

Taking Construction Education to Practicing Professionals: A Case Study

Jerald L. Rounds, Tim J. Ward, Deborah Fisher, Dick Howell, Debby Knotts, Jennifer Scott
University of New Mexico, AGC New Mexico Building Branch

Abstract

Through a unique collaborative effort with multiple industry partners, and several academic partners, a certificate program has evolved to meet the needs of practicing construction professionals. The construction Advancement Institute (CAI) was conceived seven years ago to better address the needs of practicing professionals in the New Mexico construction industry. It is comprised of a partnership between The University of New Mexico (UNM), Albuquerque Technical Vocational Institute (TVI) and several industry associations, including the New Mexico Building Branch – Associated General Contractors (AGC), the Mechanical Contractors Association of New Mexico (MCA), and the New Mexico chapter of the National Electrical Contractors Association (NECA). Based on the results of a CAI funded research project to determine needs and solutions, the certificate program was designed so that practicing professionals could take ten core construction courses offered at TVI and UNM and receive the certificate. In the fall of 2001, the New Media and Extended Learning (NMEL) unit at UNM identified the Certificate program as a priority program to disseminate across the state of New Mexico and offered to participate with the CAI group in reformatting the classes into a web-based format to be delivered throughout the state, and then marketing the program to fill the classes.

This paper chronicles the evolution of the CAI certificate program from inception to full operation. It will start by describing how the program was conceived and how the partnership came together. It will then address the initial study and design of the curriculum. Next it will chronicle the development of the program to be fully web-based and the continuing evolution of the courses. Finally, conclusions will be drawn about the process and the value of delivering asynchronous learning opportunities to practicing professionals.

A companion paper entitled *Reflections on Evaluating Web-based Courses: A Case Study* focusing on the methods and processes of evaluating two of the CAI courses is presented in another session.

Concept and Formation of CAI

The concept of the CAI began in the Fall of 1997 when Dr. Deborah Fisher, then AGC Endowed Chair Professor at the University of New Mexico (UNM) met with Vicki Mora, AGC Executive Director, Mark Henderson, President of J.B. Henderson Constructors, and Sal Reyes, graduate student and adjunct professor at UNM to brainstorm an alternative model for construction management (CM) education for the construction industry in New Mexico. At this time both

AGC and UNM were looking for a lifelong CM learning model that would bridge between existing apprenticeship, journeyman and superintendent's training programs (STP) at one end of the spectrum with higher education models, such as the associates degree in CM from TVI and the baccalaureate degrees in CM and Construction Engineering from UNM. All of the institutions were seeking an improved delivery of CM education to a broader group of people in the construction industry throughout the State of New Mexico.

This initial meeting in Fall 1997 resulted in the concept of an institute that would function within the administrative confines of UNM and would provide a truly interdisciplinary education that would meet the needs of the construction industry of New Mexico. The model was designed to combine efforts of institutions currently providing CM education in an effort to streamline the process, eliminate duplication, and generally make better use of existing resources while expanding the programs to include students with a wider range of educational backgrounds (Reyes and Fisher, 1998)

It was important early in the planning process to ensure that the CAI concept was consistent with the mission and goals of the School of Engineering and the Department of Civil Engineering. The Mission of the School of Engineering at the University of New Mexico is *The School of Engineering prepares tomorrow's engineers through comprehensive, affordable education based on intimate interaction with the creators and practitioners of new technologies. The local, regional and distance members of our diverse community of students, faculty and staff are actively engaged in all segments of industry, government and academia. Our students experience strongly interactive learning in a vibrant physical, intellectual and cultural environment.* The Missions of the Department of Civil Engineering at UNM are *to provide high-quality learning experiences for students and lifelong education for practicing professionals, and to develop and disseminate new knowledge to meet the engineering and construction needs of New Mexico, the nation and the world.* In addition to the Mission Statement, the Department has articulated values. Two of these values are excellence in academic programs and a strong commitment to community. It is clear from these mission statements and values that the SOE and the CE department recognize the types of students we serve, their needs, and how we can best meet their expectations for learning.

For example, the CE department has been providing distance education to employees of the U.S. Indian Health Service (IHS) in New Mexico for decades. These students have been pursuing MSCE degrees, and many of them have been successfully graduated from the program. Delivery to the IHS students has been primary through interactive television (ITV), which is no longer a viable operation at UNM. The CE department has also provided ITV courses to other agencies, the national labs, and companies in the state. Therefore, it is a natural extension of the Department's previous efforts to deliver courses via the web. Just like the students we serve in Albuquerque, the students living in other parts of the state are place bound and can only afford to pursue a degree if a reasonable portion of the course work can be taken off campus.

