AC 2007-1283: ADDRESSING THE CAREER DEVELOPMENT NEEDS OF EXPERIENCED PROJECT PROFESSIONALS

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Addressing the Career and Professional Development Needs of Experienced Project Professionals

Abstract

This paper presents a new non-degree graduate program in technical project management (TPM) that employs innovative teaching strategies to meet the needs of adult learners. As a result of constituent involvement and input from industry professionals, the TPM program consists of four graduate courses that address the professional and career development challenges of experienced project and program managers. This interdisciplinary program provides a professional learning environment for adult students (with and without technical backgrounds) to acquire advanced project management knowledge, skills, and abilities. Innovative learning strategies include student-selected capstone projects, course content supplemented by subject matter expert (SME) presentations, as well as advanced assignments and site visits to projects that provide material for case studies. Collectively, the TPM program provides a unique, flexible, and self-directed learning experience to its students.

Introduction

As organizations increasingly adopt project management as a formal career path, the need for both fundamental and advanced project management training and education will continue to rise proportionally. A recent report cites the explosive growth of project management and estimates the number of project managers in the world to be 16.5 million[1]. As a result of this demand, colleges and universities around the world are responding by offering a wide variety of project management-related programs.

The Global Accreditation Center for Project Management (GAC) reports a significant growth of project management degree programs over the past twelve years[2][3]. The GAC report found only two bachelor and nine master-level project management degrees in 1994, whereas by 2006, more than 284 degree programs at 235 worldwide institutions existed. The GAC states that the "programs have broadened to be part of degree offerings in business, management, construction, engineering, and architecture." This interdisciplinary focus is a core element of many programs.

Thinking globally, but acting locally, The Citadel School of Engineering listened to constituent input concerning the need for graduate level education programs in the Charleston, SC area and established a graduate certificate program in Technical Project Management (TPM). The objectives of this program 1) delivered a knowledge and performance-based curriculum focused on the knowledge, skills, and abilities needed to manage and deliver technical projects, 2) provided advanced professional development education and training opportunities for experienced professionals, and 3) supported other academic graduate programs in the education and training of their students.

Many actions were taken to develop and deliver the TPM graduate certificate program in The Citadel School of Engineering and innovative teaching strategies were designed to meet the needs of experienced adult learners. The Citadel School of Engineering received administrative

support from The Citadel College of Graduate and Professional Studies (CGPS). CGPS benefits from over forty-five years experience in the education of adult learners as an academic element of The Citadel, The Military College of South Carolina. CGPS supports all non-cadet students and emphasizes treating students as adult learners.

Author's Note: The four 3-hour graduate courses were the first and only graduate courses taught in The Citadel School of Engineering, developed at the request of The Citadel Dean of Engineering and taught by the author as an overload to existing undergraduate courses. These courses were offered to the local Charleston community and addressed a need for advanced project management training. Classes were held off-campus at a graduate center located ten miles north of The Citadel campus, but close to many of the student's places of employment. The first cohort began in fall 2005, and by fall 2006, eleven students participated in the first offering of ENGR 652 Applications of Quality Management. In spring 2007, the fourth course in the series, ENGR 653 Technical Project Support and Operations, will be offered. Moreover by May 2007, the first cohort of students will receive their graduate certificates in Technical Project Management. In Fall 2007, the TPM graduate certificate program will enroll its second student cohort.

Determining the Needs of Experienced Project Professionals

Review of Literature
Before developing the TPM courses, the needs of experienced project professionals were investigated. After extensive literature review and an extensive needs assessment from industry professionals, the TPM courses were developed. Extant professional, academic, and industry publications were reviewed for applicable content and appropriate models or frameworks for instruction. Two publication sources represented the applicable and authoritative standards of their industry: the Carnegie Mellon® Software Engineering Institute (SEI) and the Project Management Institute ® (PMI).

SEI is a federally funded research and development center and is dedicated to the advancement of software engineering, computer security, and process improvement[4]. One of SEI's five technical programs is their Software Engineering Process Management Program. One of the initiatives associated with this program is the Capability Maturity Model Integration (CMMI). While the CMMI serves as the guideline for software process and product improvement, it is also recognized as the global best practice for software management and services[5,6,7,8,9,10,11]. Many companies involved in the software industry choose to adopt the CMMI framework and become certified at one of the five levels of CMMI certification.

Another guideline under the CMMI initiative is the People Capability Maturity Model® (P-CMM®) which delineates what companies do to "successfully address their critical workforce development and management issues[12]." The P-CMM® recognizes that "an organization cannot implement all the best workforce practices in an afternoon" and proposes a framework of progressive levels to transform an organization's culture "by equipping it with more powerful practices of attracting, developing, organizing, motivating, and retaining its workforce."

