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Professional Development/Internship Opportunities for Construction Faculty: A Win/Win Outcome

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As there is an ever-increasing need for university/industry collaboration, one way to create a win/win outcome for everyone involved is the continual support for faculty professional development/internship opportunities by universities and the construction industry. This paper addresses the basic reasons for faculty professional development/internships, considerations when seeking a professional development/internship opportunity, personal professional development/internship experience of the author, and win/win outcomes of professional development for construction faculty members and sponsoring construction companies.

Key Words: Faculty professional development, faculty internship, university/construction industry collaboration.

Introduction

As can be observed in recent advertisements for construction faculty positions by higher education institutions, three key requirements listed most often are educational background, teaching experience at the university-level, and relevant construction field experience. These position requirements are the foundation for the professional degrees granted by the various construction programs at the university-level (Griffin, 1999). Although the value of professional development for a junior faculty member is more readily apparent, i.e., enhancement for promotion and tenure, senior faculty can benefit by staying current in one's area(s) of expertise. The benefit for all faculties is to bring new insight and practical applications into their coursework.

The accrediting bodies for construction programs at the university-level, the American Council for Construction Education (ACCE) and the Accreditation Board for Engineering and Technology (ABET), reinforce the collaboration between universities and the construction industry and stress the importance of professional experience of construction faculty in their standards and criteria for accreditation documentation (American Council for Construction Education [ACCE], 1998). In fact, ABET now includes outcomes-based assessment as part of its accrediting process (Rosenbaum, 1995). What better way to promote further university/construction industry relations and to ensure "best practices" in coursework than for faculty to have periodic professional development/internship experiences?

This paper presents various elements to consider when a faculty member is seeking an internship with a construction company, the experience of the author in an internship program, and the win/win outcomes for faculty and construction companies.

Considerations When Seeking Internship Opportunities

There are certain factors that should be considered when seeking an internship/professional development opportunity. As a part of these considerations, there are certain constraints/restraints for the construction company. These considerations are not mutually exclusive, either for the faculty member and/or the construction company. These considerations include: identification of construction companies, type of construction, length of time for the professional development/internship, location, economic environment, deliverables, skills, and research potential.

Identifying List of Contact Companies

Obviously, the first thing the faculty member needs to do is identify a list of contact companies that would be interested in providing an internship opportunity. A good place to start determining potential interest is the departmental industry advisory council member companies. The fact that these companies are supporters of the department in other areas such as curriculum development, marketing strategies, scholarships, etc., there is a strong potential for them to also support faculty professional development/internship opportunities. For many construction departments, the concept of faculty professional development to encourage the connection between theory and practical applications of theory based upon relevant, "real world" information be taught in the classroom (Prados, 1997) is a recommendation received from their industry advisory councils.

Another good source is personal contacts with construction professionals and other faculty members within or from outside the department. The department head of the construction program is an invaluable mentor when seeking a professional development opportunity. He/she may also know and/or recommend companies and contact individuals.

Type of Construction and Size of Company

Some faculty have particular expertise and knowledge in certain areas of construction, i.e., commercial, residential, mechanical/electrical, labor relations, etc. Therefore, after the construction company list has been finalized, an evaluation of projects that could utilize the faculty member's area(s) of expertise is recommended. This is a matching of knowledge, skills, and abilities with companies' projects that would be seen as value-added by the companies. However, a faculty member might want to use the professional development/internship opportunity as a way to learn about a new area or practice of construction. If the faculty member is not familiar with projects by company, this allows for direct contact with the company to discuss any professional development/internship opportunities.

Another consideration is the size of the construction company. Logically, the larger volume companies (based upon annual would have more ongoing projects that could utilize the expertise of a faculty member.

Length of Time

Since the majority of faculty is on nine-month appointments, the summer timeframe (twelve to fourteen weeks) allows for a full-time commitment to work for the construction company. As most projects have a longer completion schedule than three months, it should be noted that this could be a limiter. Conversely, this allows the company and the faculty member to be creative on how to determine the scope of the professional development opportunity.

It is recommended the faculty member check on any departmental, college/school, and/or university regulations relating to outside employment. In most cases, professional development for faculty is encouraged (National Alliance of Business, 1998).

Location

Determining where the professional development/internship will be conducted also is a major consideration. For some faculty members who teach at a college or university where there are limited construction companies and/or projects, relocating for twelve to fourteen weeks is not possible. If this is the case, there might be some situations where work can be conducted off-site with periodic meetings or visits over the length of the project or at another location. With the advancement in telecommunications capabilities, certain location solutions can be found.

Economic Environment

Currently, the construction economic environment is healthy with no downturns forecasted (Grogan, 1999). This healthy economic environment allows for construction companies to expand resources and payroll budgets. The converse is true, as well. Therefore, it is more probable that a faculty member can secure an internship during good economic cycles.

Deliverables

The best scenario for a win/win situation, for both the faculty member and the construction company, is when predetermined hard deliverables (outcomes) of the professional development/internship are clearly identified prior to the starting date. This allows both parties to actualize benefit from the process.

Skills

The individual faculty member should have current curriculum vitae that outline his/her knowledge, skills, and abilities. The curriculum vitae is a good place to start the discussion with the sponsoring construction company regarding a professional development opportunities. Most construction companies want the professional development opportunity to be value-added to themselves and to the faculty members.

Research Potential

The challenge for any professional is to advance a body of knowledge through practice and research. Advancing the body of knowledge in construction through collaborative efforts between the construction practitioner and faculty member on a research project can also be a potential outcome of the professional development/internship. The faculty member should develop and propose research ideas and topics to the construction company during the finalization stage of the professional development opportunity. This is especially important for junior faculty members seeking promotion and tenure.

Professional Development/Internship Experience

Company Background

C.F. Jordan LP sponsored the author for a professional development/internship opportunity. C.F. Jordan is a multi-million dollar, El Paso-based, general contractor with regional offices in Dallas, Austin, Mission, and College Station, Texas (city in which the author resides) and field offices throughout the Southwest.

The firm has been actively engaged in providing professional construction services for commercial and industrial clients, as well as government agencies at the federal, state, and local levels since its inception in 1969. These projects consist of office buildings, hotels, parking garages, sewage treatment plants, airport hangers, airport concrete paving, warehouses, industrial plants, sports complexes, military defense projects and multi-family residential. In 1999, C.F. Jordan was 124 of the Engineering News Record's Top 400 Contractors (Engineering News Record, 1999).

C.F. Jordan is a member company of the construction department's construction industry advisory council (CIAC) with the Executive Vice President of the regional office serving on the CIAC's Marketing Committee. A letter of request from the author and a letter of support from the department head were sent to both the national and regional offices. Approval for the professional development/internship opportunity was made at C.F. Jordan's national office with finalization of scope of work was made at the regional office.

Faculty Member/Author Background

The author is a junior, tenure-track faculty member at a large Southwest university in a construction science department teaching and doing research in the areas of construction labor relations, leadership in construction, facilities and project management. The author received a Bachelor's, Master's, and Ph.D. from a large midwestern university and has numerous years of industrial and teaching experience.

Professional Development/Internship Experience

The author conducted the professional development/internship at the College Station regional office. Types of projects the author was involved in were design/build (medical complex/hospital), fast track (telecommunications center/office complex), public/private partnership (office building and historic hotel restoration), and CM-at-risk (college expansion).

The matching of the author's expertise and area of interest with company needs was done in two ways: team development and team member interaction during preconstruction and construction phases of these projects (author was part of preconstruction and construction teams) and the assessment of leadership skills utilized by the architects, construction and project managers, and field superintendents (author was interacting with all parties in the office and on job sites).

A research project, in conjunction with the internship, was also discussed and finalized between the Regional Executive Vice President, Regional Vice President of Preconstruction, the Regional Vice President of Operations, President/CEO of the architecture firm involved in the design/build medical complex/hospital project and the author. The outcome of the research was to be part of the hard deliverables.

Hard Deliverables

Personality Profiling

There is a growing trend in the world of work to conduct personality profiling of employees for placement on teams for organizational effectiveness (Thomson, 1998). This is also true in the construction industry. The author administered a Myers-Briggs Type Inventory (MBTI)-based personality inventory (Thomson, 1998) to all full-time employees of the regional office and architecture firm to determine if there were any prevailing trends between and among organizational levels and job titles based upon personality type.

Internship Guidelines for Construction Majors

C.F. Jordan provides numerous internship opportunities to undergraduate students in many different university construction programs. Since the C.F. Jordan executives want the internship experience to be meaningful to the student, as well as value-added to the company, the author developed guidelines for internship assignments. These guidelines address the issues of meeting the internship requirements of the construction program(s), field and office experiences, and mentoring by C.F. Jordan construction professionals.

Discussion

Consistent with Johnson's (1996) research findings on the importance of industry work experience for faculty, the major factors that can contribute to a win/win outcome for the faculty member and the construction company relative to a professional development/internship opportunity are as follows:

- Opportunities for faculty to share/learn in the real world of construction
- Opportunities to conduct field research projects
- Opportunities to stay current in area of expertise (field), i.e., current practices
- Opportunities to develop new research areas/topics based
- Promotes industry/university relationships
- Integration of current, best practices in the field into coursework
- Supplemental income for nine-month appointment faculty
- Opportunity for faculty to learn a new area(s) of construction

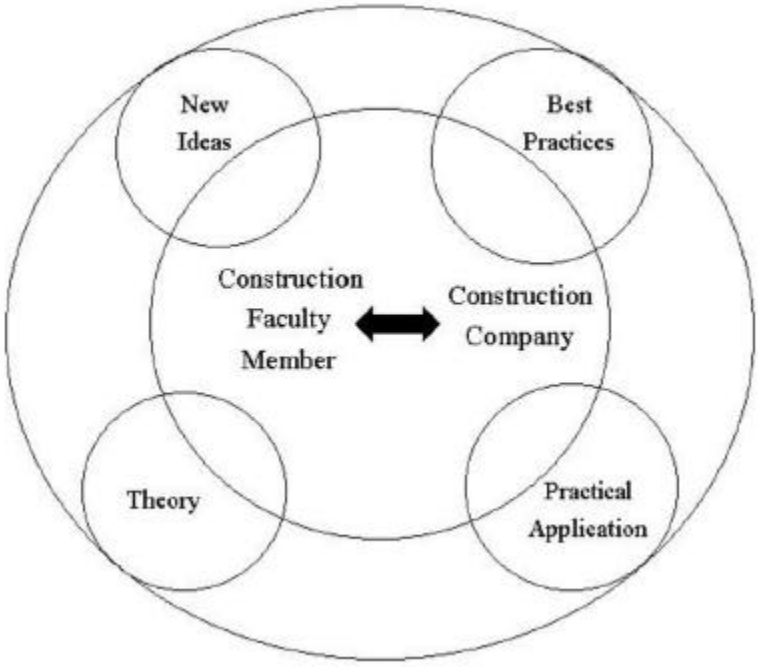

Figure 1. Win/Win Outcomes of professional Development for a Construction Faculty Member and Sponsoring Construction Company.

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Measuring Complex Achievement: The Construction Management Internship

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The internship experience is generally looked upon as the most important single part of a construction management student's professional preparation. Internships should be a competency-based program with pre-stated instructional goals and outcome performance behaviors that are designed to specifically represent the competencies necessary for the construction manager to function efficiently. Construction management students are to be accountable for attaining a given level of proficiency in achieving specific competencies that are identified. This article provides a format and objectives for a working portfolio that each construction management student will cooperatively develop with their college supervisor and on site directing manager.

Keywords: internship, field experiences, cooperative education, apprenticeship.

Introduction

The internship experience is conceptualized as a partnership between construction industry work sites and the university's academic environment. Each partner brings a special and necessary area of expertise to the partnership, thus enabling on site directing managers to assist and direct the construction management student to progress from novice to productive construction manager. One of the key difficulties with internships lies with the measurement of the complex achievements that senior construction management students must demonstrate during an internship class. Using the three phase model of teaching as outlined by Jacobsen in ***"Methods for Teaching: A Skills Approach"*** the internship class should follow three phases. These phases are: planning phase, implementing phase, and the evaluating phase. The three phases are interrelated, sequential and require the professor to plan a learning experience for their students by first planning what they need for their students to know, understand, and perform. Next actually implement those plans, and then finally evaluate the success of the planned internship activities. The program outlined in this article represent a new concept in construction management internships and evaluation.

Two Way Partnerships For Internship

The internship is designed as a field based demonstration of the course work competencies, which have been identified as necessary for successful construction management. A construction management internship course for successful completion requires the student to demonstrate they are a "competent" construction manager. A "competent" construction manager is defined by the Construction Industry and University's Construction Management programs as a manager who

can effectively coordinate activities, people, subcontractors, materials, and financial aspects of a project to bring about a company's continued growth and performance.

The internship experience is conceptualized as a partnership between the construction industry and University's Construction Management Programs. The primary partners include work-based partners and University based partners. Work based partners' work closely with the college representatives to place interns. A needed component is a list of companies representing a variety of construction operations from which a potential intern must seek employment. This variety allows a construction management student to select a company that reflects his intended career path. Each company must supply a directing manager who has successful managerial experiences, workplace expertise, strong interpersonal skills, communication skills, and willing to be a coach and mentor for the intern. The internship team consists of intern, directing manager and college supervisor. While the directing manager plays a critical role in the internship process on a daily basis, the college supervisor must provide open communications lines to the intern as well as coach and mentor. The intern as the third member of the internship team must be a construction management student in good standing, completed most of their coursework (be in the last two semesters prior to graduation) and meet all other requirements. Interns are inexperienced managers who are learning to refine their pedagogical skills under the guidance of an experienced field based manager and college supervisor.

Roles, Responsibilities and Expectations

Three individuals comprise the internship team: The intern, the directing manager, and the college supervisor. Internship experience assists construction management students to develop competence in their professional practice, learn to apply knowledge, develop a set of professional understanding, learn to examine their practice, learn from their experience while seeking to meet the needs of the construction profession.

Interns are expected to:

1. Demonstrate their commitment to their company and their learning;
2. Know the areas they perform;
3. Assume the professional roles and responsibilities linked with the directing manager;
4. Systematically think about their practice and learn from their experiences;
5. Be responsible for managing and assessing their work;
6. Be responsible for demonstrating the outcomes, professional skills and objectives of the internship experience.

Directing Managers are expected to:

1. Work as a collaborative team member on the internship team;
2. Plan the intern experience and assess performance;
3. To suggest ways for strengthening intern's competencies;
4. Clearly communicate their expectations;
5. Orient intern to work place, staff, and organization;

6. Regularly confer with the intern;
7. Provide ongoing documentation on intern's demonstration of essential competencies.

College Supervisor are expected to:

1. Observe or review intern work;
2. Review and complete intern plan;
3. Develop timelines for intern activities;
4. Maintain intern's profile;
5. Provide feedback, two seminars, and record outcomes.

Evaluation and Statement of Specific Competencies

Competencies represent the specific learning intents of the internship program. Each competency is considered to be a specific instructional goal or learning outcome that has value and is considered to be a long-range end worth achieving. The following information relates to methods for measuring complex achievement in an internship.

Evaluation & Grade Reporting

(The following data is excerpts from an internship packet- to conclusion)

Oral Expression

Students are expected to communicate orally in a coherent and logical manner using Standard English in all internship experiences.

Written Expression

On all written work, students are expected to express themselves clearly and correctly, using Standard English. Papers, which contain excessive errors (grammatical or typographical), will not be accepted for evaluation purposes.

Grade Determination

All eight specific interim objectives in this module are stated at the <u>minimum</u> level of competency expected of an undergraduate. Your final grade will be based upon the following guidelines:

1. Timely submission/performance of all assigned and mutually agreed upon tasks.
2. Successful achievement/completion of all interim objectives listed.

Weekly Homework/ Internship Requirement:

At the end of each workweek, the intern is required to fax at least a one page typed abstract of the workweek activities and assignment. Each day's activity must be documented. Failure to do this weekly assignment will result in an incomplete or failing grade.

Final Paper Requirement:

By the last class meeting each intern will turn in a typed paper that clearly analysis the competencies and knowledge acquired. Paper quality is to be college level.

Statement of Specific Competencies

Competencies in the context used in this module represent the specific learning intents for which the module has been designed as a guideline to aid in learning achievement.

Each competency is considered to be a specific instructional goal or learning outcome that has value and is considered to be a long-range end worth achieving.

1. You will demonstrate your ability to plan projects effectively.
2. You will effectively manage projects, subcontractors, and contracts.
3. You will demonstrate your ability to organize and develop projects effectively.
4. You will effectively present construction management skills.
5. You will demonstrate effective verbal and nonverbal communication.
6. You will demonstrate your ability to estimate and schedule effectively.
7. You will relate to co-workers in a positive and constructive manner.
8. You will demonstrate professionalism.

Interim Objectives, Enabling Activities, and Learning Outcomes

In the previous section goals were described in general terms. In this section specific, observable behaviors are identified for each of the goals. These goals, together with the observable behaviors, are called Interim Objectives.

In addition to the interim objectives, activities designed to help you reach each one are included. These are termed Enabling Activities and Learning Resources. A list of suggested activities is included, but you are not required to complete each one. Your directing manager and college supervisor will identify the activities in which you are to participate and will discuss them with you.

Finally, a statement is made that describes how you will be evaluated. This is called the Evaluation Procedure.

The goals and interim objectives are described in the same sequence so that they may be cross-referenced. The Summative and Formative instruments used for observation of specific objectives/competencies are found in Appendix E.

Interim Objective I

You will demonstrate your ability to plan projects effectively so when in an internship setting you will:

1. Develop a schedule (bar chart/CPM)
2. Organize a two/three week activity schedule for a project.

Enabling Activities & Learning Resources:

1. Plan a project/estimate.
2. Conference with directing manager to assess learner status.

Evaluation Procedures:

Success in achieving this objective will be measured by the quality of your schedule/plan as determined by your Directing Manager and College Supervisor.