As a result of numerous discussions, a working definition of CAI was developed, which was:

The Construction Advancement Institute at the University of New Mexico was created to advance the state-of-the-practice in the construction industry in New Mexico, the USA and internationally. The CAI will advance the industry through education, service, and applied research. Education will include programs of study leading to certification, associate degrees, bachelor's degrees, and graduate degrees so that individuals from all levels in the construction industry can choose and follow a career path aided by the appropriate coursework. The CAI is responsive to the needs of students, industry, and the citizens of New Mexico through a unique education-industry partnership unlike any other in the country.

A working definition was also developed for the Certificate Program, which was:

The Construction Advancement Institute provides a progressive, industry driven education option resulting in a **Construction Supervisor Certificate**. The Institute caters to the learning needs of individuals working as, or aspiring to be job site supervisors. It is a bridge along the career path of a commercial construction supervisor. Courses are carefully selected from a variety of sources by industry advisors and educators with the intention of providing, relevant, interactive and “up-to-date” education. Utilizing contemporary instructional methods that are meaningful to the participant and to employers, the student will be exposed to technical skills, construction management theory, communication and leadership skills, safety and some of the legal aspects of the industry. The certificate can be achieved in two to four years, (depending on the desire of the student), with options to extend course participation to degree opportunities at accredited institutions. This service is made possible through a unique educational partnership unlike any other in the country.

CAI became a new concept in CM education that utilized “partnering” in education like that which was being practiced on construction projects for better performance. The initial program was designed to be:

- Interdisciplinary - involving the School of Engineering, the School of Architecture, and the Anderson School of Management at UNM
- Inter-organizational - including UNM, TVI and AGC, and more recently, NECA and MCA, and
- Inter-level – providing education for executives, first line supervisors, associate degree students, bachelor and masters degree students, continuing education students, etc.

Figure 1 illustrates the initial organizational chart for CAI that included by-laws and a governing board representing all involved partnerships. The institute was to be involved in both providing full education programs and coordinating educational opportunities provided by others, in the form of workshops, seminars, and guest speakers. It would also provide support for educational programs in the form of assessments and analysis.