The CMMI and the P-CMM documents were used in conjunction with two PMI publications as primary reference documents for developing the TPM courses. The PMI documents were, *The Guide to the Project Management Body of Knowledge (PMBOK Guide)*[13] and the *Project Manager Competency Development Framework (PMCDF)*[14]. The *PMBOK Guide,* an approved American National Standard (ANSI/PMI 99-001-2004), provides a system of processes, tools, and techniques for managing and leading a project. With more than two million copies in circulation (including ten official translations), the *PMBOK Guide* is globally recognized as the common lexicon for the project management profession. Around this comprehensive standard, Project Management Institute (PMI) conducts a certification program; regional, national, and international conferences; and a global organization comprising 219,622 members with 212,704 certified project management professionals (PMP)[15].

The *PMBOK Guide* organizes the elements of a project in terms of five process groups: Initiating, Planning, Executing, Monitoring and Controlling, and Closing, and nine knowledge areas: Integration, Scope, Time, Cost, Quality, Human Resources, Communication, Risk, and Procurement management. The *PMBOK Guide* also serves as a foundational reference for professional development programs including:

- Project Management Professional (PMP®) certification
- Project management education and training
- Accreditation of educational programs in project management

Also, the *PMBOK Guide* provides a comprehensive framework for understanding, applying, and teaching project management concepts, tools, and techniques, and is widely used by organizations to guide their project management processes. Several organizations and industry groups have extended the *PMBOK Guide* to accommodate their specific management processes. For example, the Defense Acquisition University recently published the *U.S. Department of Defense (DoD) Extension to: A Guide to the Project Management Body of Knowledge (PMBOK Guide)*[16].

Another PMI document used in the development of the TPM graduate program is the *Project Management Competency Development Framework* (PMCDF). The PMCDF uses the *PMBOK Guide* to identify and delineate the three primary competencies of projects managers – Knowledge, Performance, and Personal. In its delineation, the PMCDF provides a structured guide to "manage the professional development of the project manager."

Based on input from industry and available sources, the PMCD Framework was validated as an appropriate model for developing the knowledge and performance competencies of experienced project professionals. The notion of creating an environment for student-designed career and professional development training was conceived using this model. While these courses are not envisioned to be an executive development program, they provide an opportunity for focused self-development and career advancement training, while preparing the students to take the Project Management Professional (PMP) Certification Examination administered by Project Management Institute.

The *PMBOK Guide*, the PMCDF, and the CMMI references provide compatible frameworks for developing the workforce capability of an organization and for formalizing and standardizing organizational process assets. These primary resources place process and documentation

standardization as key elements for improving organizational and project-level capability. Along with developing knowledge, performance, and personal competencies, the need for development and standardization of project documentation became a central and primary theme for TPM course development. PMI and CMMI influences are reflected in the Knowledge and Performance Learning Model shown in Figure 1. Also, the *PMBOK Guide* was accepted as a primary text in all TPM courses. The ability to cross-reference content with the *PMBOK Guide* was used as selection criteria of other primary and supporting texts[17].

Figure 1. Technical Project Management (TPM) Knowledge and Performance Learning Model