Interim Objective II

You will effectively manage projects, subcontractors, and contracts so when in an internship setting, you will:

1. Organize a project file.
2. Review all contracts.
3. Understand scope of work.
4. Understand contracts.

Enabling Activities & Learning Resources:

1. Know the approved subcontractors for a project.
2. Take responsibility for reviewing and managing contracts.
3. Take responsibility for managing project files.

Interim Objective III

You will demonstrate your ability to organize and develop projects effectively so when in an internship setting, you will:

1. Demonstrate effective use of time.
2. Use review techniques throughout the project.
3. Demonstrate adaptation of each project's needs.

Enabling Activities & Learning Resources:

1. Select/develop material and maintain a file.
2. Observe works by others.

Evaluation Procedures:

Success in achieving this objective will be measured by the quality of your performance on specific tasks as determined by your directing manager and college supervisor.

Interim Objective IV

1. Demonstrate ability to effectively present construction management skills so when in an internship setting, you will:
2. Develop effective understanding of condition and consequence relationships in construction management.

Enabling Activities & Learning Resources:

1. Demonstrate appropriates and varied practice and application opportunities for managing construction projects.
2. Demonstrate use of management skills in appropriately working with a project or company.

Evaluation Procedures:

Success in achieving the quality of your construction management skills as determined by your directing manager and college supervisor.

Interim Objective V

Effectively using verbal and nonverbal communication. You will demonstrate effective verbal and nonverbal communication so when in an internship setting, you will:

1. Demonstrate clear and accurate verbal discourse.
2. Demonstrate effective content, delivery, organization, and language usage while speaking.
3. Demonstrate appropriate body language, which reflects positive and enthusiastic feelings.
4. Use a well-modulated, clear and distinct voice with no significant speech defects.
5. Communicate information a given subject in a coherent, logical manner, using Standard English in oral and written form.
6. Demonstrate the ability to comprehend and interpret a message after listening.
7. Use vocabularies appropriate for the situation.
8. Use logical and coherent written languages appropriate for the target audience.

Enabling Activities & Learning Resources:

1. Practice uses of voice, which shows variation in tone, volume, pitch, and inflection.
2. Practice using body language, which reflects positive and enthusiastic feelings.
3. Practice using clear and accurate verbal discourse.

Evaluation Procedures:

Success in achieving this objective will be measured by the quality of your verbal and nonverbal communication as determined by your directing manager and college supervisor.

Interim Objective VI

Demonstrate ability to estimate and schedule effectively so when in an internship setting, you will:

1. Demonstrate effective use of estimating and scheduling techniques.

Enabling Activities & Learning Resources:

1. Use of computer in quantity take offs.
2. Prepare a computer schedule for a project.

Evaluation Procedures:

Success in achieving this objective will be measured by the quality of your estimate and schedule as determined by your directing manager and college supervisor.

Interim Objective VII

Establishing positive interpersonal relationships to co-workers so when in an internship setting, you will:

1. Understand patterns of social and personal relationships in a work environment.
2. Identify and demonstrate behaviors, which reflect a feeling for the dignity and worth of others, including those from ethnic, cultural, linguistic, and economic groups other than your own.

Enabling Activities & Learning Resources:

1. Exhibit positive attitudes and behaviors toward all workers and clients.
2. Establish rapport with Directing Manager, co-workers, and administration.
3. Demonstrate acceptance of co-workers regardless of cultural, intellectual, physical, emotional, or social differences.
4. Share with others and value their responses.
5. Demonstrate flexibility and positive response to the unexpected.

6. Display cooperative attitude.

Evaluation Procedures:

Success in achieving this objective will be measured by the quality of your relationships as observed formally and informally by your Directing Manager and your College Supervisor.

Interim Objective VIII

Demonstrating professionalism is a critical component as interns make the transition from the role of student to that of manager. You will demonstrate professionalism so when in an internship setting, you will:

1. Participate in all work-related activities expected of the directing manager.
2. Attend all internship seminars.
3. Express positive responses to the internship experience and related activities.
4. Demonstrate positive attitudes toward co-workers, clients, subcontractors, administrators, and work responsibilities.
5. Accept constructive criticism in a positive manner.
6. Dress in a manner appropriate to the work environment.
7. Contribute to the achievement of work goals by following policy and procedures.
8. Demonstrate a willingness to discuss and address important issues.

Enabling Activities & Learning Resources:

1. Attend internship orientation and debriefing meeting.
2. Attend all internship seminars.
3. Submit required forms and information to college supervisor and directing manager.
4. Attend meetings and in-service opportunities.
5. Demonstrate positive and effective behaviors in conferences with other professionals.
6. Join a professional organization and provide service in some capacity.
7. Read relevant professional publications.
8. Develop a plan for the on-going evaluation of your own work performance. List objectives for self-improvement on the Intern Professional Plan.

Evaluation Procedures:

Success in achieving this objective will be measured by the quality of your participation in professional activities as determined by your directing manager and college supervisor.

Categories of Internship Hours

Time Log

Documents record of hours spent in internship, by categories: Observing, Participating and Out-of-Class Activities.

Observation

1. Observe directing professor.
2. Observe resource manager.
3. Observe management team you are assigned.
4. Observe other management teams, if possible.
5. Observe other interns, if possible.
6. Observe all activities.
7. Observe administrative and management procedures and related construction paradigm.

Participation

1. Check duties.
2. File materials.
3. Duplicate materials.
4. Supervise tasks that are assigned to you.
5. Research and study the role of the manager in communicating with others.
6. Develop, when appropriate, a plan for using the construction resources of your company.
7. Learn cohort's names.
8. Give assistance on special topics.
9. Supervise and perform assigned tasks.
10. Work with all assigned management team members.

Managing

1. Perform estimating assignments.
2. Perform scheduling assignments.
3. Plan, implement and evaluate paper flow on a project.
4. Supervise assigned projects, tasks, etc.
5. Estimate and create project files.
6. Monitor all assigned tasks.
7. Supervise/work on a project.
8. Maintain reports.
9. Take responsibility for the management of small, medium and large groups in formal and informal settings.
10. Use a variety of management techniques such as behavior modification, reality theory, congruent communication, positive self-concept development, etc.

Self-Analysis of Work Effort

1. Analyze the effectiveness of your verbal and non-verbal communication.
2. Develop a plan for ongoing evaluation of your own performance.

Outside Work Activities

1. Read professional materials and publications.
2. Attend in-service workshops.
3. Attend company meetings as allowed.
4. Attend all internship seminars.
5. Join a professional organization and provide service in some capacity.
6. Attend/participate in extra-curricular activities.
7. Attend social events.
8. Stay physically fit.

Professional Development Plan

Helping interns to begin construction management duties is a challenging task. There is no "one plan" for all interns. However, a period of 14 weeks of full-time working is suggested. During the internship period the directing supervisor will be assessing the strengths and weaknesses of the intern's abilities. Frequent feedback through this period will assist in professional growth as well as keeping the final evaluation from being a total surprise.

One must remember the student internship is learning to be a manager. An intern is expected to make some mistakes. The directing supervisor is in a position to help the intern learn from these mistakes and develop strategies to prevent them in the future. It is generally recognized that one of the most effective methods of assessing changes in behavior is through self-evaluation. Interns must be encouraged to look at themselves objectively and to assess their assets and liabilities. Conferences, both formal and informal, provide the vehicle to accomplish this self-analysis.

Day-to-day informal discussions provide valuable feedback in checking over plans and materials, evaluating together the intern's progress as well as reviewing plans for the next day.

It is advisable for the directing manager and intern to set aside a predetermined time each week (about one hour per week) to evaluate the week in total; plan for the week ahead; discuss working techniques and materials; to discuss specific problems which have occurred; to assess areas of construction management which have been successful and others needing definite improvement; and to identify successes.

To summarize, internship activities can be grouped into four categories:

Observation - Participation - Planning - Evaluation/Feedback

Conclusion

The development of a construction management internship course requires the development of goals, competencies, an implementation method and an evaluation system. This article supplies the rationale and basic methodology for a true internship course resulting in the ultimate capstone course.

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Appendix

Operational Definitions:

Competencies – sub-goals contained with the mission statement, which represent the specific learning intent to be achieved by construction management students completing the internship.

Enabling Activities and Learning Resources – refers to the strategies and material and human resources necessary to enable students to achieve a desired competency.

Evaluation and Grade Reporting – refers to a statement of the over-all criteria that will be used in determining student achievement with reference to grades.

Intern Objective – represents an extension of the competency statements to include the behavior by performances, criteria, and conditions necessary for the construction manager to succeed in the construction industry environment.

Post Assessment Statement – statements used to clarify means by which construction management students can demonstrate achievement of interim objectives.

Directing Manager – excellent managers who have assumed the role of boss, coach, and mentor. This manager assumes the primary responsibility of day-to-day activities of the construction management student.

College Supervisor – the university professor assigned responsibility for supervising the internship experience.

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Construction and Culture: A Built Environment

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The purpose of this article is to update and inform construction educators about an "unconventional" course introduced into the curriculum at Arizona State University's Del E. Webb School of Construction (DEWSC) in the spring of 1991. Now that 18 semesters have passed and almost 2,500 students have taken the course, it is an appropriate time to report on the lessons learned. Also, the authors have just published a textbook for the course that was used for the first time in the fall 1999 semester (see references). Perhaps other schools would be interested in adopting a similar course within their own programs. The freshman-level course, CON 101, *Construction & Culture: A Built Environment*, satisfies three university General Studies requirements: Humanities (HU), Global Awareness (G), and Historical Awareness (H). While it may not be unique to the university-based construction curricula within the Associated Schools of Construction (ASC), it was certainly new to our curricula. The first course offering in 1991 had one section with 35 construction students. Today, (December 1999) we have three sections containing over 260 students representing many of the disciplines offered across the campus.

Key Words: Construction education, culture, historical, global, built environment, constructor, certification

Introduction

The purpose of CON 101 is to broaden the student's awareness of the significance of construction as a discipline that affects, and is affected by, ethical, societal, and historical values in all societies. Due to the rapid evolution of construction, and an increased specialization and sophistication of technology in terms of materials, equipment, methods and processes, the construction industry continues to have an ever-increasing impact on humanity. Crises such as the proliferation of hazardous waste and the pollution of the environment, as well as the overloading and deterioration of the infrastructure in all parts of the world, find both their genesis and their solution in the "built" environment. CON 101 is designed to address the effect that construction has had on our human and cultural values. By studying the evolution of building from the earliest shelters to the pyramids of Egypt and the temples of Greece, through the roads and aqueducts of Rome and the Great Cathedrals of the middle ages, to simple Irish farmhouses, students are given an understanding of how construction fits into what we define as "the built environment" (Clark, 1985). They can also come to appreciate the effect that human values and *culture* have had on the actual construction process as a whole. In our opinion, it is imperative that we study these civilizations as a method of learning from past successes and errors. Perhaps there are lessons that we could apply to our practices today as we prepare to enter a new millennium.

Following the historical analysis, CON 101 addresses the contemporary world from a global perspective. By analyzing the breadth of the construction profession today, the freshman student will better understand the physical world that he/she lives and perhaps establish personal ethical standards to adjust to this world. With the increased participation of foreign construction firms in the U.S., we need to become acutely aware of the innovative and challenging philosophical changes that are taking place in the construction process and the relationships between those involved in the process. For example, terms such as "Build-Operate-Transfer" and "Design-Build" were not even heard of 20 or so years ago.

Developing the Course Philosophy

CON 101, *"Construction & Culture: A Built Environment,"* is intended to give the beginning student an overview of the *origins* of construction such that he/she might better relate to the physical aspects of the industry. Unfortunately, the perception that the majority of people have of "construction" is that it is simply a vocationally or "trade-based" industry, which has an impotent set of ethical guidelines, and is often times an irritation and inconvenience to their lives (Mulligan & Knutson, 1999). CON 101 stresses the importance of construction as a ***profession***—one that is rooted in education and requires a strong code of ethics if we are to gain the recognition and respect of those outside of our industry. By studying the historical origins of the construction process, the student should grasp the significance of the extensive impact on the moral and cultural values of people down through the ages and in all parts of the world.

The Historical Impact

CON 101 initially focuses on the historical relationships that have made an impact on the construction *process*, which all began with man's first efforts to utilize the elements provided by nature and build upon these as a means for survival. Later, man's objectives became more sophisticated as the refinement of his tools and materials, along with an increase in knowledge, evolved. Soon these new discoveries became a major factor in influencing and/or modifying the social and cultural customs of a civilization, as increased emphasis was placed more on human values (e.g., comfort and aesthetics) than on mere survival (Fitchen, 1990). Even today we see that the "built" environment within which we carry on our day-to-day lives biases our decisions for future generations. Societal involvement in the construction process per se is becoming more and more apparent as we recognize the impact that development and construction have had on what we might classify as a "quality of life." If an individual's quality of life is to be one of the principles by which we quantify our standard of living, then we can unequivocally state that construction has played a major role in establishing the values that we will accept. Many times society—the general public—can influence not only what gets built, but also what *doesn't* get built. One could also debate whether the construction process is the *cause* or the *effect* in establishing human values; however, if it were not for continual *technological* improvements in this process, it is unlikely that we would see many of the cultural and societal changes that have occurred. For example, the introduction of steel into the building process created the skyscraper, which has altered the way we live and work in ways never dreamed of 200 years ago. The incorporation of air conditioning into work places and residences illustrates how vast regions of

the world were opened to populations that would have previously considered these areas uninhabitable. And there are many more examples.

In fact, a genuine cultural bond linked to construction has existed for centuries. The Pyramids of Egypt were built by a civilization that had a strong belief in the afterlife and an unwavering respect for their leaders. An entire set of human (and spiritual) values was formed around the philosophy of building and "individualizing" the pyramids of Egypt for the pharaohs, as it was felt that the immortalization of a pharaoh could be accomplished only by preservation in a virtually indestructible structure. The gigantic tombs that dot the landscape near Cairo would make absolutely no sense at all today, unless one wants to market a gambling casino in Las Vegas or participate in a mass funerary complex in Florida! But in 2500 BC they made perfect sense. We can also find many *parallels* in our evolution of civilizations. The Flavian Amphitheater (Roman Coliseum) was built in AD 72 in response to a highly sophisticated Roman culture that craved competition. In our metropolitan area, no less than *three* ballparks/stadiums/arenas have been built recently or are being planned to satisfy a highly sophisticated Phoenician culture that also craves competition. In other words, not much has changed over the past 2000 years. Whether it is the Christians versus the lions or the Arizona Cardinals versus the Detroit Lions, a society that is technically advanced and enjoys a high level of creature comforts, is most likely driven to thrive on highly competitive athletic events and contests.

The Great Wall of China is an example that symbolized the isolationist movement and cultural repercussions of that era and was built to literally keep people "out" (Sandstrom, 1970). In contrast, the Berlin Wall was constructed to literally keep people "in," reflecting an entirely different societal philosophy. In the end, both were failures.

If one researches the early Grecian approach to construction, he/she would find an extraordinary tendency to finish even the unseen (or hidden) details of a building. To the Greek builders, the act of building was an act of worship, as the gods could easily see under and/or behind an eave, an entablature, or a corbel. However, the approach the Roman builders took to the same detail was much more pragmatic, or secular, in the sense that they would likely eliminate any feature nor would they spend time finishing areas that would be unseen by the casual observer. We can also readily discover that the Gothic cathedrals of Europe, in all of their magnificence, reflected—in addition to the skills and personal characteristics of the Master Builder—the religious-based culture of the Middle Ages. Even the "hippie" communes of the 1960s were an expression of cultural beliefs that were rooted in the existing political milieu.

In all of these examples, the point is that "something" was built in response to a human requirement that was dictated by a change in, or modification to, accepted cultural practices. Whether these practices involved religious beliefs, defensive concerns, social mores, or environmental considerations, is irrelevant. What *is* important is that customs and values have been *changed by, supported by, and influenced by* the evolution of the overall construction process? Yet, as mentioned previously, no one is absolutely sure whether the construction practices of an era *reflect* the culture of that period, or *affect* it. Most likely, they do both.

The Global Impact

The Global Awareness concept of CON 101 addresses contemporary issues, rather than the historical aspects of construction. We needed to address the history in order to link the past with present-day cultures and societies as a method of emphasizing the impact that these former events, methods and practices have had on today's values. Recall the quote from Winston Churchill: *"The farther back you can look, the farther forward you are likely to see."*

The whole purpose of the Global Awareness requirement is to assist our students to take a broader view of the current issues, to understand the social, technological, ethical, political, and/or environmental problems as *international* problems in a shrinking world. The influence of rapid (instant!) communications has shrunk our world and we need to focus on the *cultural* impact that construction has from a global perspective. We hope to leave the student with a greater appreciation for the effects that ethical and human behavior, as related to construction, have had on all societies.

Our *ultimate goal* in the Global Awareness part of the course is to expose freshman students to construction from an entirely different perspective. We would hope that this might instill in them a desire to develop their own personal set of moral and ethical standards. As such, we want to explore the global impact of environmental, political, and economic events and trends on society as a whole. Each of these in turn has a significant impact on the business and economic climate within the construction industry. We want to identify those critical global issues and focus attention on the significant forces and problems that shape our industry.

Course Content and Structure

Without going into too much detail and incorporating the entire syllabus, we would like to share with you the general format that the course has evolved into over the past several years. First of all, after a trial run this past semester (fall 1999), we are going to go "on line" for much of the course materials, grading, assignments, and notices to the students. We have done some comparative studies on the value of using the web and a separate article will be written on the details of the analysis. Suffice it to say that the results have been very positive and have improved both the instructor's and the students' experience.

