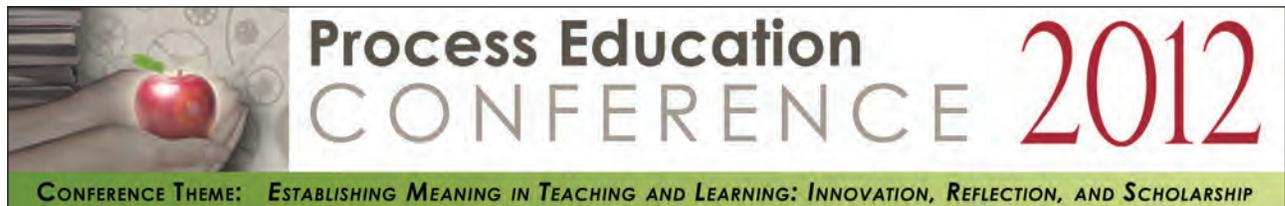


Figure 9



Process Education CONFERENCE 2012

CONFERENCE THEME: *ESTABLISHING MEANING IN TEACHING AND LEARNING: INNOVATION, REFLECTION, AND SCHOLARSHIP*

Date June 18–20, 2012 **Location** SUNY Cortland, New York
Highlights Book Chat; Todd Zakrajsek plenary
References (Academy of Process Educators, 2012b & June 2012)



Process Education CONFERENCE 2013

CREATING QUALITY LEARNING ENVIRONMENTS: PATHWAYS TO PROCESS-ORIENTED TEACHING

Date June 26–28, 2013 **Location** Hinds Community College, Jackson, Mississippi
Highlights Transformation of Education article
References (Academy of Process Educators, 2013 & June 2013)



Process Education CONFERENCE 2014

Process Education & Flipped Classrooms: Assess, Engage, Innovate, Transform

Date June 19–21, 2014 **Location** Valparaiso University, Indiana
Highlights Professional Development Panel
References (Academy of Process Educators, 2014 & June 2014)



Process Education CONFERENCE 2015

INCLUSION & OPPORTUNITY: SHARING THE PRACTICES THAT PROMOTE LIFE-LONG LEARNING

Date June 25–27, 2015 **Location** Virginia State University, Virginia
Highlights Scholarship of Teaching and Learning
References (Academy Process Educators, June 2015 & June 2015)



Process Education CONFERENCE 2016

TURNING FAILURE AND RISK INTO ACADEMIC SUCCESS

Date June 22–25, 2016 **Location** Grand Valley State University, Michigan
Highlights 25th Process Education & 10th Academy Anniversaries
References (Academy of Process Educators, 2016)

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International Journal of Process Education

Vision

The *International Journal of Process Education* will be a catalyst for the scholarship of teaching and learning in support of the efforts of the Academy of Process Educators to transform higher education.

Mission

To provide a forum for, and an archival record of, scholarly research in Process Education

To elevate skills in the discipline of the scholarship of teaching and learning

To explore promising new research areas in Process Education

To foster classroom-based research

Guiding Principles

All faculty, staff, administrators, and students can contribute to classroom research.

Every researcher's methods can be continuously improved.

The term "classroom" is a metaphor for all learning environments.

Mentorship can accelerate the development of research skills.

There is a role for both quantitative and qualitative educational research.

Collaboration among authors, reviewers, and editors is critical for a vibrant research environment.

Increasing societal complexity and pace of change make it imperative to accelerate the transition from classroom discovery to disseminated findings that are the basis of shared practice.

An educational journal can be improved by regularly assessing all aspects of its operation.



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