The Citadel School of Engineering
Graduate Certificate in Technical Project Management (TPM)
Knowledge and Performance Learning Model
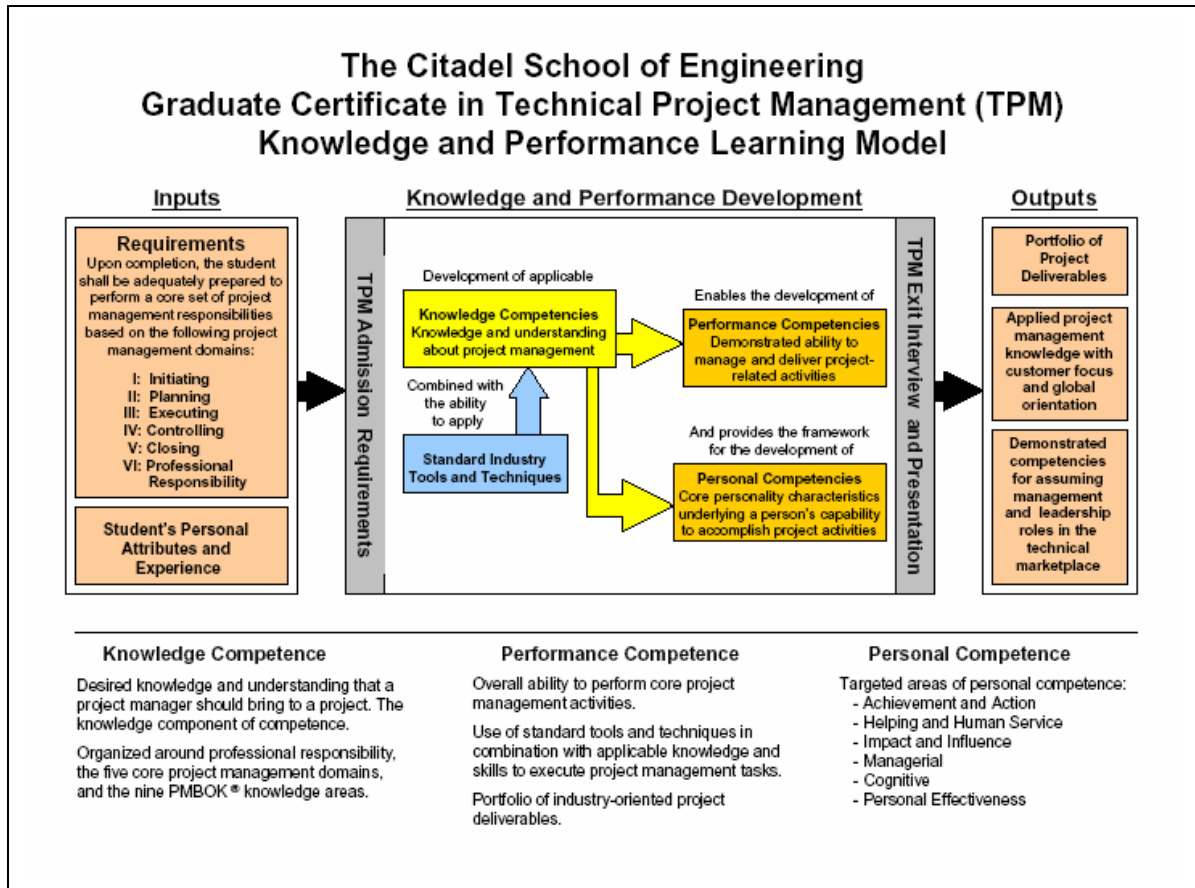
Input from Industry
Industry professionals provided input concerning the needs of their employees and explained how the TPM courses could address those needs. A TPM Advisory Group was established with membership including The Citadel Dean of Engineering, several executive and knowledge officers from local corporations, an experienced engineering and construction industry lawyer, a retired executive vice president of a major global engineering and construction company, and several management and business consultants.

The TPM Advisory Group performed an informal gap analysis of the needs of their organizations as compared with the content of the TPM graduate certificate program. Also the group obtained input from constituents concerning possible improvements to course materials. The group met

twice to gather input and review TPM course organization, descriptions and content. The group found the proposed TPM program to address their organizational needs for advanced project management education and career development. Individual group members made prescriptive comments. These comments included the need to emphasize a systems engineering approach to project management, revision of course descriptions to include relevant topics, which prompted the addition of advanced topical modules to several courses. In addition to solicited comments, the course textbooks were reviewed and accepted as relevant and applicable. As a result of the group input, the following courses descriptions were approved:

ENGR 650: Overview of Technical Project Management
This course applies a systems engineering approach to project management and introduces the student to the entire lifecycle of technical projects as offered by Project Management Institute's *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* and other resources. Practical assignments are combined with industry-accepted standards for the purpose of developing a logical framework for managing and leading technical build projects. The five major process groups of Initiation, Planning, Executing, Monitoring and Controlling, and Closing are investigated in relationship with the nine knowledge areas of Integration, Scope, Time, Cost, Quality, Human Resources, Communication, Risk and Procurement. Professional responsibility and ethics will receive particular emphasis.

ENGR 651: Technical Project Planning and Scheduling
This course explores the principles and applications of work breakdown structures (WBS); the Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT); earned value management, critical chain scheduling and buffer management; definition and allocation of resources; resource leveling; and schedule compression. Course content includes realistic projects, case studies, Primavera and MS Project computer applications, along with web-based management and technology tools.

ENGR 652: Applications of Quality Management
This course investigates the principles of quality management and their application in the technical project environment. The standards, tools, techniques and deliverables as related to the development and implementation of a comprehensive quality system will be explored. Topics related to ISO 9000, lean six sigma methodology, business process improvement, and function point analysis will be addressed.