The course follows the textbook through twelve chapters that begin with the evolution of civilization and end with the global construction market in the 20th century. We cover such topics as learning from the built environment and from the failures that have occurred; a fundamental description of structural forces; how the interior environments have been controlled; falsework and its importance (Fitchen, 1990); and the people who have made this industry so great—an entire chapter that profiles the builder and another chapter that deals with the origins of the labor force. There are also three "specialized" chapters. One is on transportation systems, one on the cathedrals, and one on the Pyramids of Egypt. A list of ten review questions is at the end of each chapter, which we use for homework assignments.

Students are also required to complete three two-page reports during the semester and a ten-page research report at the end of the semester. We vary the content of the shorter reports, but generally the first one will include a visit to one of two local museums and reporting on the early Native American structures. The second report requires them to select a current construction-oriented article from a journal, a periodical, the Internet, or even the newspaper, and analyze the importance and relevance of it to the course and the construction industry. The students are required to comment on such items as the culture of the society that built the structure, how it was built, and materials/tools used in each of the first two reports. The third exercise challenges their creativity by asking them to build a colony on the moon (for example) using a minimum of guidance and a lot of imagination. Some of the submittals are absolutely incredible, outlandish, unbelievable, extraordinary, etc. But they are also refreshing, intuitive, innovative, and fun to grade! The final research paper is based on an assigned topic anywhere from "A" (*Aqueducts of Rome*) to "Z" (*Zeus and Hera Temple*) and it involves a significant historical construction project. It must be written following a very strict format, including an abstract and a bibliography with a minimum of three references.

In addition to the occasional "pop quiz," students take two multiple-choice exams (about 50 questions each) and a 100-question, comprehensive final exam. Also, there is a provision for a student to obtain extra credit by sharing with us some item of topical interest. The class meeting times range from 50 minutes, three times per week to one hour and 15 minutes, twice per week. All of the "core" presentation slides are available to the student on the web.

Our selection of instructors to teach this course is based on several criteria, such as: *interest* in teaching such a course; ability to work with a diverse group of students; knowledge of, and interest in, the historical beginnings of construction; knowledge of, and interest in, the global issues facing the industry today; and their own personal motivation and creativity. We have been very fortunate over the past several years in identifying the *right* people and have never had to go outside of the DEWSC for a CON 101 instructor. However, during the spring 1995 and spring 1997 semesters, instructors visiting the DEWSC from the United Kingdom on faculty exchanges taught a section of CON 101.

The instructors can use either overheads or Power Point for their lectures and discussion. Each of the chapters has a complete set of slides that are augmented by special interest photos and/or articles. For example, when we discuss the many ways that builders have learned from failures caused by natural disasters, there is usually a current catastrophe (hurricane, tornado, flood, etc.) in progress somewhere in the world that can be used as a model for how to build to withstand the forces of nature. There is also the dark side of these events that reveal such things as "shoddy construction" or Jerry building or ignorance of building codes.

Feedback from Students

The feedback from the students via student evaluations and informal surveys has always been very positive. Some examples from a recent section included the following comments under the heading "What did you like most about the course?"

"*I thought it was very interesting. It covered many historical landmarks and concepts. It also covered interesting (projects) of the present."*

"Learning about construction history."

"The course was engaging, fun, and interesting."

"Learning about historical construction of houses and buildings around the world."

"Was interesting. Kept me awake."

The only constructive *criticism* challenged the time of day (late afternoon) and the lack of an adequate textbook (this was part of the motivation in writing a textbook for the course). To be fair, we have also had a few *non-constructive*, unprintable criticisms that usually were targeted at a specific instructor(s). Usually the comments have nothing to do with the course and are based strictly on a personality conflict or a low grade on a paper. Anyone who has been teaching for any length of time will get his or her share of these inevitable comments. Right?

Conclusions

ASU's Del E. Webb School of Construction took somewhat of a risk by making a humanities course part of the *core* curriculum because it is such an extreme departure from our more standard construction management courses. The objective was to stimulate the students' creative and conceptual skills and allow them to *think* about other issues related to construction rather than the typical physical entities of design, materials, methods, financial control, and management. We believe that now, with eight years under our belt, that the course has proven to be a winner. Not only has it given the new construction student an overview of the building industry, it has allowed us to communicate with students in a broad range of disciplines across the campus. One of the current sections has students from computer systems engineering, pre-business, civil engineering, computer science, architectural studies, electrical engineering, justice studies, chemical engineering, communication, recreation studies, history, and a large population of "undeclared" students. This "mix" has had two very positive effects. The first is that with the merging of students from varied areas of study creates an atmosphere in which there is an exchange of ideas, bringing an entirely new dimension to the construction classroom. The second positive effect is that it has served as one of our most productive recruiting techniques. This is most likely due to the fact that most CON 101 students are freshmen and about 50% entering ASU are "undeclared" majors. We generally have at least two to three students from each of the three sections change their major to construction.

In conclusion, we have tried very hard to impart a more professional *image* of construction to these students. We have emphasized the importance of their education as a stepping-stone to certification and introduce the reality that it is now possible to become a *Certified Professional Constructor*. In fact, the address, phone number, and fax number of the AIC Constructor Certification Commission is clearly highlighted in Chapter 3 of the text!

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"Developing a Design/Build Internet Class: Communication, Communication, Communication!"

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At a time when the design and construction industries are aware of the increasing use of the Design/Build project delivery strategy, there is little attention to its implementation in architectural or construction management programs as a classroom experiment. East Carolina University Department of Construction Management and the University of Oklahoma Department of Architecture have begun to investigate the ramifications for such programs in their curricula. This research presents the development strategies created to instigate an Internet Design/Build class for the two schools. This paper relates the positive and negative components confronted during the development and implementation of the overall class. Using available computer information technology resources, such as NetMeeting and MIRC32, the Design/Build class approach of study emphasizes the management of design, construction, planning, finance, and marketing, as well the absolute need for communication between the team members. Rather than face the traditional confrontation of the parties, this class is intended to strengthen the professional bonds, complementing each partners' strengths and thereby creating a strong TEAM approach to design and construction. The implications derived in developing this program will show the need for such investigations in other schools of construction and architecture interested in pursuing a relevant and emerging domain of education. Rather than deny the existence of Design/Build, this study recognizes the need for its integration and acceptance into professional programs.

Key Words: Design/Build, Internet Learning Environments

Introduction

For the past 100 years, the primary method of Project Delivery for construction projects has been the Design-Bid-Build method. This system is cumbersome for the Owner who wants to avoid conflicts between the A/E and Contractor during the project, while still attempting to meet his/her needs of a cost-effective, well designed structure built in a reasonable time frame.

In response to these needs, the Design/Build method of delivery was developed as single-source procurement for the Owner. Design and construction are provided to the Owner for a "Guaranteed-Maximum Price" (GMP) from the Design/Build firm. By employing this project delivery framework, adversarial relationships between A/E's and Contractors have the probability of being significantly reduced. The Design/Build firm acts as the facilitator for the two entities so that they are working for the Owner's objectives. Design/Build shares the responsibility for product delivery between the historically adversarial groups of builders and designers. With this shared responsibility and product, there is no finger pointing to shirk the responsibility of a non-performing product or team member (Whitlock, 1992, p. 90).

At a time when architects and construction managers may scoff at Design/Build and wish it would go away, a greater need for owners to obtain design/build services has increased ("Design/Build Gains Appeal," 1994). It is this need that this classroom setting attempts to enhance. Although there are a variety of company configurations for Design/Build firms, the project was centered on the method of a total Design/Build firm that encompasses both design and construction within their organization (See Fig. 1). It is the most advantageous method for maximizing the strengths and minimizing the weaknesses of the A/E and Construction components.

Figure 1: Design/Build Project Delivery System

Schools have previously provided classes in Design/Build at some construction-focused architectural programs ("Learning From Construction," 1996), however these classes have dealt primarily with creating a hands-on clinic to teach students about sites, structures, materials, and joinery. Research did not uncover any true Design/Build courses directed towards the complete development of such a project delivery course. With this need to expose graduates to the reality of the fastest growing method of project delivery in the design and construction industries, the course was developed.

Class Organization

The initial Internet Design/Build class for the spring 1998 semester provided the researchers the opportunity to investigate the Design/Build project delivery system. The Internet class permitted the enhancement of the learning experiences for both disciplines, and the interaction between remote universities, specifically East Carolina University (ECU) and the University of Oklahoma (OU).

The class organization was composed of six (6) teams created with one ECU Construction Management student and one OU Architecture student. Communication between all parties and teams was required to be totally through the Internet. The communication software programs available to students, as well as those that they have discovered on their own initiative, allowed for this form of interaction. In order to maintain written records of the communication, formal communication records were required by all teams. This obligation allowed the research team the opportunity to study the dynamics of the decision making process through the semester. The

necessity of these records was reinforced to instill in the students the need for complete written documentation in the working environment.

Each team created homepages that were maintained throughout the duration of the semester. The professional homepage became the marketing showcase for each team's Design/Build firm. Because of the special character of this class, a number of programs, alumni and interested individuals were watching the development and progress of this project.

In addition, all semester course presentations were accomplished via the Internet. This allowed each team to display their designs to many individuals and groups simultaneously and thereby enrich the learning experience. This method of project presentation delivery was used to experiment with the given software technology to verify its viable use for design and construction firms.

Class Project

The project for the Design/Build Internet Class was a Fire Substation located in Las Vegas, NV. The building type was selected because of its relative complexity to the time constraints of this new learning environment; the electronic studio/classroom. In addition, the facility type was at a design and constructability level that enabled a more complete investigation by the teams.

The project site was the actual location of a recently constructed fire station designed by Carpenter Sellers Architects. Project photographs and topographic surveys were provided for the teams. Based on preliminary project programming requirements and cost constraints, teams were instructed to develop full programming studies, site development studies, preliminary and final materials research, code analysis, schematic designs preliminary designs, structural designs, preliminary cost and scheduling, value engineering, and final design development. During the semester, intermediate assignments were given to provide needed direction.

Weekly presentations enabled the teams to update their project development to other class members and to the professors and visiting critics. Final presentations were given at the end of the semester to a combined critique of academics, architects, and contractors at both university sites.

Expected Outcomes from the Class

Because of the multiple issues relative to the combined disciplines of Architecture and Construction Management, and the inaugural Internet learning environment, there were a variety of expected outcomes of interest to the research team. Not only was the issue of the success of a Design/Build teamwork program important, we are also interested in the role and implications of using Internet technology to enable effective collaboration. Specifically we were addressing:

1. Communication, Communication, Communication

Communication was the primary goal of the project. Not only were we interested in the dynamics of two distinct disciplines and how they would interact, but also the significance of how Internet collaboration would influence or hamper the team process. Two specific modes of communication were utilized: *asynchronous and synchronous*.

The *asynchronous* mode allowed team members to work at different times on different components of the Design/Build project without the simultaneous presence of their partner. Therefore they were not required to be electronically connected in a common environment, however were united through e-mail and FTP software. This allowed directed research by individuals based on prescribed duties negotiated by each team.

The *synchronous* mode allowed necessary multi-task interactions with partners. When it was critical to discuss findings, as well as evaluate changes or needed changes during the project, members were linked simultaneously in a common electronic workspace. Group presentations, where the electronic classroom simulated the traditional classroom, were convened in this communication mode.

2. Exposure and Appreciation to the Strengths of Both Parties

The understanding and appreciation of both disciplines were issues that too often have been overlooked by programs in construction management and architecture. In many instances, as programs have become more exclusive, the potential for continued adversarial relationships increases. New technologies and practices trends require reassessment of the long held attitudes of the two disciplines of architecture and construction management (Ross, 1997). Contributions by both partners to the design, development, management, constructablity, and building use, all determine the outcome of design decisions. Therefore, by engaging the students in the framework of TEAM, the class experience presented them with the opportunity to experience the strengths and weaknesses of the current learning environment. The TEAM organization made the researchers more acutely aware of the different values inculcated by the two disciplines of Architecture and Construction Management.

3. Understanding the Building Process

It was essential that both parties gain a firm understanding of the "building process." This was defined as the comprehensive nature of a structure being constructed, from idea, to drawing, to design, to refinement, to cost refinement, to buildability refinement, and ultimately the implementation into its final constructed form. A successful experience would elevate this project to a higher level of learning for all students.

4. Internet Communication Skills

With the requirement that all communication for this project take place via the Internet, students were confronted with the difficulties of current Internet video software. Based on the technical hardware and software capabilities created for graduate coursework at ECU, existing mainstream communication software was employed. This level of interaction

allowed the students to experiment with NetMeeting communication software, in conjunction with standard chat rooms, e-mail, and FTP software.

5. AutoCAD and Construction Management Computer program enhancement

Because of the differences in curriculum between Construction Management and Architecture, exposure to differing software and the needs of documentation and information required for their successful implementation, became a strategic issue to address. Exposing architecture students to the pragmatic issues that construction management students must address in utilizing Primavera and Timberline software, along with the necessity of Construction Management students having the ability to manipulate AutoCAD drawings to obtain information, were specific hurdles required by all to teams to explore. The project also allowed both members to enhance their working knowledge of the programs on a realistic project, thereby enforcing their decision-making skills during the design phase.

Educational and Technical Requirements of the Class

Based on the following general requirements for both disciplines, students were selected for the initial Design/Build Internet class:

1. Construction Management

- Senior status.
- Working knowledge of Primavera and Timberline software.
- Internet experience (Preferable WWW design knowledge).
- High communication skills, both verbal and written.
- Enthusiasm for the challenge.

2. Architecture

- Junior/Senior status.
- Working knowledge of AutoCAD and 3D Studio or appropriate compatible CAD software.
- Internet experience (Preferable WWW design knowledge).
- High communication skills, both verbal and written.
- Enthusiasm for the challenge.

From this baseline of knowledge, twelve (12) students were selected. A primary concern was in the understanding of the Design/Build project delivery format of the class. Two Internet class sessions were held to discuss the dynamics of the process to provide a better understanding of the roles of the partners. This was deemed insufficient and a more thorough discussion was required.

Students were introduced to Microsoft NetMeeting (See Fig. 2) as the primary method of communication. This software allows for one-to-one video and audio communication, with the

ability to share applications and to collaborate electronically. These applications allowed team partners to discuss issues at length over the Internet and share software applications when required. Whiteboards were used as a standard method of discussing design ideas prior to their development in CAD documents (See Fig. 3). Chat boards became the primary method of retaining the required written documentation of all discussions during the design development phase. In addition, when the need arose for other teams to come together as a group, NetMeeting provided the capability of six individuals communicating via the Chat Room application. The software additionally allowed maximum flexibility for teams to discuss day-to-day problems.

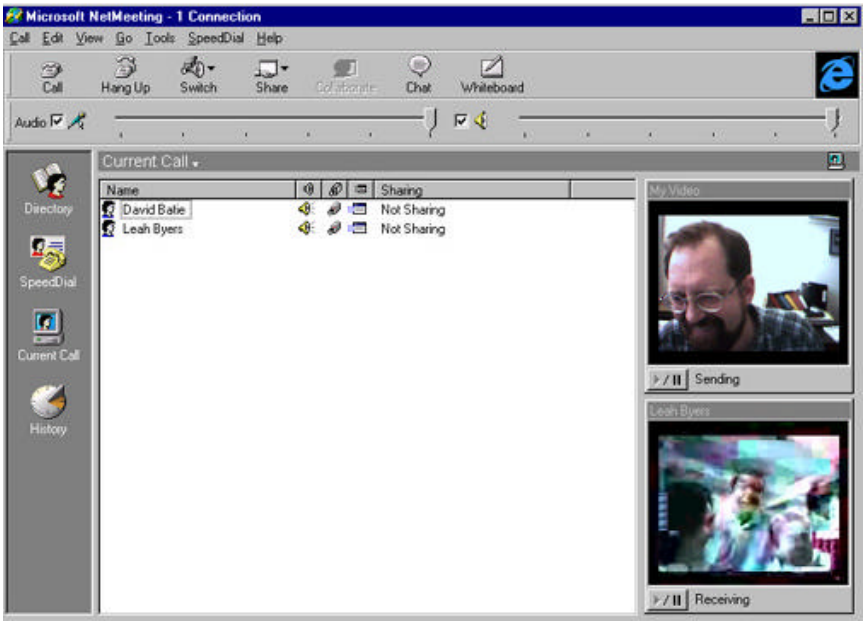

Figure 2: NetMeeting Video Conferencing

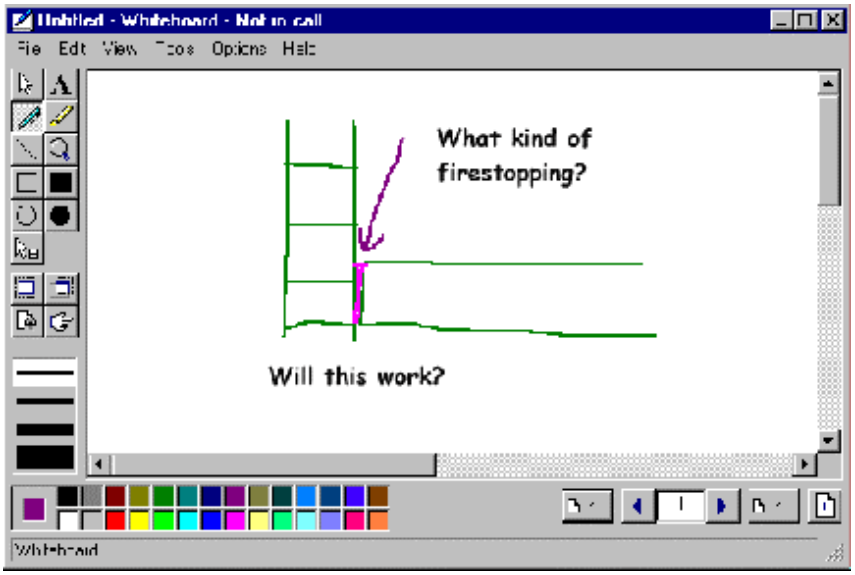

Figure 3: NetMeeting Whiteboard

Both universities utilized established labs for use of the software, maintaining 200 Pentium PCs computers with all relevant software installed, including Cu-See-Me cameras, speakers, and microphones. Students were also given the option to download the NetMeeting software for their home computers. Because no specific university-governed time was established for the class, teams had the option to set their own meeting times and schedules. This allowed for a great deal of freedom by the students, but also required self-directed discipline to maintain the required time schedule. Presentation meeting times with the professors were established for every Friday afternoon.