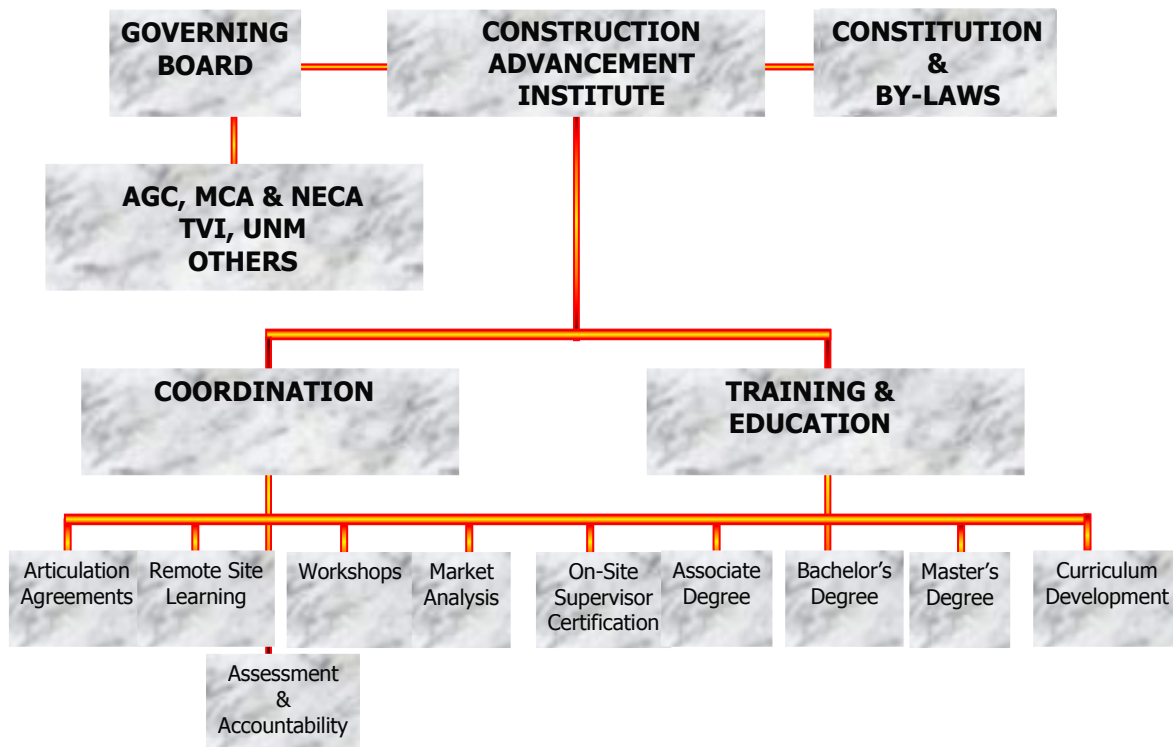


Figure 1: Proposed Organization Chart for CAI (Fisher and Reyes, 1998)

Figure 2 illustrates the educational career track feeding from both the local public school system, and the adult learning community.

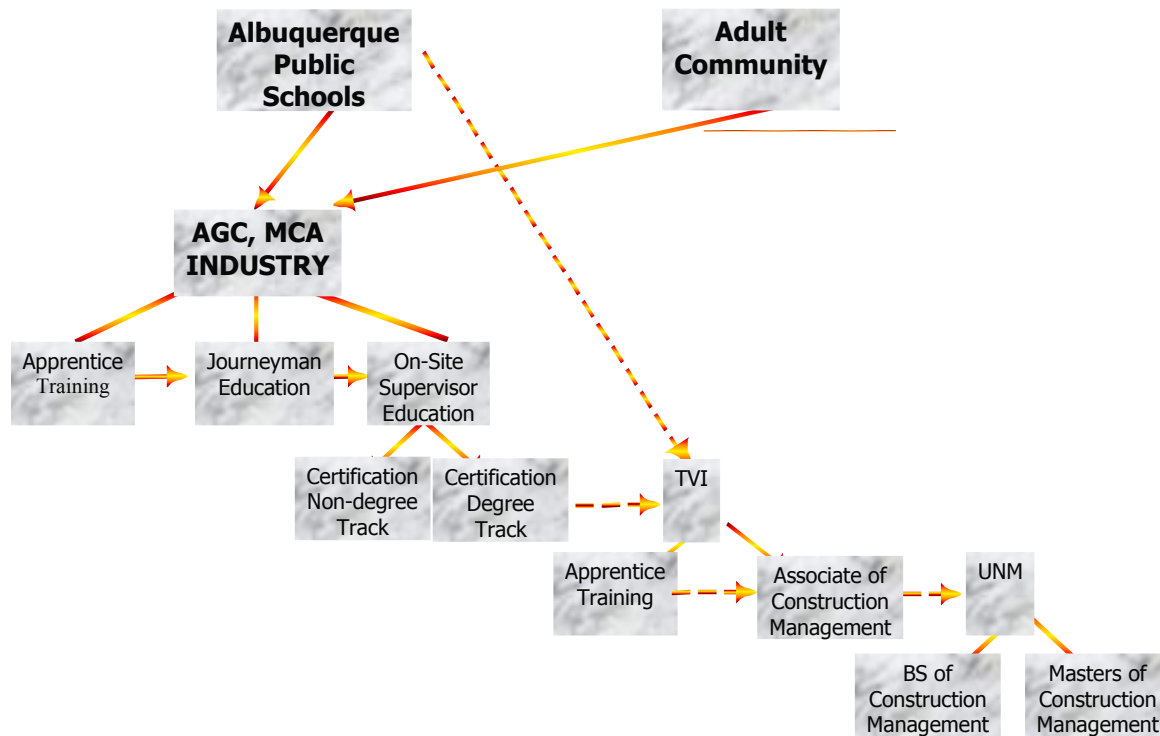


Figure 2 – Proposed Education Track for CAI (Reyes and Fisher, 1998)

Research Basis And Curriculum Design

One of the key components of success in any career is continually expanding professional knowledge and skills. However, it is one thing to understand the importance of developing your potential and it is another to fit continuing professional education into an already busy schedule. This is especially true in the construction industry where jobs consistently require unpredictable and extended hours. CAI members, with the objective of addressing these unique continuing education needs, developed the CAI curriculum through interactions and dialogs with representatives from all facets of the construction industry.

The partnership relied on the input of various construction-related associations in order to keep a pulse on the broad variety of construction professions. Representation on the advisory board typically includes a commitment of both expertise and contribution (donations, in-kind services, materials etc.). With these resources at the table, it was possible to appraise the educational offerings already available to the industry, ascertain where the gaps might be, and design curriculum to fill those gaps.