ENGR 653: Technical Project Support and Operations
This course is designed to provide students with knowledge and understanding of the activities necessary for the completion of a project, but not normally recognized as project activities. These activities include project plan development, negotiations, coaching and interpersonal skills, contract specifications and general conditions, bonds and insurance, and risk planning and mitigation.

Feedback from the TPM Advisory Group proved to be effective in ensuring that the individual courses addressed the professional and career development needs of the local community. The

idea of providing career development opportunities to working professionals was a major marketing item during the initial offering of courses.

Innovative Learning Strategies for Experienced Project Professionals

Background
The philosophical and technical approach used in developing learning strategies for the TPM courses came from the work of adult education and andragogy theorist Dr. Malcolm Knowles, who defined adult learning as "the process of adults gaining knowledge and expertise." In his seminal work in adult education and human resource development, Knowles analyzes the various theories associated with adult learning and compares the pedagogical assumptions about pre-adult learners with the andragogical assumptions about adult learners. When he describes the contemporary learning and the andragogical model, he presents the following five assumptions concerning adult learners[18]:

- The learner is self-directing. Adult learners want to take responsibility for their own lives, including the planning, implementing, and evaluating of their learning activities.

- The learner enters an educational situation with a great deal of experience. This experience can be a valuable resource to the learner as well as to others. It needs to be valued and used in the learning process.

- Adults are ready to learn when they perceive a need to know or do something in order to perform more effectively in some aspect of their lives. Their readiness to learn may be stimulated by helping them to assess the gaps between where they are now and where they want and need to be.

- Adults are motivated to learn after they experience a need in their life situation. For that reason, learning needs to be problem-focused or task-oriented. Adults want to apply what they have learned as quickly as possible. Learning activities need to clearly relevant to the needs of the adult.

- Adults are motivated to learn because of internal factors, such as self-esteem, recognition, better quality of life, greater self-confidence, the opportunity to self-actualize, and so forth. External factors, such as pressure from authority figures, salary increases, and the like, are less important.

The above five assumptions were applied vigorously in the development of the TPM courses. In addition, Knowles' implications for teachers helped differentiate the andragogical orientation from the pedagogical commonly used in pre-adult situations. Knowles identifies the "basic concern of people with a pedagogical orientation is *content*," and teachers with a strong pedagogical orientation will be "concerned about what needs to be covered in the learning situation; how that content can be organized into manageable units; the most logical sequence for presenting these units; and the most efficient means of transmitting this content."

Knowles contrasts the pedagogical orientation with the andragogical orientation by noting, "the basic concern of people with an andragogical orientation is *process*." He builds upon this idea by identifying the following eight elements of the andragogical process:

- Prepare the learners,
- Consider the physical and psychological climate setting,
- Involve the learners in planning for their learning,
- Involve the learners in diagnosing their own needs for learning,
- Involve the learners in formulating their own learning objectives,
- Involve the learners in designing their own leaning plans,
- Help the learners carry out their learning plans, and
- Involve the learners in evaluating their own learning outcome.

Utilizing several other relevant sources[19][20], the process orientation was applied in developing TPM coursework. This level and orientation toward learning necessitated the development and implementation of several innovative learning strategies:

- A comprehensive Capstone Project assignment,
- Project deliverables and assignments that must conform to industry standards
- Course content supplemented by subject matter expert (SME) presentations and assignments, and
- Case studies and assignments derived from project site visits and presentations

Adult learners benefit from the potential for increased cognitive complexity in reasoning, induction, and conceptual understanding due to several factors. Within the brain the neural networks are more dense permitting heuristics to be more established and allowing an understanding that results can be multi-causal [21][22]. Intellectual maturation is thus reflected in more reliance on reasoning instead of memorization, and as a result adults have an increasing capacity to make sense of the world from a position of neutrality. Making sense of the world from a position of neutrality, rather than from a biased or predisposed position is a hallmark of critical thinking[23].

The adult who appears in a graduate or TPM class is a composite of prior social and psychological development, but with adult capacities and capabilities that reflect growing and subsequent maturity. The adult is widely connected through work and has increased personal responsibilities as maturity is socially, not just physiologically defined. It is because the number of psychosocial roles increased and with the neurological changes, self-concept is more likely to have evolved from self to other perspectives[24]. While personality remains consistent, conscious and planned control over behavioral displays of personality are more likely in different settings[25].

Knowles theory amply supported by research and experience with adult learners yields a framework for the TPM program that creates the ideal learning environment with retention potential demanded by the requirements of the engineering field. In addressing the needs of experienced project professionals, it was essential that an advanced level of instruction be provided, while encouraging active learning in a structured professional environment.