Implications of the Project

What we learned, what students learned from the experience.

Because the instructors were dealing with a program arrangement that had no known prior examples, there was no specific basis of comparing the results of this project against previous work. The program schedule and content expectations were established from each professor's previous teaching experiences in their specific disciplines. In addition, the pragmatic requirements for course credit dictated a variable observance of requirements. Since ECU students were using the course as a three (3) credit hour special problems course and OU architecture students were involved in a five (5) credit hour design course, a disparity of required work existed. Because of the complexities of work taking place at different times during the term, it was not possible to simply accumulate both content areas hours to assign hourly work requirements. Ultimately the decision was made to evaluate the outcomes based on observations of group dynamics, completeness of intermediate goals, completeness of intermediate requirements, individual research, and final project completeness and holistic quality of the entire project achievement.

The learning requirements were compounded by the realities of having a partner with a different perspective and interest, causing delays for consideration, coordination, collaboration, and communication that are not required of the content material of any course by themselves. There were clear differences in “values” pertinent to the particular disciplines. Architecture strongly valued issues concerning originality, whereas construction management strongly valued issues concerning buildability, i.e., cost and the precedence of building. The Design/Build Studio process was slower than expected; however we believe it was also more refined and resolved. Professors and students were required to be more flexible in scheduling their time.

Electronic contact versus human contact had certain results that were not anticipated. One major issue confronted involved the situation when students were physically out of touch with their typical studio context classroom. There was greater potential for students to “wander” into areas of the work process that would not occur in the traditionally structured classroom or studio. It was discovered that students were taking advice from technical experts through Internet discussions where the information, although possibly being correct, was in direct opposition to the educational intentions of the project. By limiting some building requirements, the instructors chose to direct the program to simulate a complete building process. While the instructors intentionally shaped some issues simply for the sake of moving the learning experience to meet

educational goals, technical advisors provided advice that sidetracked the work process and thus students are not clear whom they should have taken the advice.

Secondly, students had the potential to stray into directions of design that would not go unnoticed by a typical classroom instructor. There would normally be immediate feedback to design decisions. However when using the Internet to converse with the teams, the comments would come to the students via e-mail or chat board. The asynchronous process was deemed to be much slower and required that students be diligent in checking their e-mail regularly. Frequently messages were received by the students but not responded back to the professors. This asynchronous communication led to confusion and there was doubt if the comments were understood or even received. This had the effect of eroding confidence in the communication process and the loss of control over the studio/classroom learning environment.

With communication being the primary learning goal of the project, the lack of control contributed to a breakdown in the TEAM concept. There were instances when instructors received comments from team members that indicated team partners were not contributing equitably in the Design/Build process. Until both professors investigated the situation, the perception caused dissension among some teams. Part of the misunderstanding can be attributed to the Internet communication environment. This was caused by the fact that their partner did not witness their work. In addition, understanding the nature of each partner's discipline was another contributing factor. We believe a more thorough understanding of the process and actual witnessing of the work process would have eliminated this perception immediately. The issue of trust was at stake in the virtual environment.

Other factors that do not have direct implications on the project were also observed. Impressions over the Internet involve the "TV" image of the screen used for Videoconferences. Individuals not comfortable or familiar with being in front of a camera have a tendency to look away from the camera that translates in body language as a lack of certainty about the subject being presented. Uneasiness with being on the screen caused persons to desire a speedy presentation, thereby providing false signals to the receiver of impatience lack of interest, or indifference. Therefore, certain levels of "On-Screen" skills are necessary for effective communications.

The quality of interactions can be compared with a previous Internet Studio conducted in 1994 (Connell, 1995). The Design/Build studio clearly proved to be more effective. As a form of comparison, the 1994 studio lost nearly 2/3 of the class participation by the end of the semester. In the current situation, full participation was maintained in spite of unforeseeable technical problems, shortcomings with electronic communications, misunderstandings, and discipline differences. This is attributed to technology-literate and interested students, more active involvement of the instructors, and having the benefit of previous experience in such a teaching/learning environment. Collaborations could clearly have been better and one would expect that such a situation would occur if additional pre-class preparation had been expanded as post-evaluation of student perceptions of the course indicated. This pre-preparation is vital for a successful "Internet Learning Environment" (ILE).

Additionally, students explored and adapted new software during the semester that proved more effective to the needs of the Internet Studio. The heuristic process applied to software use in the

course experience was a natural outcome of the educational endeavor. Accordingly, research has shown that tool usage influences the fashion that individuals learn and how they learn, both positively and negatively. These ideas can be viewed positively as paradigm shifts in learning and negatively as an "analogue takeover" (Noble, 1998 and Broadbent, 1988).

The quality of the design product of the Internet collaborations proved to be clearly superior to a typical design studio that does not have a Design/Build Construction Management team member. If one were to compare the work of a same design project in a traditional architectural studio to the products that were derived from this collaboration, the differences are significant. The Design/Build teams referenced (1) performance specifications for the design, (2) material options with explanations for the choices made, (3) detail drawings of various types of design conditions with specific manufacturers, (4) cost estimates for all decisions, and (5) an overall decision making process grounded in real current context experience. Student homepages showcased the development stages of their designs in a variety of professional designs (See Figs. 4 & 5).

Teams experienced the complexity of the "building process" first hand, thus meeting one of the initial goals for the class. The members also displayed the stereotypical responses to each others discipline; examples being 1) designing at the last minute without regard for or understanding the consequences of such decisions, 2) seemingly always focusing on cost as a primary form constraint, 3) taking on the role of the design lead rather than a position of equity, 4) teams at times had self perceptions of difference when they were expected to have coalesced as partners. This is not completely without justification if one considers that they only were partners as they interacted, while the rest of their daily time was spent in other activities not related to their working relationship.

Figure 4: Student Project

Figure 5: Student Project

Observations for Future Development

From the initial teaching endeavor, areas of development and improvement are required for future Design/Build classes. Specific areas include the understanding that students with field experience (architectural or construction related) will fare better in collaboration. Specifically architectural students should have a strong technical understanding of construction in conjunction with design expertise. It is equally important to understand that in scheduling or allotting time for design, the process has an unruly nature; this is attributed to the design process being conceived as "continuous and on-going" (Connell, p. 110-111). Additionally, construction management students are deficient in their CAD capabilities, which led to frustration when working out original budgets. By not being familiar with the capabilities of CAD, and expecting dimensioned drawings to work from, students were confused and delays developed in compiling the cost figures. Future classes should provide an initial short-term class in CAD for the construction students.

Structured communications with specific goals per interaction will streamline the decision making process between teams. For example, when making formal presentations, individuals must identify themselves, explain the purpose of the meeting (what is going to be discussed), and then conclude with what just transpired (repeating the instructions of the introduction). This assists to make communication explicit (Peña, 1987, p. 54-56). Otherwise team members have the tendency to avoid speaking about their accomplishments by internalizing the information and considered it common knowledge.

Organization and documentation of information for the Internet (distant learning) environment requires special attention to how an audience will interact with the data (Tufte, 1990, p. 101-111). This applies to home page design and how one is able to understand the whole working process and presentation of graphic and verbal information concerning the design/build process. It is clearly a communication exercise at a sophisticated level. Whether the intent is to work over the Internet or in a close collaboration of same-location disciplines, the results of a design/build endeavor will provide a greater appreciation, a better understanding and a more informed student body for the effort. However, communication remains essential.

Dedicated computing facilities would make the process more reliable and would help to create a learning space for students when requiring help. Conditions of sound and light can be improved in a dedicated space, thereby helping link the distant interactions. Information could be distributed via a bulletin board in the dedicated space for improved communications that occur naturally in a non-Internet environment. This can be thought of as a workplace or studio for distance learning. It does not have to be exclusive for the singular class but should be for Internet activities.

Finally, exit interviews with the participants provided needed documentation for the development of future Design/Build classes. A one-year post evaluation of student status in the industry is underway. The researchers hypothesize that many of the members will be leaders in the technological/communications areas of their companies, due in large part to this experience.

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Searching for Faculty-The Mundane and the Controversy

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The search for an appropriate construction faculty member is a very challenging process. The process has changed over the years with technological advances that are utilized in disseminating the advertisement, as well as legal restraints that are imposed during the search. (broaden/restrict) There are controversial questions to be asked as well. Is it more important to have faculty that have been practitioners in the construction industry, or to have new Ph.D.'s with proven records of scholarly activity in construction? Are faculty from international backgrounds going to relate to the students and to the local construction organizations? Should construction faculty be diverse? Should construction faculty be politically correct? These questions should be addressed at the beginning of the search process.

Key Words: Assessment, Discrimination, Faculty Search

Introduction

Both the search methods and the composition of the construction faculty have changed over the years. In the early years of construction programs, a much more subjective search was made with few legal implications that were imposed. A department head might have examined applications from the mailbag, invited a candidate to campus, and soon after would offer a contract. Later years added legal checks and balances to the process to help avoid non-intentional discrimination. As the construction discipline has matured, faculty needs to be more than good teachers. Scholarly activity is a good indicator of the sophisticated needs in industry that have affected the expectations of new faculty. The changes in composition of faculty capabilities have affected other aspects of the search and the pool of those available. Increases in technology have now allowed the use of the Internet for the search process through e-mail and the World Wide Web. However, does this mean that the search process for faculty has arrived at an end result with no root problems that need to be addressed?

A detailed search procedure is advised, but careless and hurried steps at the beginning may still cause problems. There are not only legal problems that might occur, but also some moral issues that cause controversy behind closed doors. There are questions about what kind of faculty member is really needed.

Preliminary Considerations

The initial part of the search, before applications are received, has more impact on whether the search will go well than any other part of the process. It deserves a great deal of thought and examination, even though there is a great temptation to hurriedly get things moving quickly.

Committee Composition

The composition of the search committee should have a good mix of people, and obviously should consist of those who will take the task seriously since the task of recommending candidates is typically more time consuming than one would think. The number of committee members can vary--the author has served on such committees with as few as three and as many as eight members. However, personal experience has indicated that a committee of three allows too much weight given to an erratic evaluation by one of the committee members, whereas such variations average out with a larger number of members. However, the larger committee sizes may become unwieldy with difficulties in meeting times, needlessly long meetings to allow everyone to make verbal comments, or discouragement of expressing opinions in the interest of saving time.

The question of having a committee member from outside the program may depend on local dynamics. There are obvious advantages to doing so if the position requires much coordination with another program at the institution. In such cases, having a representative from the other affected program on the committee would be expected. A practitioner representative may be desirable if the position requires a lot of coordination with local industry. Examples of such situations could involve the hiring of a department chair/head, or a research position sponsored by industry. However, committee members who are not in the "chain of command" may not be able to continue the task with the same intensity that they started with once the time commitment increases and meetings need to be arranged during "crunch" time when short lead times are the norm.

The Announcement

A hurried preparation of the announcement could easily be regretted once screening of the responses begins. An overly restrictive requirement in the ad may rule out some perfectly adequate candidates that would be discouraged from applying, or require the committee to reject them as being non responsive. Educational background is the requirement that comes to the forefront--since construction is a newer academic discipline, degrees in architecture, business, engineering, industrial arts, etc. might be perfectly appropriate instead of restricting candidates to a degree in construction.

With this in mind, the announcement should distinguish between which qualifications are *required*, and which qualifications are *preferred*. Since the screening method should be tied to the description given, careful wording can help in narrowing the field to those that are truly qualified and assure that each standard is related to successful performance of the position. In addition to qualifications, the announcement should obviously include a brief statement

describing the position, the contact person, and dates for when the position will be opened as well as the cut-off date.

Methods of advertising the position have changed in recent years. The increased use of the computer Internet has made information available in many new ways. The home page for the construction program is often used to provide information about faculty vacancies. The home page for associations like the Associated Schools of Construction (ASC) might include such announcements or links to them. There are also e-mail lists of people with common interests that would find vacancy announcements within the scope of their purpose. Again, the ASC maintains such a list where utilizing one e-mail address sends the message to all members on the e-mail system. Another example is the Co-operative Network for Building Research (CNBR) list maintained in Australia, but open to all subscribers around the world that have construction research interests, and provides an extensive international audience of over 500 faculty.

However, these have not replaced the old standby methods of sending hard copy vacancy announcements to other programs and organizations. Advertisements in magazines reach a large audience that may not be reached through any other method. While announcements sent to other schools are likely to promote applications from new Ph.D. graduates or an occasional current faculty member, magazine ads are more likely to be seen by those with more experience. Among the many examples of magazines, Civil Engineering is a good source for reaching ASCE members, and Engineering News Record reaches many practitioners. Ads in these particular magazines are fairly expensive, and one should also be prepared for many applications that are "blanket responses" from people that respond to all ads regardless of whether they are remotely qualified or not.

It is likely that the university office of equal employment and affirmative action has some guidelines for wording of the announcement, lists of organizations to send the announcement to, and some oversight of the search process. This office should not be thought of as just another set of guidelines to meet, but rather a valuable resource. Since that office deals with searches from all kinds of departments, they have probably seen most types of situations that might arise. For example, it is possible that the search could result in a legal challenge from an unsuccessful applicant. Even if it seems inconceivable that it would happen in your search, the university has probably already dealt with such an incident. Their experiences can help prevent future difficulties that your search would never have thought of.

Operating Procedure During the Search

Once the preliminary steps have been completed, the faculty search process needs to be well organized.

Screening Applications

An orderly method of handling applications needs to be developed. Logging them in, numbering, and sending an acknowledgment should be routine. This is also a good time to note and request

any incomplete information from the applicant. Mailing any EEO/AA forms that may be required for anonymous tracking of the applicant pool is easiest to include in the same mailing.

After reading a number of applications, they all begin to look alike. Rather than a subjective reading of the applications by the committee, a screening method that allows for rejection of those that do not meet the advertised requirements and permits a ranking of those that remain should be utilized. It should be recognized that consistency in the evaluation is absolutely necessary as it is typical that the applicants will not all be evaluated at one sitting. One method that has proven successful (Al-Khafaji, 1996) is to utilize a form that starts with the requirements stated in the ad (such as required degrees, experience, etc.) and space for the committee members to indicate whether the candidate meets those requirements or not, and then if they should be considered further. In addition to just "yes" or 11no", one option might be a "hold" category for unusual circumstances such as an incomplete application.

To provide a quantitative method to preliminarily rank applicants, a spreadsheet can easily be developed that allows rating the applicant (e.g. from 1 to 5) in several different categories. The committee weights each category according to the desired balance before evaluations begin. Categories might include teaching background, industry experience, academic course background, research and publications, and quality of institution as examples of things that might be considered. If teaching background were considered more desirable than industry experience, that category might be weighted by a factor of 3 instead of the 2 for industry experience, as the committee desires. A total score is computed by summing the products of the rating by the committee member of the applicant for each category times the weight of that category. Although it may be considered somewhat dehumanizing to assign numbers to people, this does permit a preliminary method of sorting through a possibly large number of applicants in an objective manner. As long as committee members are consistent in their rating values, it also provides a method that is valid over long time periods when later applications are received and must be evaluated.

One area of caution should be emphasized. It is most important to avoid any illegal discrimination in the process. Such discrimination is not necessarily intentional. Any method that results in screening out members of a protected group at a higher rate than other groups is suspect (Bradley University, 1986). For example, the category on the screening form mentioned above: "quality of institution" could be used in an ulterior manner to discriminate against candidates that attended an institution typically identified with one group of people. An outside list of "quality institutions" should be utilized instead.

Other unexpected results can happen with the use of the screening form if care is not taken in its preparation and implementation. Such an example is the category "research and publications". Merely counting publications could eliminate new Ph.D.'s that are just beginning the process of submitting articles for publication.

References

References are utilized to provide independent information about the candidate. Phone conversations with the reference provide the most information, but require more time to arrange.

If phone references are used, a standard list of questions is advisable for consistency. Such questions are likely to include "How well do you know the applicant?", "Why are they leaving their current position?", "What is your evaluation of their scholarship/personality/teaching ... ?", etc. Written reference letters are less likely to include any information on limitations of the applicant, whereas phone conversations may allow the opportunity to ask probing follow-up questions. If written reference letters are utilized, originals should obviously be sent directly from the reference rather than copies provided by the applicant. References are less likely to be honest and complete in nature when the letter is given to the applicant and allowed to be read by them. Glowing reference letters addressed "To Whom It May Concern" fit in this category. Reasons for such a situation may range all the way from the letter being supplied as a gesture when fired from a previous position, to the situation where the person giving the reference will no longer be available. Fax machines and e-mail though, have made it easier to get written letters of recommendation directly.

Transcripts

If original reference letters are desirable, it is even more desirable for transcripts or degree verifications to be originals. Past history shows that there is exaggeration, misrepresentation, and down right fraud in some elements of our society and this has been shown to be true with statements about college degrees as well.