An ad-hoc curriculum sub-committee of the CAI was formed to design the core certification courses for On-Site CM Certification. This initial sub-committee included one representative each from AGC (Jennifer Scott, AGC Workforce Development Director), TVI (Joe Rodman, TVI Dean of Trades), UNM (Deborah Fisher, AGC Chaired Professor), and the construction industry (Mark Henderson, President, J.B. Henderson Constructors).

It was both critical and meaningful to do an “environmental scan” of existing construction education options with as many partners at the table as possible. However, this can be an exhausting effort, and it is likely that a number of valuable programs were overlooked despite best efforts. Whether a similar program already exists is not as important as a focus on delivering a *quality* program to a group of people who will then use that quality educational experience to contribute effectively to the high quality construction that is demanded of the industry by its consumer. Additionally, it might be argued that the continuing active participation of representatives from each association in ongoing development and oversight of the initiative is not as critical as is their effort to market the program to their own members. Marketing is a fundamental requirement for education and training programs, even for programs of exceptional quality.

The basic template with which the committee began was AGC’s national STP program. This is a strong and well-proven program with which the industry was already familiar. From there, industry feedback provided the committee with additional areas that were felt to be needed in the curriculum. These areas included CADD, surveying, and an applied hands-on CM clinic, similar to other states’ programs, such as AGC’s Carolina’s Supervisory Training Program.

Curriculum issues with which the committee wrestled included:

- Course availability,
- Course equivalencies,
- Course delivery mode,
- Course quality maintenance, and
- Certification cost

The committee looked at what was already available through AGC, TVI and UNM. The initial list of core certification courses that was developed is illustrated in Table I. This table indicates STP equivalencies. To receive On-Site CM Certification from UNM would require the completion of all 11 of the courses listed in Table I.

The CAI Certificate Program curriculum has evolved over several years to now comprise ten courses jointly provided by TVI and UNM. These include:

COMM 232: Business & Professional Communication
CM 257: Construction estimating
CM 277: Construction Project Management
CE 473: Construction Law
CE 474: Principles of Written Construction Documents
CE 475: Construction safety
CE 479L: Methods Improvement
Mgt 306: Leadership & Organizational Behavior

Two elective courses bring the total to 10 courses encompassing 30 academic credits.

CAI/AGC	TVI	UNM	Credit Hours
CADD CAI 132	CM 132	CE 132	3
Construction Overview (STP 3 & 8) CAI 255	CM 263/175	Arch 285	3
Construction Surveying CAI 261 L	CM 261L	CE 283L	3
Construction Clinic CAI 476	-----	CE 476/ 576	3
Communications Oral and Written (STP 2) CAI 274	Comm 130 & Eng. 101	Eng. 219	3
Planning & Estimating (STP 5 & 6) CAI 277	CM 277	CE 277	3
Legal Issues (STP 9) CAI 453/553	BA 211	CE 453/ 553	3
Contract Documents (STP 4) CAI 412	CM 171/201L	Arch 412	3
Construction Safety (STP 7) CAI 475	EPT 213	CE 475/ 575	3
Leadership (STP 1) CAI 450	-----	CE 450/ 550	3
Productivity & Quality Control (STP 10) CAI 479	-----	CE 479 / 579	3
Total Credit Hours			33

Bold lettering indicate preferred equivalent course.

Table 1: CAI'S On-Site CM Certification Equivalences with TVI and UNM

(Reyes and Fisher, 1998)

Recognizing the Need To Take CAI To the Customer

A critical problem exists in training professionals, especially in the construction industry, which is the need to step out of ongoing professional activity to participate in training. This is particularly critical in the construction industry with fast paced projects and the requirement that management and supervisory personnel often work 50, 60, and more hours a week just to keep up with their jobs. It is possible to find an hour or two randomly scattered throughout the day, or in the evening to learn, however, few quality learning options exist to meet this type of schedule. Academic classes may only meet for an hour three times a week over a 15 week period, but this regular time commitment does not fit into the chaotic schedule of a construction job. Classes appropriate for practicing professionals are often scheduled in the evening, and sometimes “executive” programs are scheduled in condensed formats on the weekend. However, these are difficult for practicing professionals working extended hours to attend and virtually impossible for field supervisors who rarely leave the job site during extended working hours. Thus, when the Board of CAI became aware of the interest of UNM in developing distance deliverable programs, after serious discussion, they made the commitment to work with the University to move the CAI program into a web-based format.