Capstone Project Assignment
A Capstone Project Assignment spans the four TPM courses. The objective is for each student
to develop project management knowledge and performance competencies by producing typical
project documents normally associated with a major risk project. Each student must develop and
submit these documents, along with supporting evidence, for a project of their choosing.
Problem based learning (PBL), a pre-curser to self-directed learning[26], is an instructional method
in which students learn through facilitated problem solving. In an adult application of PBL,
student learning centers on a complex problem that does not have a single correct answer.
Students work to identify what they need to learn in order to solve a problem. They engage in
self‑directed learning (SDL) and then apply their new knowledge to the problem and reflect
using peers on what they learned and the effectiveness of the strategies employed. Such projects
stress autonomy, a keystone of adult self-directed learning that encourages greater complexity of
mind[27].

By developing the applicable project documents, students are self-directed in their learning and
understanding of project management. The expected result is a personalized portfolio of project
documents as delineated by the *PMBOK Guide*. These documents, also known as Organizational
Process Assets, are described in PMBOK subsection 4.1.1.4. This Capstone Project assignment
begins in the prerequisite ENGR 650 course and continues in the three subsequent courses within
the program. One aspect of the Capstone Project assignment that keeps the student engaged is
the requirement to present several of their products during each semester to receive comments
from their peers. By seeing and commenting on peer's work, the class reached a consensus
concerning the content and format of the documents, while normalizing the level of difficulty
between projects. On several projects, the scope of the project was simplified for clarity, while
other cases; the student feedback strongly suggested that additional areas be added to increase
the level of difficulty. For example, when a civil engineer presented a project involving the
construction of a roadway, his peers suggested that the project would be more valuable if an
environmental impact (wetlands) and a railroad crossing were added to the scope.

Appendix 1 contains the first page of the Capstone Project Assignment. As noted in the matrix,
each deliverable correlates with the *PMBOK Guide* and the applicable course and has been
revised as the program evolves. Documents that were originally associated with one particular
course were adapted to better fit the requirements of another course. Comments were added to
explain specific elements. Some documents were consolidated into one common document. For
example, change requests became a multi-purpose and universally applied Change Request
Form.

At the completion of all program requirements and to obtain the Graduate Certificate in
Technical Project Management, students will present their Capstone Project to a panel of
academic and industry professionals that may include, at the discretion of the instructor,
representatives from the student's company or organization.

Subject Matter Experts
Another innovative learning strategy is the inclusion of subject matter experts (SMEs), who
assist in the preparation and presentation of advanced topics and applicable modules of
instruction. From course assessments, the SMEs generate an expected educational environment

for experienced project professionals. The SMEs engage the students on their cognitive level and connect the course to operational and applicable specifics. The cross-communication between the SME and students provides educational opportunities that rarely exist in routine class meetings.

It was observed that the presence of a SME in the classroom prompted the students to engage in Gagne's instructional events[28]. The introduction and background of the SME tend to gain the student's attention. Many SMEs are quite clear on the learning objectives and the transfer of knowledge to the students. Because of many students' experience level, the opening discussion tends to stimulate recall of prior learning. In presenting the content as a case study or actual project, the SME provides learning guidance on the instructional content to elicit performance as part of the instructional module. In several cases, the SMEs provided reading assignments to prepare the students for the presentation and module assignments. During and after the presentation, feedback was solicited through a comprehensive assignment or through class discussion to ensure that a working level of knowledge was transferred.

A consensus of the student group during a formative mid-course assessment indicated that the topic of Lean Six Sigma needed a SME to explain how the tools were selected and applied in an organization. The students requested specific examples and explanations of how the course material could be implemented. A search of local Six Sigma Black Belts yielded a person with considerable knowledge and experience. The SME, a Six Sigma Black Belt for a large organization, was brought into the classroom and made a presentation on Six Sigma concepts and how these concepts were applied in his organization. The result was a riveting and well-assessed presentation.

Another SME developed and delivered 2 three-hour modules on Applications of Deming Quality Systems and Variation of Process Systems. These modules were shortened versions of much longer (and more expensive) training courses. The students engaged the SME on several different levels and derived maximum benefit from the presentations. Student comments on the course assessment encouraged the author to maintain connection with the SME and retain his services for the next cohort.

The SME was also a contributor in another sense of adult learning. Communities of practice have been shown to be a functional means of supporting the learning of procedures, but also data. Choi, in her review of communities of practice, noted that participation and practice in real world contexts and practice at a group level, is not just an exchange to simply give and take similar to friendship, but should include a strong trust to facilitate performance[29].