Phone Interviews

A phone interview with the highest rated candidates helps to narrow the field further. As is the case with phone references, a standard list of questions helps to keep the evaluations consistent. Such questions might include "Do you consider yourself to be a researcher or a teacher?", "What are your strengths/weaknesses?", etc. By using this method, an assessment can also be made of the applicant’s accuracy of information previously furnished, communication ability, and personality. Salary expectations could also be addressed to see if this might be a stumbling block.

Campus Visit

Once these steps have been completed, selections of candidates for a campus visit can be arranged. More than one candidate should be interviewed on campus to allow for more complete comparisons. Bringing the candidate to your campus allows both the candidate and the people in your program to gain much more familiarity with each other than can ever be possible otherwise. Tours of the facilities should be arranged, and individual meetings with the search committee and administrators are necessary to get questions answered. A classroom presentation by the candidate to faculty and students is desirable so that a feel for teaching ability and communication openness can be developed. In addition to having students at the presentation, it is good to have a time for the candidate to talk with students alone. This not only allows the candidate to get familiar with what he is getting into, but student input is valuable in completing the evaluation form for recommending appointment.

Clarifications/Expectations

The campus visit allows for clarification of any expectations. Questions from the candidates are commonly expressed about what the course teaching load is, what kind and how much scholarly activity is expected, and what the tenure process involves. Making sure that these are answered clearly avoids long-term problems that might arise from false expectations. Having the candidate indicate which courses listed in the catalog they would be most comfortable in teaching, helps to identify capabilities as well.

Legal Considerations

In any phone conversations and during the campus interview, care must be taken in the types of questions asked the candidate (Bradley University, 1985). One should be familiar with how to handle these procedures with information from the EEO/AA office. For example, questions that divulge marital status should not be asked. For access purposes only, the candidate could be asked for their current legal name and if any records needed are under a different name. Candidates should not be told that any particular religious groups are required to work on their religious holidays, but should be advised of the normal hours and days of work required instead. Likewise, questions that bring out information on handicaps that are not job related should be avoided. Instead ask if they are able to carry out particular job assignments and perform them in a safe manner. The goal should be to ask questions that help assess the critical areas of job performance.

Rejections

Applicants will often be anxious to know the status of the search, and if they are still in the running for the vacant position. In answering phone calls, perhaps the best approach is to be honest about where the search is (whether the search is still in the preliminary screening mode, phone interviews with the top candidates, or waiting to see if an offer made will be accepted), but also to indicate that it is not yet closed and the applications are still active and under consideration. However, once the position has been filled, letters should be sent advising applicants of that fact. In the relief of finally filling the position, one may feel that the job is done and might be reluctant to even touch the files again. Even though rejection letters are not pleasant to handle, it is the polite thing to do and they should be neither brutal nor condescending in manner.

Controversial Area

Even though the search would seem to be straightforward and logical, areas of controversy can rise from biases deep within. An email announcement (Timothy O'Leary, personal communication, December 13, 1995) that advertised a position for women only caused emotions to run high with "flaming" responses from the recipients. Such gender specific advertisements would not be used in the US, but were appropriate in the sender's country. It is hoped that illogical biases are scarce in this day and age, but some questions should be addressed.

Practitioner vs. New Ph.D.

One area that needs to be addressed very early in the search process is settling the controversy over whether the new faculty member should be a new Ph.D. or a practitioner from industry. The local situation could dictate that it is purely one or the other--perhaps a new research program is being developed or a relation with industry extension service is needed, but this is seldom the case. Ideally, one would like to have everything in one person. The author has found that stereotypes commonly held are not necessarily valid. Should one think of a practitioner as one who can ramble in front of the class while guzzling a can of beer, cuss and swear a blue streak, and share "war stories" from his experience that the students will eat up--that they will be imparting the knowledge needed in a particular course? Should one think of a new Ph.D. as one who is thrilled with his theoretical thesis and applies partial derivatives to all examples, imports them to PowerPoint for his classroom lecture, and is really only interested in research--that they will be able to keep students interested in a lower level course? These notions are silly! At least the author has never met anyone who exactly matched either of these stereotypes. A good fit for the program is necessary and that is why the search criteria need to be thought out well in advance about the qualifications necessary. If a person is interested in teaching construction to college students, they are very likely to have a mixture of both theory and practices. A new Ph.D. might be very up to date on the slang and jargon used in construction that was acquired through his research. A practitioner might be well read and versed in new areas that have had to be dealt with in practice.

International/Minority Faculty

Another controversial question that might be heard is "Why are there so many faculty with international backgrounds?", the implication being that this is bad. While this question is seldom heard from colleagues, it has been heard from prospective students and from practitioners on occasion.

The concern from prospective students is perhaps better expressed as "Will this faculty member be able to be understood in class?" If this is truly the concern, then it is obviously one of the categories to be used in evaluating faculty candidates. The communication ability of faculty members can then be addressed in answer to an improperly phrased question from a prospective student.

Such a question about international faculty or other ethnic, racial, or religious groups might arise from a limited segregated exposure to such groups. The earlier comments about stereotypes apply again. The author would argue that exposure to groups outside ones experience is part of the education process that universities espouse. This can even be illustrated within construction practices. The author has encountered students who felt from their construction experience that one type of construction method must be a universal practice (the "we've always done it this way" attitude). They were amazed to find that geographic conditions, even within the 48 contiguous states, might dictate that their construction method could be less desirable or even totally impractical in other areas of the country! This little incident could be multiplied many times if one were to consider construction in the international arena. Since our society is becoming more global in nature, the views that international faculty expose construction students

to, provide an advantage in the students education that may allow them to be more competitive globally.

If the asking of such a question implies an initial bias toward ones own group, it should be recognized as probably being true. If the population in general is initially attracted to their own groups, it is as true for students and practitioners as it is for anyone else. It is noted that African American students desire African American professors as role models and as someone that they can relate to. The same is said for female students. Thus when minority or other group enrollments in construction programs are desired, a faculty member on staff from that group is recognized as being very advantageous. The point is that a broadly based and balanced faculty can be a wonderful combination. Although awareness of different groups is part of human behavior, attitudes of group superiority are not to be part of it.

Conclusion

Faculty searches have become more sophisticated and technologically advanced. However, a detailed examination needs to be made at the beginning of the process to not only avoid potential problems, but to get a picture of the faculty member that is really needed for the program. A vision for the future, needs to be developed and considered. If construction is becoming more global in nature, more globally oriented faculty are needed in the program. Exclusion of certain faculty groups does not become an issue if the real goals of the program and the requirements of the faculty member are examined in detail. One important aspect of outcome assessment has been the establishment of goals and objectives of construction programs. The same principles should be used in the faculty search. Hiring the right faculty member becomes more than getting a good match for the short term, but also requires matching long term goals that are not just individual but broad in nature for the future of the program. All the seemingly mundane work involved in the search process then becomes worthwhile.

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A Study of the Effectiveness and Value of the Institute For Project Management's Two-Week Project Management Course

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This is a summary version of a complete study that was conducted on current practicing construction industry employees who were voluntary students in the Institute for Project Management's Managing for Profit two-week intensive course. The goal was to obtain data that evaluated the effectiveness of the Institute for Project Management course and on the usefulness and value of an actual ongoing construction continuing education course from current practicing construction industry employees. Since no published papers were located on construction continuing education, hopefully, this will serve to initiate more studies. From this data, administrators of the Institute for Project Management course can extrapolate what most of the students concluded about this one construction continuing education program. The results indicated that the students were satisfied with the course meeting their needs and would attend an advanced project management course if one were offered.

Key Words: Continuing Education, Project Management, Mechanical Contractors, IPM Course

Introduction

A review of the literature indicated that there was a growing trend to require all licensed professionals to obtain continuing education in their fields. The literature stated that liability insurance and the promotion of competency-based standards were pushing the growth in state-mandated continuing education. No published research was located on the success or failure of a construction continuing education course. Because the trend nationwide is to require licensed professionals to accrue continuing education credit as part of their license renewal, it is important that these continuing education programs provide substance for the construction professionals. Otherwise, mandated continuing education programs of poor quality provide no value to the consumers or taxpayers that must pay for these licensing programs. The Institute for Project Management course has indicated that a construction continuing education course can be worthwhile and effective.

Research Method

The population for this research was members from the Mechanical Contractors Association of America and those members who were students in the Institute for Project Management's course. Since this course had been taught for more than ten years, there was a large population of past students. Students from nine classes held between 1994 and 1998 were selected for this study. It

was assumed by using the most recently completed classes; addresses would be current and provide a better response rate. These students had a vested interest in the information provided by the Institute for Project Management course as they were currently employed in the mechanical construction industry. These students had experience in construction and the ability to directly apply the principles they were learning in their everyday work duties. These students have also had the opportunity to practice the skills that were learned in the construction continuing education course and could provide quality insight into the training received.

In this study, the investigator developed one instrument to collect data. A questionnaire was developed to elicit responses from past students of the Mechanical Contractors Association of America's Institute for Project Management course. An educational board member from the Mechanical Contractors Association of America and Purdue University's committee on human subjects reviewed the questionnaire before being sent to the students. The questionnaire was mailed out to 268 students who had completed the course. The answers received were then analyzed for the research findings.

Questionnaire Responses

Responses were sought from 268 students of the Mechanical Contractors Association of America's Managing for Profit course. This population represented nine classes of students from 1994 to 1998. All the students were actively employed in the mechanical construction industry and worked for mechanical contractors who were members of the Mechanical Contractors Association of America. One complete mailing to all 268 students' latest known work address was performed. Each individual mailing included a one-page cover letter, a one-page questionnaire, and a stamped return envelope. From the total of 268 mailed questionnaires, 68 were completed and returned. Thirty-nine questionnaires were undeliverable and returned. The overall response rate excluding the undeliverable questionnaires was 30 percent or 68 out of 229. Tests of significance or t-tests were calculated on both the response rates per state and per company and were found to have P-values that were less than 0.01. With a P-value less than 0.05 being considered statistically significant, It can be assumed that the 68 respondents did represent a cross-section of the states and companies.

Demographic Information

The demographic information was of interest and can be used by the Institute for Project Management course administrators to find out where these students were working and how many of the Mechanical Contractors Association of America member companies were sending students. This could be used to help with the strengths and weaknesses in their marketing of the course nationwide. Students attending the nine classes from 1994 to 1998 represented 32 states and Puerto Rico. An average of thirty students attended each class.

The information reported in this section presents demographic information that describes the respondents. The information includes the companies for which the respondents worked, the dates the respondents attended the Managing for Profit course, and the size of the companies employing the respondents.

The pool of potential students to be surveyed was 268 from 149 different mechanical construction companies that included 32 states and Puerto Rico. Each of the nine classes conducted from 1994 to 1998 had an average of 32 students.

Appendix A indicates the distribution of the respondents by state represented. Twenty-two states including Puerto Rico were represented by the respondents of the questionnaire. The largest number of respondents was eight from California comprising 11.76 percent. The second largest number of respondents was seven from Ohio with 10.29 percent. Finally, the third largest number of respondents resided in Massachusetts and was five comprising 7.35 percent of the total respondent population.

Appendix B indicates the number of different mechanical contracting companies where the respondents worked. The companies are listed with a random identification numbers to help ensure the anonymity of the respondents. The company with an identification number of 26 had five responses out of a possible 16. This was both the largest number of responses and the largest number of potential respondents from a company. The second largest number of responses was three each from three different companies. There were a total of 49 different companies represented by the 68 respondents. There were 149 different companies represented out of the current 1505 Mechanical Contractors Association of America member companies.

The size of the mechanical construction companies represented by the respondents is listed in Table 1. The company size was ranked based upon the estimated dollar volume of work in a year. The category with the most respondents was 14 mechanical construction companies doing a volume of $10 to $25 million dollars per year. The $25 million to $50 million and the $50 million to $100 million dollars per year categories each had 12 respondents working for them. Table 4 shows that 75 percent of the respondents worked for contractors performing $10 million to $100 million dollars per year.

Table 1

Size of Respondent's Companies

Size Based Upon the Annual Estimated Dollar Volume of Work	**Number Responding**	**Percent Responding**
$0 to $2 Million	0	0.00
$2 to $5 Million	4	7.84
$5 to $10 Million	2	3.92
$10 to $25 Million	14	27.45
$25 to $50 Million	12	23.53
$50 to $100 Million	12	23.53
$100+ Million	7	13.73
Total	51	100

The number of respondents per class is listed in Table 2. The course was considered full with 34 students and maintained an average 87.69 percent capacity for the nine courses. The class with the highest number of the respondents was the April-September 1997 Managing for Profit course. However, there were respondents from all nine courses covering the 1994 to 1998 timeframe.

Table 2

Respondents per Class

Class	Number Attending Class	Number of Respondents	Percent of Respondents per Class	Total Students Required for a Full Class	Percent of the Class Capacity
Mar. 94 to Sep. 94	26	3	11.54	34	76.47
Oct. 94 to Jan. 95	22	6	27.27	34	65.71
Apr. 95 to Sep. 95	35	5	14.29	34	102.94[a]
Oct. 95 to Jan. 96	37	9	24.32	34	108.82 [a]
Apr. 96 to Sep. 96	33	8	24.24	34	97.06
Oct. 96 to Jan. 97	30	8	26.67	34	88.24
Apr. 97 to Sep. 97	33	13	39.39	34	97.06
Oct. 97 to Jan. 98	21	4	19.05	34	61.76
May 98 to Sep. 98	31	12	38.71	34	91.18
Total	268	68			

Note: Percent of the class over 100% includes those allowed to reschedule week two with another class.

Results

Support for the Managing for Profit Course

Correlation statistics were used after the reliability of respondents answers were checked using Cronbach's alpha. Correlation results close to the values of -1 or 1 will indicate the strongest results. The tables included in this section will be used to indicate the results for each research question tested.

Appendix C indicates the mean values of all returned questionnaire statements 1 to 84 and categories A to I. The Likert scale used had a 5 that equaled a response of strongly agree, a 4 equaled a response of agree, a 3 equaled a response of undecided, a 2 equaled a response of disagree, and a 1 equaled a response of strongly disagree. Students also had a "not applicable" choice that was not weighted with any value. The only time the "not applicable" choice had been used by students was in the specific instructor category. This happened because not all students were exposed to all instructors listed in the survey during the nine courses.

Factors In the Course That Could Influence Each Other

The students who have completed the two-week course rated the Institute for Project Management course a success and the factors that most strongly associate from the course are listed below. Correlation statistics were completed between some categories and statements and values indicating the strength of association between these categories and statements were analyzed. Values close to 1.0 were considered high correlation values indicated greater strengths of associations. Greater strengths of association mean that changing either one of two variables in a pair will probably change the other variable, but association between two variables is not a guarantee that any change will occur. By considering only the strongest correlation values from either the categories or statements of the questionnaire, 24 pairs indicated that if either of the students' measured opinions or beliefs in the statement or category of the following pairs was changed the other statement or category would probably change. Therefore, it is very important

for the course administrators and MCAA facilitators to consider any future curriculum changes that take into account either factor listed in the pairs within Appendix D.

What Did the Students Rank as the Most Important Aspects of the Entire Course?

By breaking the course down into five main categories, the students were asked to rank which category made the course the most successful (question 84). The categories were ranked from 1 being the most important to 5 being the least important. The five categories were the course instructors, the course geographically location, the student interaction, the MCAA facilitators (educational committee members), and the course manuals given to the students. The results indicate that according to the participants the most import category affecting the success of the two-week course was the teaching by the instructors. The second most important category that made the course a success was the student interaction. The third most import category that made the course a success was the MCAA facilitators. The fourth most import category that made the course a success was the course manuals. The least important category that had an overall impact on the success of the course was its geographically location. The results ranked from the students' own opinions of the most important to least important are:

1. Instructors
2. Student Interaction
3. MCAA facilitators
4. Manuals
5. Location

Written Responses to Questionnaire Questions 85-89

Questionnaire questions 85-89 were open-ended. The students had an opportunity to address any compliments or concerns about the course in these questions. Responses varied greatly from each individual student who took the time to provide a written response. Some respondents chose to elaborate with many comments while others chose not to respond to any of these open-ended questions. The comments are listed in the following tables as randomly recorded from the questionnaires.

Table 3 lists 33 responses to what topics students would like to see covered in this course (question 85). Some of the frequent responses were (1) more construction scheduling being needed mentioned seven times, (2) time management and organizational skills needed to be covered mentioned five times, and (3) personnel interaction such as leadership skills should also be covered were three times.

Table 4 lists 49 responses to what topics the students would like to see in an advanced course (question 86). Some of the frequent responses were (1) more construction scheduling coverage mentioned twelve times, (2) more coverage of construction claims and liability issues mentioned eight times, and (3) more coverage of contract issues mentioned six times.

Table 3

Questionnaire Question Eighty-five Results

- Crisis management
- Planning, job start up
- E/A labor tracking
- How to address in writing typical problem or claims to the owner.
- More scheduling understanding.
- Prefabrication effectiveness.
- How to deal with difficult people such as GC's, owners and people in general.
- Scheduling and computer interaction
- More on change orders.
- Labor productivity, analysis, projections, comparisons of manpower vs schedule, labor impacts, etc.
- Cost loaded scheduling.
- More time spent on job scheduling / manpower.
- Spend more time on leadership and handling labor problems.
- Foreman training, decision making
- Computer scheduling
- Fabrication and material handling techniques.
- Executive order #22, minority participation.
- Handling multiple projects, effective day planning. Fast track project, multiple project management.
- Class exercise on claims, how to quantify some costs.
- I would like the scheduling to be more practical. Every student at a computer and more time spent on it.
- I have had several projects where the general contractor is not very organized is there a way to discuss this topic.
- More real life examples of common problems/issues and how good or bad management affects the outcome.
- Leadership "Hands On"
- Computer for scheduling tool control.
- Contracts and disputes.
- Labor relations
- More time management classes.
- None
- How to stay organized.
- Maybe some project manager computer software.
- Multiple project management, estimating, close out (small jobs, multiple crafts, 30 jobs/month)
- Inventory management and pre-fab.
- Dealing with multiple deadlines.