UNM has recognized the importance of taking educational opportunities to practicing professionals wherever they are, whenever they have the opportunity to participate. To meet this need, the Extended University (EU) was created. The mission of the EU is *to coordinate distance education programs using current and emerging technologies to facilitate access and further the outreach efforts of the University of New Mexico*. The EU uses a number of distance technologies to deliver instruction, including six regional centers with live, classroom instruction and student support staff; instructional television, videoteleconferencing, online, and blended delivery strategies. In addition, it provides comprehensive course instructional design, multimedia, and faculty training support services to Departments on campus.

In keeping with national trends, the University of New Mexico had begun in academic year 2000 creating the infrastructure and delivery system necessary to reach out with quality online coursework to the rural and diverse population of the state of New Mexico. It accomplished this effort through the work of the New Media and Extended Learning (NMEL) group, a unit of the EU. At the current time, NMEL supports four online degree programs and one certificate (CAI) program, and over 600 web-enhanced courses, with enrollments of 1,600 and 22,000 students respectively.

New Media and Extended Learning’s (NMEL) mission is *to engage in the development and delivery of online courses, provide faculty training, and support*. NMEL, as a division of UNM’s Extended University (EU), is responsible for the administration of online courses at the University of New Mexico and the system-wide implementation and management of UNM’s web-based learning management system – WebCT. In this effort, NMEL provides support for UNM Main Campus, Health Sciences Center, Law School and all UNM branch campuses. NMEL is comprised of three units: Course Development Group, Systems Group, and Web Applications Group.

NMEL's technical staff provides a broad range of IT support services and resources for the entire University system. These include web application development, streaming media production and hosting for online learning, web and application server administration, computer lab maintenance, and WebCT administration.

NMEL Instructional designers partner with faculty in helping them add interactive activities, assessment techniques, design aids, and pedagogical methods to their online course design. The unit creates and implements course templates, student tutorials, and evaluation tools in online courses. Results from the evaluation tools are used to highlight effective areas of online course design and improve other areas to increase student performance and learning over time. Training and Development Specialists offer workshops and reference materials to train instructors in the use of WebCT software for course components, assessment methods, grade book management, and effective online quizzes. In addition to these functions, staff members provide on going technical support services for faculty and students.

The strategic focus of curriculum development for distance offerings was determined to be full degree, licensure, and certificate programs that concentrated on a critical need in the state. Given the large concentration of public and private contractors and engineers in the state, and their relative isolation from institutions of higher education – the potential for a certificate program in the area of construction supervision and management was seen as a state priority. This solidified for EU the decision to move ahead in the collaborative effort that was being proposed by the CAI partnership.

Moving CAI From Traditional To Web-Based Instruction

Initially, all of the CAI courses were delivered in a traditional face-to-face format. Each of these courses needed to be redeveloped in an on-line format. TVI had already begun the on-line conversion process with their courses. However, all five of the UNM courses needed to be redeveloped for web-based delivery. The platform for web-based delivery used at both UNM and TVI is WebCT.

The process of moving existing courses into a web-based format is both complex and time consuming. Even though the content does not change fundamentally it must be completely restructured. Elements of live classroom instruction like guest speaker presentations and class discussion must be replaced with elements appropriate to on-line instructional media. Live discussions can be replaced with threaded asynchronous discussions or synchronous chat room discussions. Student class presentations become written rather than oral, and discussion takes the form of having each on-line student read the other students' papers and critiquing them. Guest speakers can be invited into a chat room discussion, allowing exceptional content experts who would never travel to campus to provide a live presentation to interact with students from wherever they are around the world. In one recent UNM "virtual class" in which the students entered into a synchronous discussion of a recent journal paper, one of the paper co-authors joined the discussion from California. Though certain aspects of the traditional classroom delivery that students value are unavailable, other opportunities are presented in the on-line environment which can more than offset what is lost in the transition.

Much of the complexity of building courses in a web environment, whether by transitioning existing courses or creating new courses is involved in mastery of the technology. Two elements were of inestimable value in development of the UNM CAI web-based courses. The dedication and very strong technical support of the NMEL group was a critical component in the success of moving the courses to WebCT. This group provided not only technical support, but also guidance in instructional design for electronic media based courses, vital assessment support, and cheerful encouragement. These services continue to play a vital role in the ongoing delivery and continuous improvement of the courses. The second element is dedicated graduate assistants who can master the technology and search for creative ways to enhance the course, allowing the professor to concentrate on content development and course delivery.