Project Site Visits
All of the TPM students have worked on projects, but few have seen the inner workings of a major project. For this reason, it became necessary to arrange and coordinate visits to project offices. Because of the proprietary and sensitive nature of the briefings, it became necessary to obtain Statements of Non-Disclosure from each student and to maintain these on file.

One successful site visit was to the project office of a major aeronautical project, where the students received a corporate briefing from a global project manager, which included the overall

logistics of the project, descriptions of individual contracts and major deliverables, timetables, along with successes, problems and pitfalls. This class meeting was followed with a detailed comparison of the aeronautical project with a case study from Denver International Airport. The combination of the best possible project and one of the worst possible projects provided a significant learning experience for all involved.

Student evaluations revealed that the timing of the aeronautical project site visit enhanced the value of the educational experience. Prior to the site visit, the students had modules of instruction including project integration, scheduling, work breakdown structures and work packaging. These knowledge and skills were quickly reinforced with a clear and intimate demonstration of these topics. Also, the students understood the complex briefing presented by the global manager, which made the site visit to the project "war room" much more valuable.

Based on course assessments, more site visits are planned. As most educators know, site visits are not easy to interweave with scheduled course activities, because they tend to interrupt the learning process and to generate more problems than they are worth. Taken in the andragogical perspective and watching the *process* of adult learning, site visits are worth the required time and effort.

Assessment of the Technical Project Management Graduate Certificate Program

Assessment of the TPM graduate program is a progressively evolving activity. Currently, course and program assessment is obtained through several different mechanisms, which include informal (formative) and formal (summative) course assessments and assessment of SMEs and their presentations. The formal course assessments are the standard student evaluation of instruction that is utilized throughout The College. The assessments, while good in results and in theory, reflect many of the pedagogical aspects of the course, but lack insight into andragogical process and performance.

Assessment of the andragogical aspects of the courses was obtained using class discussions and written questionnaires. The class discussions, led by the instructor, were held during class time at approximately mid-semester, which allowed the student group to understand the direction of the course, while engaging them at what is normally a low point in the semester. These discussions provided an opportunity to provide feedback on the strengths and weaknesses of the course.

The most revealing discussion came during the initial course when the group expressed a consensus that they were experienced professionals and asked to be challenged. They asked for content and assignments not normally offered in graduate school and requested learning modules that started with project management basics, but soon moved into very challenging material. Their comments resulted in a philosophical change in the program. From that point forward, the TPM program became more oriented toward advanced and applied topics that were not normally found in traditional textbooks. From their comments, several textbooks were changed to provide advanced content, and the result was a new course focus.

In essence, the feedback process and acceptance of the comments demonstrated that the andragogical learning process applied to both adult learners and instructors. As a result of this session with the students, it became necessary for the author to reevaluate course content, develop and deliver more advanced topics, and to approach the courses more in terms of executive related training.

Written responses to formative assessment instruments provided clear feedback about the courses. The most insightful responses came from three simple questions:

Give two examples of specific things Dr. _____ did that really helped you learn Quality Management.
- Brought in SMEs to discuss real world applications of material and subjects that I had only a very basic understanding of their use
- Was quick to adapt lectures to questions I had about the course material and subject that would help me in my work
- Brought in SMEs that helped with the practical applications [8 responses]
- Capstone requirement [2 responses]
- Coach class discussions that also brought in practical applications
- Provided some examples (Quality Management Plan)
- Going through the PMBOK

Give two examples of specific things Dr. _____ did that made it more difficult for you to learn Quality Management.
- Focusing so much on Deming. Needed more overview of Deming, Crosby, and others
- Little too sporadic at times, either needed step by step progress or periodic wrap ups to time the loose ends
- Class content seemed fluid and at time unstructured
- I don't think anything was done that made it difficult

Suggest two specific, practical changes Dr. _____ could make that would improve your learning in this class.
- I would rather have 3-4 small outside papers to do than one big one.
- More case studies for Lessons Learned perspective
- In class use/demo of software (Minitab, etc.) for analysis, etc.
- For statistics – a series of real problems where we tackle the finer points of certain values
- More history and background of quality. Review changes in quality systems over time (TQM, etc.) to come to modern quality philosophies
- More quality improvement examples. Specific quality improvements companies/organizations have made the improved outcomes

This particular questionnaire proved useful. In response to student's comments, the author resolved to further develop learning modules that (1) inform the student of the objectives, (2) stimulate recall of previous learning, (3) provide more examples and explanations, (4) provide

opportunities to apply new knowledge, (5) provide detailed feedback, and (6) relate objectives to real-world applications.