Table 4

Questionnaire Question Eighty-six Results

- Negotiations, role playing
- Productivity - all aspects
- More planning
- Methods, labor forecasting
- Legal issues (killer clauses), negotiation strategies, financial/banking
- How to address in writing typical problem or claims to the owner
- Claims
- Business development, productivity tracking
- Prefabrication.
- How to handle manpower shortages, productivity, motivation, computerized CPM scheduling in detail
- Insurance and bonding
- Job costs forecasting, change order selling.
- Advanced computer scheduling resource loading.
- More "case study" type topics.
- Claims how to better prepare.
- Detailed overview on complex issues of claims, change orders and contract issues with construction managers.
- No scheduling.
- "Volatile" topics i.e.; EEOC, sexual harassment, minority subs and emerging small business.
- Critical path scheduling.
- Labor productivity, analysis, projections, comparisons of manpower vs. schedule, labor impacts, etc.
- Litigation covered more in depth by instructors that have been through several and can state real examples from experience.
- More on claims, liability issues.
- Time and personnel scheduling, change orders.
- More scheduling as it relates to holding general contractors and owners responsible, diplomacy for presenting changes, cost increase to owners, and computer integration.
- Contract language, job costing and projections.
- Claims, scheduling, fabrication, problem solving, material handling.
- I would like to see students with laptop computers working on certain programs that we deal with on a regular basis
- Design build topics
- More legal topics such as contracts, claims, etc.
- How to maintain current customers while getting new ones.
- Computer scheduling, multiple projects.
- Post bid interview, closing deal to be award project.
- Scheduling (Sure Track), actual PM giving the course.
- Ethics.
- More real life examples of common problems/issues and how good or bad management affects the outcome.
- Leadership and business planning.
- Job cost tracking, day-to-day schedules, and unit of measure.
- More advanced contracts and negotiating.
- Job cost tracking and time management.
- Managers training of project managers.
- In depth scheduling.
- Financial.
- Additional time on advanced scheduling.
- More on construction productivity and scheduling.
- Financial and business management.
- Negotiation work.
- Group management, division management.
- Jobsite productivity. Cost control / job forecasting.

Table 5 lists 49 responses to the factors that have made this course a success (question 87). Some of the frequent responses were (1) interaction with other students was a major factor making this course a success mentioned 21 times and (2) the course instructors also made this course a success mentioned 13 times.

Table 5

Questionnaire Question Eighty-seven Results

- The interaction of the students.
- MCAA facilitators, other students
- Interaction with other students, practical exercises.
- MCAA facilitators, "real" situations, interaction, instructor
- Facilitators, interaction with other students
- All the mechanical contractors that came from different part of the states.
- The instructors.
- The array of students' background. You can learn a lot by talking with them.
- Not many.
- Some instructors lack on the job situations.
- Good group discussions
- Instructor organization and peer group discussions.
- Very organized, interesting instructors, nice food in back of class to combat sleepiness.
- There is always something that comes up in my everyday job that was discussed in the class.
- Focused on being proactive rather than reactive.
- Facilitators
- Intensive instruction, diversity of instructors and students, the U.T. campus environment.
- I feel this program is more effective for training an inexperienced PM. This is a valuable service for those in that category.
- Excellent content and presentation.
- Overall package.
- Interaction with others would be at top of list.
- The individual group activity projects.
- Most of the course is applicable to daily work issues.
- The instructors and the in class discussions.
- Student interaction.
- Jack Kennedy and Shirley Tucker
- Interaction with managers from all regions.
- Most instructors very good with subject matter.
- The interaction with other students was a great learning experience.
- The class is set up and run professionally.
- Instructors / students. Seems everyone had knowledge of the industry.
- Interaction with the students, John Koontz.
- Student Interaction
- Interaction with other students.
- The enthusiasm of the instructors.
- The setting the course was held in.
- The courses themselves.
- Continually updating the subject matter to the industries needs.
- Interaction with students from around the nation and specific studies related only to mechanical trades by competent instructors.
- Examples from instructors and students.
- Interaction and discussion with other students.
- Location, distribution of material in two weeks.
- The general atmosphere that encouraged each of us to think and broaden how we understand.
- Specific areas of instruction and manuals.
- Good knowledgeable instructors, different companies from different parts of the country combining ideas.
- MCAA commitment
- Build confidence our company is doing things right.
- Open discussion
- Discussions with other peers from around the country.

Table 6 lists 39 responses to question 88. Even though all results of this study indicate that this course was not a failure, question 88 was asking for factors that made this course a failure. Therefore, the responses were really problem areas in the course that needed improvement. Some of the frequent responses were (1) that lectures were too long creating boredom mentioned eleven times and (2) the scheduling portion needed improvement mentioned nine times.

Table 7 lists 24 responses to critical evaluation of the Managing for Profit course (question 89). Some of the frequent responses were (1) that more construction topics should be added to the course mentioned four times and (2) more hands-on activities should be added to the course mentioned three times.

Conclusions

The following conclusions list important points that were derived from the results and analysis of this study. These can be used to modify and/or support current instructional methods used in the Mechanical Contractors Association of America Institute for Project Management's Managing for Profit course. The list implies no order in importance of conclusions.

Table 6

Questionnaire Question Eighty-eight Results

- The only bad experience was waiting for transportation.
- None
- Too much scheduling.
- Scheduling (Primavera) not taught well.
- Calin Popescu trying to sell scheduling software. Language barrier is tough.
- TQM instructor was ill prepared; presentation unorganized and lacked enthusiasm or conviction was reflected in presentation.
- Shirley Tucker does not seem to have an understanding of our profession.
- Calin is knowledgeable but he is not a very good presenter. It is too long a time frame for someone like him to talk. It is a hard topic to make exciting but it needs improvement. Overall, I thought the class was great and would highly recommend it to anyone.
- Too much lecture without interactions.
- CPM scheduling - Instructor was good, material not relevant.
- Long days and too much sitting.
- Too much detail on scheduling!
- Some instructors seemed "outdated."
- The course is not a failure.
- Hard for some to get to Austin, TX. Rotating locations may spark attendance.
- Went over a good bit of information that was already being used in our company.
- Spending too much time on less important topics.
- Some of the instructors don't come through to the students.
- More input from actual current owners of companies. Less from "teachers". More class interaction and discussion.
- Long-winded speaking, redundant issues, long days.
- Not all instructors are at the same level. Mr. Tuckers's lecture on future of construction was poor.
- Some topics were too long and boring.
- Having an instructor teach Sure Track instead of a project manager / scheduler in construction.
- I was looking for more interaction with experienced project managers.
- Training aids are weak.
- Too much of the material as covered and re-covered under another topic.
- Very poor manual
- Romanian scheduling (way too much).
- Didn't feel safety was done well or didn't fit right with the course material.
- Too much time devoted to scheduling. Important, but needs to be pared down.
- Very few instructors need to change the style to keep the class participating more.
- Some of the lectures and lecturers were to long or monotonous. Became boring.
- The course should have added days during the week 7 full days with 8-hour durations.
- Classroom atmosphere and length of daily presentation.
- P.M.'s do not sit still for this long and attention was lost at the end of the day.
- Not a failure per se, but the days were a little long for us "older guys"
- The only thing that would cause this to be a failure is the attendee not having an interest in learning.
- Job scheduling could be shortened.
- At the time, I took course there was too much lecturing from overheads. Not enough use of a variety of teaching techniques.

1. The 24 strongly correlated pairs of categories and statements indicated earlier in this paper should be taken into consideration when changing the course to ensure that the students' opinions of this course will not be affected negatively.
2. Contractors from 32 states and Puerto Rico attended but there are Mechanical Contractors Association of America member contractors in every state that could attend.
3. Only 149 different companies sent employees to the course. There is tremendous room to improve this number since the Mechanical Contractors of America has 1505 member companies.
4. Classes had only an average of 87.69 percent capacity of potential students. The MCAA facilitators and administrators need to evaluate if this attendance rate is sufficient.
5. From statements 1-4 the following was supported by the results. The students expected to learn a great deal of project management skills in the Managing for Profit course and they indicated that after completion of the course they did find the project management skills gained during the course useful in their work. They also agreed that the information obtained from the course covered their company's investment. Finally, they thought that this was one of the best industry courses they have attended.
6. The students were overwhelmingly satisfied with the Managing for Profit course. Although, there is room for improvement in all categories.
7. Students agreed that they expected to learn a great deal of project management skills in the Managing for Profit course and they also agreed that they found the project management skills gained useful in work.

Table 7

Questionnaire Question Eighty-nine Results

- Call SMACNA and emulate their program.
- Scheduling training could be done as a correspondence course via Internet with class discussion and application done in Texas.
- Hands on scheduling.
- I think that a better mix of students from contractors with similar business volumes would help tremendously.
- More topics touched. Maybe shorten some of the other topics already being discussed.
- Shorten up safety to about 2-3 hours. As with anything else in life you get out of what you put into it. For myself, I went into this course expecting to learn "new" things. What I came away with was validation of things I have been doing for years but had forgotten why. Different perspectives on old procedures. New ideas to tackle old problems and several new concepts all together. Overall, I felt the program was very well done. There were a few classes that should be shortened and a few that should be lengthened. And advanced project management course for senior PM's, like myself, would be very welcome.
- Overall, a very good course. Very much enjoyed the experience.
- Use more instructors from pier group (i.e. owners and senior officers).
- Too much theory, not enough hands-on. I'm an engineer so this was not a problem, but most of the students were not. They wanted more hands on work or lab work. Also, I think you need more examples of the different forms used from different companies.
- Would like more "informal" time with other students. Not necessarily free time, but more discussion time.
- I can't remember which instructors taught which sections. You should have identified their section next to their name.
- Overall, excellent course that strengthened my ability as a PM.
- The course was excellent but scheduling is very involved and should be limited.
- Complex issues of negotiating and paperwork trail are very important.
- Mrs. Tucker's presentations took up too much of the course. Paul is a nice person, but should retire from the program. His presentations were poor, outdated, and irrelevant.
- A little less time on personality profiles, time management, leadership, motivation, and team building. Time would be better spent on "case study".
- Overall, this was one of the most positive learning experiences I have ever had.
- Addressing change order for small companies. This topic was dealt with as though everyone worked for large sue happy contractors.
- A lot of undecideds are due to having taken course so long ago.
- More on contracts and claims, computer scheduling.
- Too many charts and graphs with the same information only in a different form. Week 2 book was not much different from week 1. These folders could be condensed to a readable size and still have all the information included.
- I would like to see more time spent on computerized project scheduling.
- Try and include some more hands-on activities during the lectures.
- The MCAA (IPM) should make sure that each new student has the proper PM experience. This course is not for the new PM but should be for the PM with a few jobs under his belt. As a student who did take this class with out much of a PM background, I found myself unable to participate in a lot of classroom meetings for no other reason than the large amount of experience around me.

8. While students rated the most important major factors that made the course a success were the instructors and the student interaction throughout the course, the specific instructors had the least amount of association to the success of any other part of the course.
9. The least important factors associated with the course are its location and manuals. The manuals need to be evaluated and rewritten based on students' comments.
10. The two individual factors that students' believed made the course a success were that the Managing for Profit course provided an opportunity to learn from other students and that the job cost control topic was the most important covered.
11. Additional topics that should be covered included more scheduling, time management and organization, and personnel interaction skills as well as more hands-on activities.
12. Frequently mentioned factors making this course a success included interaction with other students and course instructors.
13. Frequently mentioned factors that needed improvement were long lectures and the manner in which scheduling was taught.
14. Students agreed that they would recommend this course and attend an advanced project management course. In the advanced course, students would like to see topics on claims and liability issues, more scheduling, and contract issues.

Recommendations

While this research was being conducted, it became evident that there were other areas that needed to be investigated. These areas would clarify, challenge, and increase the database on the Institute for Project Management course. Some of these areas needing investigation are identified in the following itemized listing.

1. A similar study should be conducted on the owners of the mechanical construction firms for whom the students worked. The owners would then have a chance to give input as to the success or failure of the Managing for Profit course by evaluating their employees' work with the new project management skills.
2. A study could be conducted throughout the two-week course questioning the students before, during, and after completion of the course or each day to get more questions specifically about various aspects of the classes in the course.
3. Prospective students to the Mechanical Contractors Association of America' Managing for Profit course could take a pre-test before attending the course. Then take a posttest one-year after completing the course. This would allow a numerical improvement in their knowledge of project management skills to be compiled and these results could be compared with their own reported project management changes.
4. All 1505 Mechanical Contractors Association of America should be surveyed to find out the reasons they are either sending or not sending their Project Management staff to the Managing for Profit course.

Summary

The Institute for Project Management has developed and maintained a construction continuing education program that is considered effective and valuable by former students. While there is room for improvement, careful consideration should be given to any major changes in the program. From the students' written responses several areas that need attention have been revealed but they are far from affecting the course success. This success has lead to a desire by the students to have an advanced project management program sponsored by the Institute for Project Management.

While this study has collected much information on the Institute for Project Management two-week project management course, it will be up to the course administrators to decided how to use this information. This study was not meant to suggest specific ways to change or move the course direction, but to inform the administration of students' opinions on the current effectiveness and value of the course. It is the opinion of this researcher that if any major changes were to occur in the course, further study should be conducted to ensure that the owners of mechanical contracting firms have input too.

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Appendix A

States of Respondents

State	Number Responding from a State	Percent Responding	Number of Possible Respondents from a State	Percent Possible Responding
Arizona	0	0.00	2	0.75
Arkansas	0	0.00	1	0.37
California	8	11.76	23	8.58
Colorado	4	5.88	8	2.99
Connecticut	1	1.47	1	0.37
Florida	0	0.00	6	2.24
Georgia	1	1.47	5	1.87
Illinois	4	5.88	12	4.48
Indiana	0	0.00	5	1.87
Iowa	2	2.94	6	2.24
Kansas	2	2.94	4	1.49
Louisiana	0	0.00	7	2.61
Maryland	0	0.00	4	1.49
Massachusetts	5	7.35	16	5.97
Michigan	4	5.88	20	7.46
Minnesota	3	4.41	16	5.97
Missouri	3	4.41	10	3.73
Montana	0	0.00	1	0.37
Nebraska	4	5.88	7	2.61
New York	1	1.47	13	4.85
New Jersey	2	2.94	5	1.87
North Carolina	1	1.47	2	0.75
Ohio	7	10.29	28	10.45
Oregon	2	2.94	8	2.99
Pennsylvania	2	2.94	8	2.99
Puerto Rico	3	4.41	6	2.24
Rode Island	2	2.94	3	1.12
Tennessee	0	0.00	2	0.75
Texas	1	1.47	9	3.36
Utah	0	0.00	3	1.12
Washington	3	4.41	8	2.99
West Virginia	0	0.00	1	0.37
Wisconsin	3	4.41	18	6.72
Total	68	99.96[a]	268	100.03

Note: [a] Does not sum to 100% due to rounding.