The partnership between EU and the academic department works very well and that relationship is continuing to improve as anomalies are worked out. An example of a topic currently under discussion is how to manage the extra compensation faculty members receive for offering web-based courses through the EU. The EU pays an instructor a certain amount for developing and teaching a course the first time. Subsequent offerings of the course are paid out at a reduced rate. Tenured and tenure-track faculty members receive the pay as extra compensation. This makes sense for the first offering. However, what is occurring now is that a faculty member will offer the course on the web, but not live in the classroom, and still be paid the extra compensation. Some persons believe that should not be allowed and that extra compensation should be for work performed beyond the assigned teaching duties. This and other issues have not been addressed at the Department or School levels.

Conclusions

CAI and its flagship certificate program have developed over a number of years as the result of extensive efforts by a broad and strong consortium of individuals and entities. The result is a strong, versatile professional development program with unique accessibility for a wide variety of practicing professionals in the construction industry. The program has evolved extensively since the initial concept surfaced in the Fall of 1997. It will continue to evolve as opportunities are identified and assessments reveal ways in which the program, and the individual courses can be improved.

Unique elements of the CAI program include:

- Diverse participation across the industry and among academic institutions
- Inviting practicing professionals engaged in professional development to participate in learning experiences alongside students in academic programs
- Delivering broad, high quality asynchronous professional development opportunities to practicing professionals in their time frame and at their chosen location.

There are a number of plans for the future of the program. First is continuous improvement of the courses based on on-going assessments. Second is broad marketing of the professional development opportunities throughout the State of New Mexico, with the expectation of reaching a goal of 25 students in each course each semester, including the summer. It is anticipated that as a result of the marketing and the ubiquitous availability of the courses throughout the State of New Mexico, the academic construction programs will be enhanced, as well as the professional

development program. Finally, once the CAI certificate program is running well, other opportunities for CAI offerings can be identified, such as expanding professional development opportunities, identifying other service opportunities, and initiating applied research projects.

Bibliography

Reyes, Salvador, and Deborah Fisher, "An Alternative Model for Construction Management Education at the University of New Mexico," report to the Dept. of Civil Engineering, University of New Mexico, Albuquerque, NM, April 22, 1998.

Biographical information

JERALD L. ROUNDS, PhD, PE, ASEE is AGC Endowed Chair Professor in the Department of Civil Engineering, University of New Mexico, and is responsible for the construction engineering and construction management programs. With over 20 years in construction education and over 10 years practicing in the industry, he is also extensively involved in industry training in the areas of project management and field supervision.

Tim J. Ward, Ph.D., P.E., F. ASCE, M. ASEE, is Professor and Chair of the Department of Civil Engineering at the University of New Mexico. He has oversight responsible for the three accredited undergraduate programs in the department - civil engineering, construction engineering, and construction management - and the Masters and Ph.D. programs. Since his arrival at UNM in Fall of 1997, he has continued to nurture the interactions between the department and the construction community. He is the recipient of the 2003 AGC Excellence in Construction Education award presented by the New Mexico Building Branch of the AGC

DEBORAH FISHER, PhD, PE was the first AGC Endowed Chair Professor at UNM from 1994 to 2001 and is Associate Professor in the Department of Civil Engineering with responsibilities for teaching, research, and outreach in the construction programs. She has 10 years of practicing industry experience and 20 years of academic construction teaching and research experience.

DICK HOWELL, PhD is the special assistant to the Vice Provost of Extended University and an Associate Professor in the Honors Program at the University of New Mexico. In this capacity, he is responsible for the development of online teaching and learning initiatives at the University. Dr. Howell is concerned with improving access and instructional capacity in the areas of health, literacy, mathematics, and science to students throughout the state of New Mexico.

DEBBY KNOTTS provides administrative leadership for NMEL. Ms. Knotts has over 20 years experience in development and support for university level computer based technologies. She has managed UNM's primary web application development and web based course unit since 1996 growing the unit to support over 15,000 users. Ms. Knotts holds a Master of Science with her postgraduate work and research having focused on design for children's technology, telecommunication and distance learning.

JENNIFER SCOTT is the Workforce Development Director for the New Mexico Building Branch, Associated General Contractors and is responsible for facilitating education and workforce development solutions for commercial construction companies throughout the state of New Mexico. Ms. Scott has been with AGC for four years and has been working in positions related to training and development in a variety of career paths for about ten years.