Improvement of the Technical Project Management Graduate Certificate Program

Assessment and improvement of the graduate certificate program is an evolutionary process. Knowles' Adult Learning Process was selected to provide the framework for developing, assessing, and improving the TPM program. As shown in Figure 2, Knowles provides a framework for the educational process and utilizes four phases of an adult learning planning process surrounded by an outer ring of adult learning theory. The four phases are:

Process Phase I: **NEED.** Determine what learning is needed to achieve goals.

Process Phase II: **CREATE.** Create a strategy and resources to achieve the learning goal(s).

Process Phase III: **IMPLEMENT.** Implement the learning strategy and use the learning resources.

Process Phase IV: **EVALUATE.** Assess the attainment of the learning goal and the process of reaching it.

Currently, the TPM program uses the Knowles Framework at both the program and course level. Formal assessment of the program will come at the next meeting of the TPM Advisory Group, while at the course level, each course undergoes both a formal and informal assessment processes. The results are reviewed and changes are made when possible. At times, assessments can be made and the changes implemented within the same course. In other instances, applicable changes are implemented during the next course cycle.
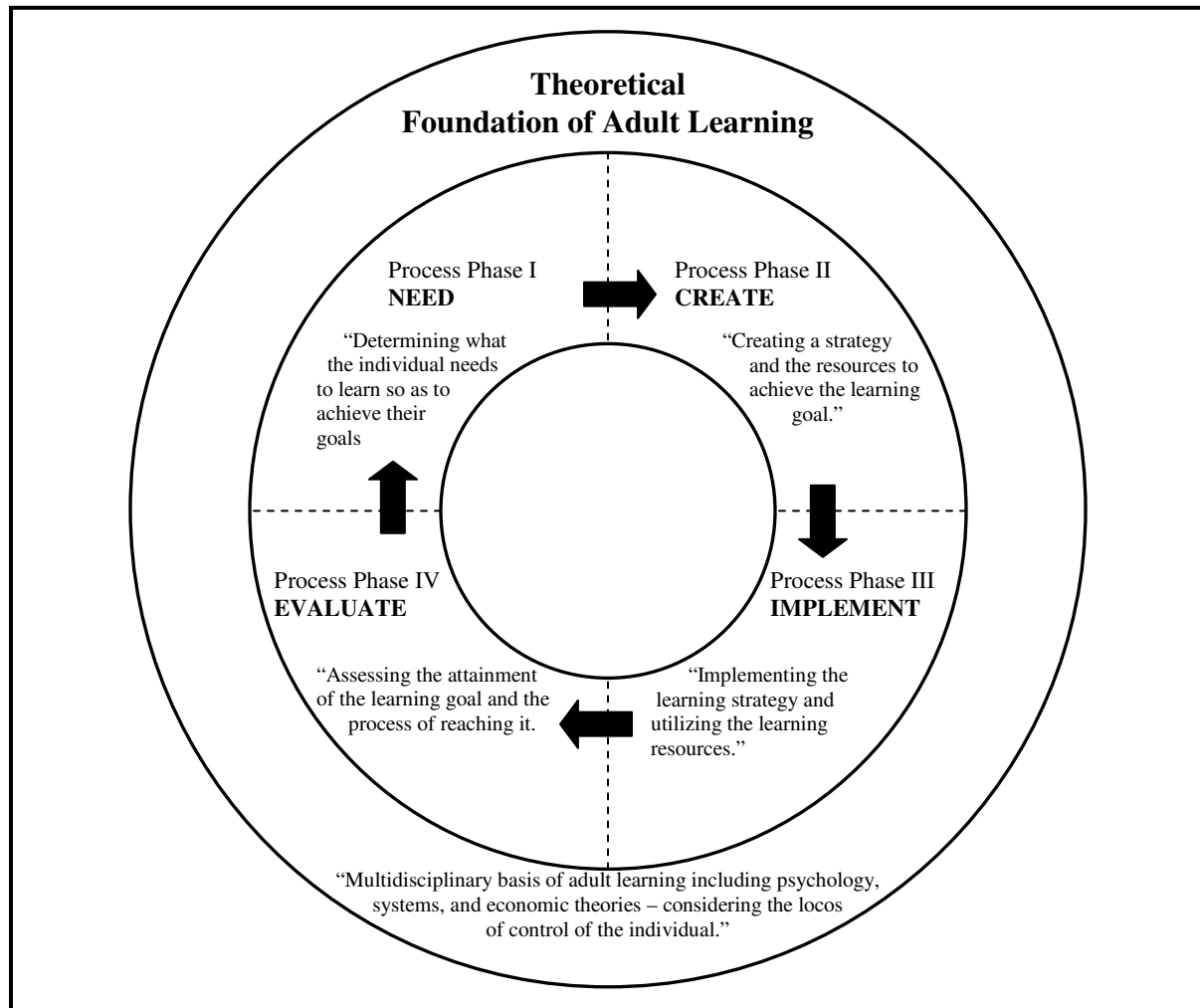
The TPM graduate certificate program is not static. Each cohort represents a baseline for determining overall performance. Improvement of the TPM program will utilize formal and informal assessment tools, including the TPM Advisory Group, to determine course content, best practices, and opportunities for improvement. These improvements will be implemented and assessed with each cohort of students. This should be the nature of adult, or andragogical, education.