Appendix B

Companies of Respondents

ID Number	Number Responding from Company	Percent Responding	Number of Possible Respondents in a Company	Percent Possible Responding
1	3	4.41	3	1.12
2	2	2.94	2	0.75
3	1	1.47	1	0.37
4	2	2.94	3	1.12
5	1	1.47	3	1.12
6	1	1.47	1	0.37
7	2	2.94	2	0.75
8	1	1.47	2	0.75
9	1	1.47	3	1.12
10	1	1.47	1	0.37
11	1	1.47	10	3.73
12	1	1.47	1	0.37
13	1	1.47	2	0.75
14	1	1.47	4	1.49
15	2	2.94	4	1.49
16	2	2.94	9	3.36
17	1	1.47	2	0.75
18	1	1.47	9	3.36
19	2	2.94	5	1.87
20	1	1.47	1	0.37
21	1	1.47	1	0.37
22	2	2.94	4	1.49
23	1	1.47	3	1.12
24	1	1.47	3	1.12
25	1	1.47	1	0.37
26	5	7.35	16	5.97
27	3	4.41	5	1.87
28	1	1.47	1	0.37
29	1	1.47	3	1.12
30	1	1.47	4	1.49
31	3	4.41	5	1.87
32	2	2.94	2	0.75
33	1	1.47	1	0.37
34	2	2.94	2	0.75
35	1	1.47	1	0.37
36	1	1.47	1	0.37
37	1	1.47	3	1.12
38	1	1.47	1	0.37
39	1	1.47	1	0.37
40	1	1.47	4	1.49
41	1	1.47	2	0.75
42	1	1.47	3	1.12
43	1	1.47	1	0.37
44	1	1.47	3	1.12
45	1	1.47	2	0.75
46	1	1.47	1	0.37
47	1	1.47	1	0.37
48	1	1.47	1	0.37
49	1	1.47	1	0.37
50	0	0.00	1	0.37
51	0	0.00	1	0.37
52	0	0.00	1	0.37/0.37
53	0	0.00	1	0.37
54	0	0.00	1	0.37
55	0	0.00	1	0.37
56	0	0.00	1	0.37
57	0	0.00	1	0.37
58	0	0.00	2	0.75
59	0	0.00	1	0.37/0.75
60	0	0.00	2	0.75
61	0	0.00	1	0.37

62	0	0.00	1	0.37
63	0	0.00	1	0.37
64	0	0.00	2	0.75
65	0	0.00	2	0.75
66	0	0.00	1	0.37
67	0	0.00	1	0.37
68	0	0.00	1	0.37
69	0	0.00	1	0.37
70	0	0.00	1	0.37
71	0	0.00	1	0.37
72	0	0.00	1	0.37
73	0	0.00	1	0.37
74	0	0.00	1	0.37
75	0	0.00	2	0.75
76	0	0.00	1	0.37
77	0	0.00	1	0.37
78	0	0.00	1	0.37
79	0	0.00	1	0.37
80	0	0.00	2	0.75
81	0	0.00	2	0.75
82	0	0.00	1	0.37
83	0	0.00	1	0.37
84	0	0.00	2	0.75
85	0	0.00	1	0.37
86	0	0.00	1	0.37
87	0	0.00	2	0.75
88	0	0.00	1	0.37
89	0	0.00	1	0.37
90	0	0.00	2	0.75
91	0	0.00	1	0.37
92	0	0.00	2	0.75
93	0	0.00	1	0.37
94	0	0.00	1	0.37
95	0	0.00	1	0.37
96	0	0.00	1	0.37
97	0	0.00	3	1.12
98	0	0.00	1	0.37
99	0	0.00	1	0.37
100	0	0.00	1	0.37/0.37
101	0	0.00	1	0.37
102	0	0.00	3	1.12
103	0	0.00	1	0.37
104	0	0.00	2	0.75
105	0	0.00	2	0.75
106	0	0.00	1	0.37
107	0	0.00	1	0.37
108	0	0.00	2	0.75
109	0	0.00	1	0.37
110	0	0.00	1	0.37
111	0	0.00	1	0.37
112	0	0.00	1	0.37
113	0	0.00	1	0.37
114	0	0.00	1	0.37
115	0	0.00	2	0.75
116	0	0.00	1	0.37
117	0	0.00	1	0.37
118	0	0.00	1	0.37
119	0	0.00	1	0.37
120	0	0.00	1	0.37
121	0	0.00	1	0.37
122	0	0.00	1	0.37
123	0	0.00	1	0.37
124	0	0.00	1	0.37
125	0	0.00	1	0.37
126	0	0.00	1	0.37
127	0	0.00	1	0.37
128	0	0.00	1	0.37
129	0	0.00	1	0.37
130	0	0.00	1	0.37
131	0	0.00	2	0.75

132	0	0.00	2	0.75
133	0	0.00	1	0.37
134	0	0.00	1	0.37
135	0	0.00	1	0.37
136	0	0.00	1	0.37
137	0	0.00	1	0.37
138	0	0.00	1	0.37
139	0	0.00	1	0.37
140	0	0.00	1	0.37
141	0	0.00	1	0.37
142	0	0.00	1	0.37
143	0	0.00	1	0.37
144	0	0.00	2	0.75
145	0	0.00	1	0.37
146	0	0.00	1	0.37
147	0	0.00	1	0.37
148	0	0.00	1	0.37
149	0	0.00	2	0.75
Total	68	99.96[a]	268	99.90[a]

Note: [a] Does not sum to 100% due to rounding.

Appendix C

Questionnaire Results Statements 1 to 84 and Categories A to I

Questions (5 = Strongly Agree, 4 = Agree, 3 = Undecided, 2 = Disagree, 1 = Strongly Disagree)	**Mean Values**
1. Before I attended the course, I expected to learn a great deal of Project Management Skills.	4.27
2. After I attended the course, I have found the Project Management Skills useful in work.	4.16
3. Overall, I think that the information obtained from this course covered my company's investment	4.15
4. Overall, this course was one of the best industry related courses I have attended.	4.08
A. Usefulness/Relevance of Content	3.92
5. Overall, I have become a more effective Project Manager	4.04
6. Overall, this course contributes significantly to my professional growth.	4.06
7. Overall, I can apply information/skills learned in this course.	4.22
8. Overall, my technical skills were improved as a result of this course.	3.64
9. Overall, this course directly contributes to my job.	4.15
10. Overall, the practical application of subject matter is apparent.	4.01
11. Overall, this course is up-to-date with developments in the field.	3.87
12. Overall, this course includes a sufficient number of practical exercises.	3.73
13. Overall, the amount of material covered was reasonable.	3.79
B. Specific Course Areas	4.10
14. Overall, contracts was a valuable topic to cover.	4.18
15. Overall, job cost control was a valuable topic to cover.	4.41
16. Overall, scheduling was a valuable topic to cover.	3.99
17. Overall, productivity was a valuable topic to cover.	4.27
18. Overall, claims was a valuable topic to cover.	4.07
19. Overall, people skills (leadership, communication) was a valuable topic to cover.	4.04
20. Overall, change orders was a valuable topic to cover.	4.37
21. Overall, safety was a valuable topic to cover.	3.99
22. Overall, project administration and implementation was a valuable topic to cover.	4.22
23. Overall, personal action plan (project completed between classes) was a valuable topic to cover.	3.63
C. Course Goals or Objectives	3.87
24. Overall, this course has clearly stated objectives	3.96
25. Overall, the objectives of this course were clearly explained to me.	3.90
26. Overall, the goals of this course are consistently pursued.	4.03
27. Overall, the objectives of this course allow me to know when I am making progress.	3.54
28. Overall, I was able to set and achieve some of my own goals.	3.91
29. Overall, lecture information is highly relevant to course objectives.	3.90
30. Overall, the course content is consistent with my prior expectations.	3.87
D. Discussion	4.06
31. Overall, the instructors developed classroom discussions skillfully	4.04
32. Overall, there is sufficient time in class for questions and discussions.	3.90
33. Overall, the instructors allow student discussion to proceed uninterrupted.	3.99
34. Overall, the instructors encourage students to debate conflicting views.	4.01
35. Overall, the instructors do not monopolize classroom discussion.	3.97
36. Overall, the real strength of this course is the classroom discussion.	4.32
37. Overall, challenging questions are raised for discussion.	3.79
38. Overall, this course provides an opportunity to learn from other students.	4.54
E. Clarity and Effectiveness of Presentations	3.94
39. Overall, my instructors display a clear understanding of course topics.	4.22
40. Overall, my instructors are able to simplify difficult materials.	3.79
41. Overall, difficult topics are structured in easily understood ways.	3.75
42. Overall, my instructors have effective styles of presentation.	3.88
43. Overall, my instructors seem well-prepared for classes.	4.19
F. Student Interest/Involvement in Learning	3.81
44. Overall, the instructors make learning easy and interesting.	3.85
45. Overall, the instructors hold the attention of the class.	3.66
46. Overall, the instructors sense when students are bored.	3.37
47. Overall, the instructors display enthusiasm when teaching.	3.90
48. Overall, this course supplies me with an effective range of challenges.	3.93
49. Overall, in this course, many methods are used to involve me in learning.	3.99
50. Overall, the instructors make me feel involved with this course.	3.93
51. Overall, in this course, I always felt challenged and motivated to learn.	3.75
52. Overall, this course motivates me to take additional continuing education courses.	3.91
G. Specific Instructors	3.40
53. Overall, the quality and effectiveness of Shirley Tucker's instruction was excellent.	3.59
54. Overall, the quality and effectiveness of John Borcherding's instruction was excellent.	4.02
55. Overall, the quality and effectiveness of Jack Kennedy's instruction was excellent.	4.40

56. Overall, the quality and effectiveness of Jim Broaddus' instruction was excellent.	3.74
57. Overall, the quality and effectiveness of Calin Popescu's instruction was excellent.	3.50
58. Overall, the quality and effectiveness of Pete Chaney's instruction was excellent.	3.81
59. Overall, the quality and effectiveness of Dennis Johnson's instruction was excellent.	3.83
60. Overall, the quality and effectiveness of MCAA Contractor Facilitators' instruction was excellent.	4.22
H. Broadening Student Outlook	3.82
61. Overall, my instructors have stimulated my thinking.	3.98
62. Overall, my instructors have provided many challenging new viewpoints.	3.86
63. Overall, my instructors taught one to value the viewpoint of others.	3.91
64. Overall, this course caused me to reconsider many of my former attitudes.	3.61
65. Overall, in this course, I have learned to value new viewpoints.	3.95
66. Overall, this course stretched and broadened my views greatly.	3.74
67. Overall, this course has effectively challenged me to think.	3.88
I. General Student Perceptions	3.73
68. Overall, the class mixture is appropriate.	4.05
69. Overall, the size of this class is appropriate to course objectives.	4.14
70. Overall, the facilities for this course are excellent.	4.29
71. Overall, I would highly recommend this course.	4.44
72. Overall, I like the way the instructors conduct this course.	4.09
73. Overall, I am satisfied with my accomplishments in this course.	4.03
74. Overall, I have put much effort into this course.	4.02
75. Overall, the Instructors of this course made the course effective.	3.97
76. Overall, the team usage made this course effective.	4.11
77. The time between class meetings was too long.	2.66
78. The class should be condensed into 1 week.	2.11
79. The course should always be held in Austin, Texas	3.44
80. The course should be held in different regions of the country.	3.30
81. I would attend a 3 day advanced Project Management course	4.26
82. I believe that portions of this course could be completed via the Internet before coming to class.	3.09
83. How many of your fellow classmates have you contacted since the completion of the course?	1.87 Average
84. Please rank the following in order from 1 as the best to 5 as order of course importance:	

Instructors 2.32 Location 3.91 Interaction with other students 2.40 MCAA Facilitators 3.06 Manuals 3.42

Appendix D

Factor listed in the pairs

Pair one
- The students' belief that this was one of the best industry courses they have attended (statement 4).
- The students' belief that this course was a good company investment (statement 3).

Pair two
- The students' belief that the project management skills were useful in work (statement 2).
- The students' belief that this was one of the best industry courses they have attended (statement 4).

Pair three
- The students' belief that the project management skills were useful in work (statement 2).
- The students' belief that this course was a good company investment (statement 3).

Pair four
- The students' belief that the project management skills were useful in work (statement 2).
- The students' belief of the usefulness and relevance of the course content meeting their needs (category A).

Pair five
- The students' belief that this course was a good company investment (statement 3).
- The students' belief of the usefulness and relevance of the course content meeting their needs (category A).

Pair six
- The students' belief that this was one of the best industry courses they have attended (statement 4).
- The students' belief of the usefulness and relevance of the course content meeting their needs (category A).

Pair seven
- The students' opinions of the course having clear and effective presentations (category E).
- The students' belief of the usefulness and relevance of the course content meeting their needs (category A).

Pair eight
- The students' opinions of the course broadening their outlook (category H).
- The students' belief of the usefulness and relevance of the course content meeting their needs (category A).

Pair nine
- The students' opinions of the general perceptions of the course meeting their needs (category I).
- The students' belief of the usefulness and relevance of the course content meeting their needs (category A).

Pair ten
- The students' belief that this course was a good company investment (statement 3).
- The students' opinions of the course goals and objectives meeting their needs (category C).

Pair eleven
- The students' belief that this was one of the best industry courses they have attended (statement 4).
- The students' opinions of the course goals and objectives meeting their needs (category C).

Pair twelve
- The students' belief of the usefulness and relevance of the course content meeting their needs (category A).
- The students' opinions of the course goals and objectives meeting their needs (category C).

Pair thirteen
- The students' opinions of the course having clear and effective presentations (category E).
- The students' opinions of the course goals and objectives meeting their needs (category C).

Pair fourteen
- The students' interest and involvement in learning (category F).
- The students' opinions of the course goals and objectives meeting their needs (category C).

Pair fifteen
- The students' opinions of the course instructors' instruction meeting their needs (category G).
- The students' opinions of the course goals and objectives meeting their needs (category C).

Pair sixteen
- The students' opinions of the course broadening their outlook (category H).
- The students' opinions of the course goals and objectives meeting their needs (category C).

Pair seventeen
- The students' opinions of the general perceptions of the course meeting their needs (category I).
- The students' opinions of the course goals and objectives meeting their needs (category C).

Pair eighteen

- The students' opinions of the course having clear and effective presentations (category E).
- The students' belief of the course discussions meeting their needs (category D).

Pair nineteen

- The students' interest and involvement in learning (category F).
- The students' belief of the course discussions meeting their needs (category D).

Pair twenty

- The students' interest and involvement in learning (category F).
- The students' opinions of the course having clear and effective presentations (category E).

Pair twenty-one

- The students' opinions of the course broadening their outlook (category H).
- The students' interest and involvement in learning (category F).

Pair twenty-two

- The students' opinions of the general perceptions of the course meeting their needs (category I).
- The students' interest and involvement in learning (category F).

Pair twenty-three

- The students' belief of the usefulness and relevance of the course content meeting their needs (category A).
- The students' opinions of the course broadening their outlook (category H).

Pair twenty-four

- The students' opinions of the general perceptions of the course meeting their needs (category I).
- The students' opinions of the course broadening their outlook (category H).

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Liquidated Damages: Testing when in Time the Intent Test is Applied

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This research paper examines the issue of whether United States courts demonstrate a trend in preference for when in time the intent test is applied in ascertaining the validity of a liquidated damages clause. Judicial opinions dating from 1853 to 1991 formalize the study population. Retrieval of judicial opinions are from official and unofficial legal reporters for the United States. Of the 223 selected appellate court cases, 175 met the population parameters. Data derived from these judicial opinions were statistically tested by: (a) the chi-square test for binomial data, and (b) the Stuart-Cox sign test for trend analysis. Results of the chi-square test reveal that at present the courts demonstrate a preference for applying the intent test at the time of contract when construing the validity of a liquidated damages clause. Based on the Stuart-Cox sign test, the current application preference of the courts is in the direction of apply the intent test at the time of contract when determining the validity of a liquidated damages clause, there is, however no presence of a statistical trend that would allow one to conclude that this is the preferred application in the future.

Key Words: Liquidated Damages, Three-Prong Test, Intent Test

Introduction

Determining the amount of damages recoverable for a breach of contract is a difficult and expensive task (Corbin, 1964). In an attempt to fix damages in advance of a future defined breach, parties to a construction contract normally include a liquidated damages clause (Dunbar, 1959). In construction contracts, liquidated damages are usually assessed when the contractor fails to attain substantial completion by a specified date, barring excusable delays (Fleder and Smith, 1986). Substantial completion is achieved when the project is sufficiently complete, enabling the owner to take possession and use the facility for its intended purpose (Jervis and Levin, 1988). If no liquidated damages clause exists within the contract, the contractor is liable for the actual damages caused by its delay (Simon, 1979). Damages for delay are considered consequential damages because they flow naturally from the direct breach (Farnsworth, 1990; Simon, 1989). Typical delay damages include harm to future business prospects, lost credibility, and lost opportunity (Jervis and Levin, 1988).

The use of a liquidated damages clause in a contract serves the goal of efficiency and predictability and, thereby makes it easier for a party to balance the anticipated costs of performance against the risk exposure of breach (Hunter, 1986). Such clauses are best suited for situations where it is impossible to introduce evidence as to the reasonable rental value of things such as bridges, highways, and sewer systems (Acret, 1986). From the standpoint of the party who promises to pay liquidated damages, the clause creates a more definite obligation in the

event a contractual breach occurs, thus establishing a maximum limit on the contractual liability amount (Dunbar, 1959). An owner, on the other hand, may not elect to waive the liquidated damages clause in an attempt to recover actual damages due to a delay, but is still entitled to recover actual damages for breaches other than late completion (Peckar, 1972).

A contractual provision for pre-agreed damages that has been fairly negotiated, absent some unconscionable behavior such as fraud or duress, generally benefits the parties to a contract (Brizzee, 1991). However, mutual acceptance of a liquidated damages clause by the contracting parties, at the time of contract formation does not guarantee that the clause will be held valid in a court of law regardless of the label the parties place upon it (Gantt and Breslauer, 1967). Thus, a liquidated damages provision that is ruled a penalty by the court will not be enforced (Williston and Thompson, 1938). To be held valid, a liquidated damages clause must represent a good-faith effort to estimate in advance the actual damage that will probably result for pre-defined breach (Simon, 1979). In contrast, a penalty clause is not a pre-estimate of probable actual damages, but instead functions as a contractual punishment designed to prevent the breach (Sweet, 1972, et al).

The question that logically follows the above discussion is: How do the courts ascertain the legal difference between a valid liquidated damages clause and an invalid penalty provision? In determining whether a liquidated damages clause is legally enforceable, the US courts apply a three-prong test. The three-prong test includes: (a) the intent test, (b) the difficulty test, and (c) the reasonable test (Kaplan, 1977; Calamari and Perillo, 1987).

The intent test is based on the objective theory of assent. Application of this test places importance on whether the parties intended to liquidate damages in advance on the basis of the parties' acts and words (Farnsworth, 1990). The parties' actions are judged by the standard of reasonableness. The words of the parties are given their clear meaning by the courts when interpreting the contract language (Kaplan, 1977). Finally, the courts examine the circumstances surrounding the parties at the time of contract (Corbin, 1964). Thus, the intent test examines the actions, words, and circumstances of the contracting parties at the time of contract execution.

When the courts apply the difficulty test, great weight is placed on the ascertainment of the contractual damages and the degree of uncertainty involved in the estimate (Corbin, 1964). The greater the degree of difficulty in correctly calculating the accuracy of likely future damages, the more valid the liquidated damages clause becomes in the eyes of the court. Conversely, the more ascertainable or less difficult the actual damages are to estimate, the more likely the court will be to construe the agreed damages clause as a penalty provision and thus invalid. (American Jurisprudence, 22, 1964). Prentice (1937) in writing about liquidated damages, in essence maintains that the difficulty test refers to how readily capable and improbable a calculation for compensable damages will be to ascertain. The greater the improbable nature of the damages is to make certain, the more favorably the court views such a covenant as a valid operable liquidated damages provision (Prentice, 1937; American Jurisprudence, 13, 1964; Calamari and Perillo, 1987).