Conclusions

The need for project management education and training is not diminishing. Institutions who respond with educational programs that address the needs of their constituents will command an influential presence in their academic and business community. The TPM graduate certificate program addresses the needs of its constituents and provides an advanced educational learning environment for experienced professionals. Innovative learning strategies are employed to allow adult learners to control their own learning processes. On a regular basis, students report on their ability to transfer recently learned concepts and techniques to their daily work environment.

As a result of the TPM courses, students engage in personalized career and professional development.

Figure 2. Knowles Framework for the Adult Learning Process

Theoretical Foundation of Adult Learning

Process Phase I
NEED

"Determining what the individual needs to learn so as to achieve their goals

Process Phase II
CREATE

"Creating a strategy and the resources to achieve the learning goal."

Process Phase IV
EVALUATE

"Assessing the attainment of the learning goal and the process of reaching it.

Process Phase III
IMPLEMENT

"Implementing the learning strategy and utilizing the learning resources."

"Multidisciplinary basis of adult learning including psychology, systems, and economic theories – considering the locos of control of the individual."

The process of developing and presenting graduate courses, in an environment where no graduate courses existed before, continues to be a rare and unique experience. Following a defined, but adaptable, process is key to developing a successful program. Being open to new ideas and recommended changes from students and constituents is considered essential to creating successful and well-received courses. While difficult at times to schedule, subject matter experts are a resounding success in delivering advanced topics of instruction.

In the classroom, adult or andragogical education centers on process. Developing an andragogical learning environment that provides the content, while fostering the adult learning process, is difficult and at times fluid. Sometimes, it is necessary to create challenging assignments that generate a certain amount of disequilibrium within each student. However, faced with these challenges, students become receptive to applicable course content and collaborative learning opportunities.

Assessment processes provide feedback at several different levels. Many of the assessment processes are transparent and often with quick responses allow the students to identify with changes. Therefore, this identification appears to enhance retention and transfer of knowledge to subsequent courses. Assessment also shows the value of the courses to both the students and the instructor. In this sense, development, delivery, and assessment become integral to the continued ability of the TPM program to address the professional and career development needs of its students.

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Appendix 1.

Knowledge and Performance Competency Matrix for TPM Courses

The table below associates the process documents and outputs as identified by the *PMBOK® Guide* with the courses in the Technical Project Management (TPM) Non-degree Program. For each process, instruction and learning will focus on the applicable knowledge and performance competencies at either the Introductory (I) level or Comprehensive (C) level. C level represents a course deliverable.

PMBOK Process Group	Sect	Process	PMBOK para.	Process Outputs (Course Deliverables)	ENGR 650	ENGR 651	ENGR 652	ENGR 653
Initiating	4.1	Develop project charter	4.1.3.1	Project charter	C			
	4.2	Develop preliminary project scope statement	4.2.3.1	Preliminary project scope statement	C			
Planning	4.3	Develop Project Management Plan	4.3.3.1	Project management plan	I	I	I	C
	5.1	Scope Planning	5.1.3.1	Project scope management plan	C			
	5.2	Scope Definition	5.2.3.1	Project scope statement	C			
			5.2.3.2	Requested changes				
			5.2.3.3	Project scope management plan (updates)				
	5.3	Create WBS	5.3.3.1	Project scope statement (updates)				
			5.3.3.2	Work breakdown structure	C			
			5.3.3.3	WBS dictionary	C			
			5.3.3.4	Scope baseline	C			
			5.3.3.5	Project scope management plan (updates)				
			5.3.3.6	Requested changes				
	6.1	Activity Definition	6.1.3.1	Activity lists	I	C		
			6.1.3.2	Activity attributes	I	C		
			6.1.3.3	Milestone list	I	C		
			6.1.3.4	Requested changes				
	6.2	Activity Sequencing	6.2.3.1	Project schedule network diagrams	I	C		
			6.2.3.2	Activity list (updates)				
			6.2.3.3	Activity attributes (updates)				
			6.2.3.4	Requested changes				