The reasonable test measures the liquidated damages amount in view of the actual damages suffered by the breach. Should the court construe the proposed damages as significantly greater than the actual damages, then the liquidated damages proviso is generally determined to be a

penalty provision and ruled invalid (Corbin, 1964). The reasonable test measures the probable approximation of the uncertain compensatory damages likely to occur in the future (American Jurisprudence, 13, 1964). The operative constructs used by the US judicature in its application of the reasonable test are: “reasonable forecast” or an “honest forecast” (Dunbar, 1959). Reasonableness further draws on the notion of disproportionality vis-à-vis the anticipated loss from the nonperformance. The larger the fixed sum is in relation to the anticipated loss resulting from the breach, the more likely the courts will rule the clause a penalty provision and, thus, unenforceable (Koezuka, 1990; Prentice, 1937).

Review of the Literature

Commentators on the subject of liquidated damages maintain that the courts have encountered difficulty in establishing the proper test to distinguish a valid liquidated damages clause from a penalty provision (Murray, 1974; Kaplan, 1977). The particular language used in the contract must be considered, but it is not necessarily conclusive (American Jurisprudence, 1964).

The confusion the courts have experienced in distinguishing between valid liquidated damages clauses and invalid penalty provisions arises not from an irrational legal rule, but from a failure to perceive a rational policy underlying the distinction between tests applied (Clarkson, Miller, and Muris, 1978). Before creating or similarly contracting for a contract for construction, the party should know when a liquidated damages clause will be ruled valid by the court (Dunbar, 1959). The mere labeling of a sum to be paid under a contractual liquidated or stipulated damages agreement will not prevent the court from treating the clause as a penalty provision (Williston and Thompson, 1938). The clause must be tailored to the particular type of delay to which it is expected to apply (Sweet, 1989). An improperly constructed provision for liquidated damages is subject to condemnation by the court and, thereby ruled nugatory. In the event a liquidated damages clause is ruled invalid and thus inoperable by the court, the owner must prove actual damages incurred as a result of the delay (Chirelstein, 1990). This scenario could prove costly to both the owner and the contractor since actual delay damages can be difficult, if not impossible, to measure from an evidentiary standpoint.

Although the general principles for testing the validity of a liquidated damages clause are well defined, it is the application of each test and the time in which the test is applied that creates much controversy within the scholarly literature (Gantt and Breslauer, 1967; Koezuka, 1990). The controversy supposedly exists because the courts are not entirely in agreement as to which of the three-prong test apply, or whether all three tests must apply simultaneously when construing the validity of the liquidated damages provision (Murray, 1974). Kaplan (1977) suggests that each test receives unequal treatment in application both in time the tests of applying all three prongs separately or jointly, and when in time the tests are to be applied. Murray (1974) points out that the test can be applied by the courts at three distinct points in time: (a) at the time of the original writing of the contract, (b) at the time of trial (after the damages have actually occurred), or (c) the time is undefined by the courts (no discussion within the court opinion regarding test application). Thus based upon the literature, one would conclude that presently the courts do not demonstrate any consistency or application preference in applying the three tests and when in time the courts apply the test to formulate a decision criteria for ascertaining the

validity of a liquidated damages clause.

Importance of the Study

In light of the above discourse, it is not infrequent for the prime contractor to contend that a liquidated damages clause is in actuality a penalty provision (Ward, 1985). In this context, the contractor sues the owner for the balance on account for monies held in retainage and/or relief of the liquidated damages in general. Owing to the supposed confusion by the courts in ascertaining the validity of a liquidated damages clause, the managerial problem encountered by the contractor is whether or not to pursue the legality of same. The management decision to challenge the validity of such a clause creates a business risk decision that may possibly threaten the financial position of the firm (Hardie, 1981). Within this risk decision is the inherent legal and managerial question of whether or not the construction organization should challenge the validity of a liquidated damages clause by initiating formal legal proceedings in view of the supposed uncertain preference of the courts in this area of contract law.

The managerial risk is the uncertainty of receiving a disfavorable court award as a result of the supposed inconsistencies in court decisions, thereby incurring further financial loss than otherwise would be the case. In order to make informed risk management decisions and further mitigate a degree of uncertainty, a good management decision requires probabilistic projections on the certainty of future outcomes. Despite this pervasive requirement by management, currently there exists a paucity in the literature regarding studies that apply statistical analyses to determine specifically the application preference and time of preference by the courts relative to the intent test prong (Sweet, 1972). Although the literature concerning liquidated damages is extensive, erudites on the subject appear satisfied with broad generalities encompassing statements about the extreme uncertainties in this area of law by placing reliance on interpretative qualitative analysis of past judicial decisions. Although such a priori knowledge is meritorious, it unequivocally lacks scientific investigation. Therefore, the purpose of this research study is to provide management in the construction industry with a quantitative study that empirically measures both the courts' application preference for when in time the court applies the intent test when construing the validity of a liquidated damages clause. In this effort, it is the researcher's intent to ascertain the probabilistic outcome for such an event (probabilistic pattern of preference for one time dimension) and similarly whether such a pattern of opine display a future trend.

Methodology/Limitations

This study will employ the quasi-experimental design content analysis for archival data. The sample will consist of the entire population of appellate level court cases involving an owner-contractor dispute over a liquidated damages clause in a construction contract which have occurred within the United States from 1858 through 1991. The cross-sectional data represents non-experimental correlational historical data that shall be statistically tested by the chi-square test statistic for a binomial one-way dimensional classification.

Case data will be collected using a written survey-type document by researchers and research assistants familiar with the subject matter. Questions on the data document are to be answered only from opinions issued by the court trying the case at hand. If that court's opinions do not explicitly answer a question on the data document, an *undefined* selection is to be chosen for that question. Court opinions cited from other cases which are not clearly applied to the case at hand shall have no influence on the answers selected on the data document.

Limitations

This study is confined to cases involving an owner-contractor dispute over a liquidated damages clause in a construction contract. Cases that deal with contractor-vendor, contractor-subcontractor, or non-construction disputes over liquidated damages clauses were excluded from the study. This study will consider only appellate level court cases since documentation on lower court decisions is not readily available. The two other validity test, reasonableness and difficulty, which have historically been applied by the courts, will not be a part of this study.

Research Statement

Conceptual Research Problem Statement

This study will measure the application preference for when in time the intent test has been applied by the United States' appellate courts within when the courts are attempting to ascertain the validity of liquidated damages clause in a construction contract.

Research Problem Statement

Measure the application preference for when the intent test has been applied; at time of contract formation versus at time of trial versus at time undefined.

Conceptual Research Hypothesis Statement

Court decisions for all judicature jurisdictions at the appellate level within the United States demonstrate an application preference for when in time the intent test is to be applied when determining the validity of a liquidated damages clause.

Research Hypothesis Statement

There is significant application preference for when in time the courts apply the intent test when construing the validity of a liquidated damages clause.

Results

For data reporting purposes, the population of cases was arranged chronologically and divided into 10-year intervals, as shown in Table 1. Over the population of 175 court cases included in

this study, the intent test was applied in 70 cases, or 40% of the time. The intent test was applied at the time of contract formation in 58 of the 70 cases, or 83% of the time. The intent test was applied at the time of trial in 2 of the 70 cases, or 3% of the time. The intent test was applied at time undefined in 10 of the 70 cases, or 14% of the time.

Table 1

Frequency Distribution for the Intent Test: 10-Year Intervals

	Chronological Time Intervals														
Intent Test	1858 1867	1868 1877	1878 1887	1888 1897	1898 1907	1908 1917	1918 1927	1928 1937	1938 1947	1948 1957	1958 1967	1968 1977	1978 1987	1988 1991	TOTAL
Case Count for Interval	1	1	3	11	22	25	7	4	8	10	12	20	33	18	175
Test Not Applied	1	1	1	2	12	12	4	1	5	3	8	16	24	15	105
Test Applied	0	0	2	9	10	13	3	3	3	7	4	4	9	3	70
Time of Contract	0	0	2	8	5	11	2	3	3	7	4	4	6	3	58
Time of Trial	0	0	0	1	0	0	0	0	0	0	0	0	1	0	2
Time Undefined	0	0	0	0	5	2	1	0	0	0	0	0	2	0	10

Category	%
Intent test not applied (105 / 175) =	60%
Intent test applied (70 / 175) =	40%
Intent test applied at time of contract (58 / 70) =	83%
Intent test applied at time of trial (2 / 70) =	3%
Intent test applied at time undefined (10 / 70) =	14%

Figure 1 displays the percentages of cases in which the intent test was applied in each of the 10-year intervals. The percentages were calculated from the data given in Table 2.

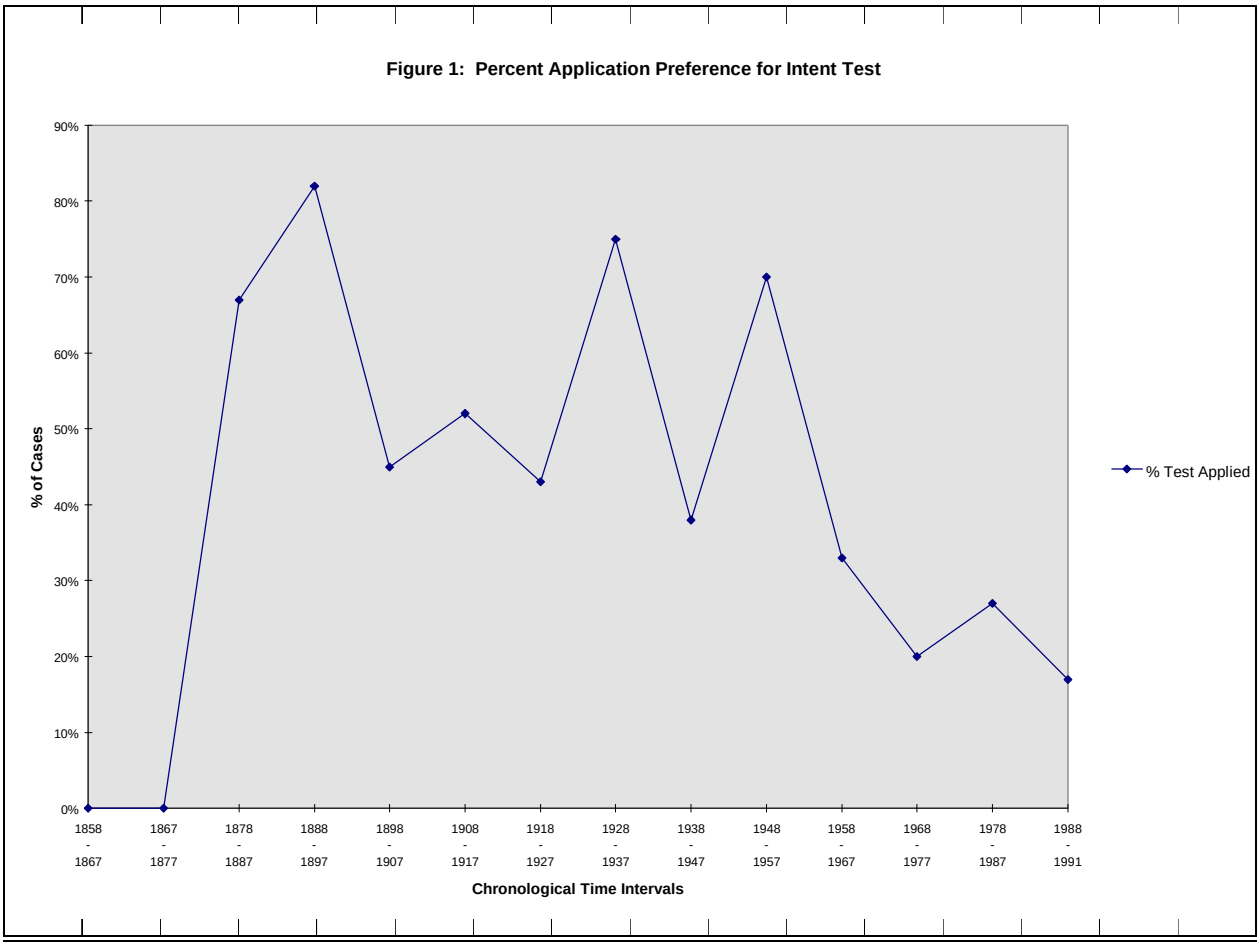

Figure 1. Percent application preference for intent test.

Figure 2 displays the percentages of cases in which the intent test was applied at the time of contract formation, time of trial, and time undefined for each of the 10-year intervals. The percentages were calculated from the data given in Table 3. The selection of *time undefined,* for when in time the intent test was applied, was chosen when it could not be determined, from the case content, whether the test was applied at the time of contract formation or at time of trial. For the one-way classification matrix shown in Table 4, a chi-square calculated statistic equaling 78.77 was calculated. The chi-square critical value with degrees of freedom two, with an ? = 0.05 criterion level of significance equaled 5.99. This statistical value of significant difference substantiates the rejection of the null hypothesis, there is no application preference for when in time the courts apply the intent test; and supports the conclusion that when the courts do apply the intent test, there exists a patterned preference by the courts for a particular when in time classification category.

Table 2

Percent Application Preference for Intent Test

Interval Number	Time Interval	Cast Count for Interval	Test Applied	% Test Applied	Test Not Applied	% Test Not Applied
1	1858 - 1867	1	0	0%	1	100%
2	1867 - 1877	1	0	0%	1	100%
3	1878 - 1887	3	2	67%	1	33%
4	1888 - 1897	11	9	82%	2	18%
5	1898 - 1907	22	10	45%	12	55%
6	1908 - 1917	25	13	52%	12	48%
7	1918 - 1927	7	3	43%	4	57%
8	1928 - 1937	4	3	75%	1	25%
9	1938 - 1947	8	3	38%	5	63%
10	1948 - 1957	10	7	70%	3	30%
11	1958 - 1967	12	4	33%	8	67%
12	1968 - 1977	20	4	20%	16	80%
13	1978 - 1987	33	9	27%	24	73%
14	1988 - 1991	18	3	17%	15	83%
	TOTALS	175	70	40%	105	60%

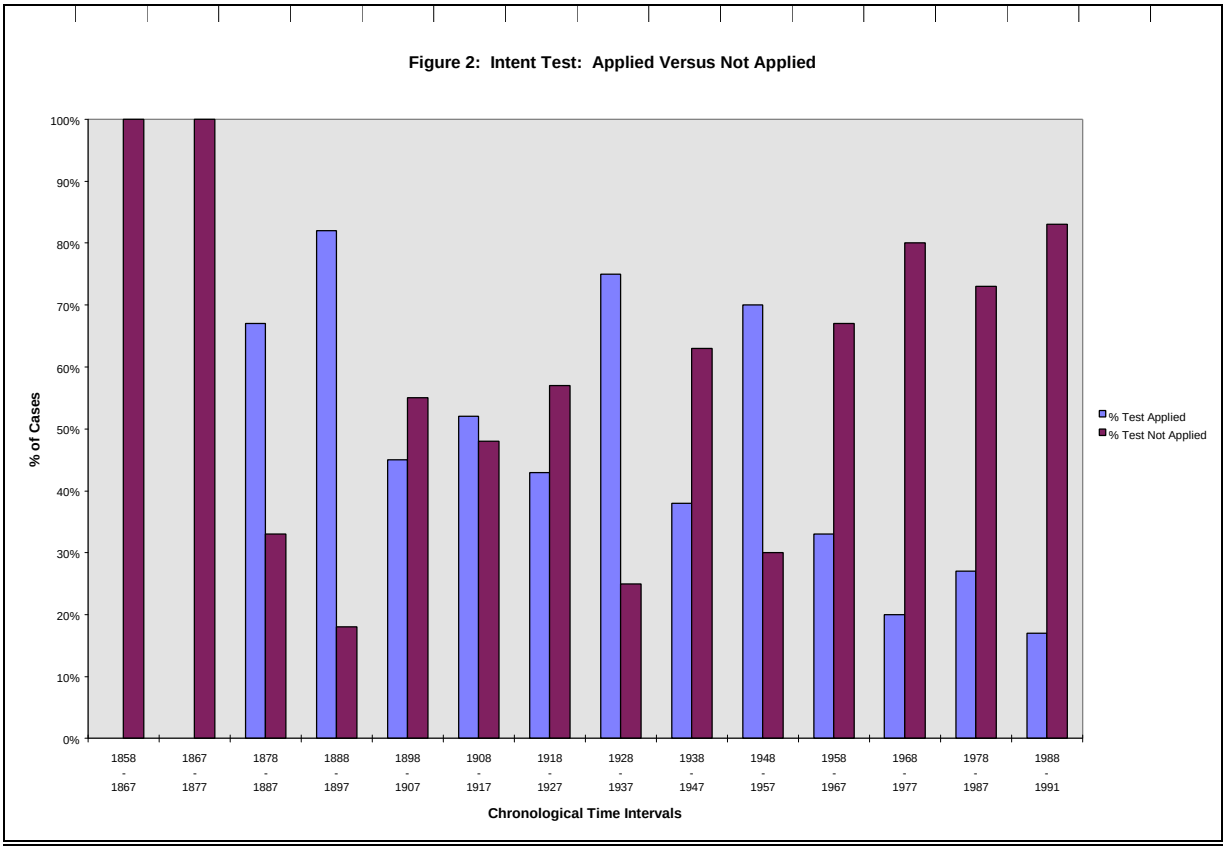

Figure 2. Percent application preference for when in time courts apply the intent test.

Table 3

Percent Application Preference for When in Time Courts Apply the Intent Test

Interval Number	Time Interval	Cast Count for Interval	Time of Contract	Time of Trial	Time Undefined
1	1858 - 1867	1	0%	0%	0%
2	1867 - 1877	1	0%	0%	0%
3	1878 - 1887	3	100%	0%	0%
4	1888 - 1897	11	89%	11%	0%
5	1898 - 1907	22	50%	0%	50%
6	1908 - 1917	25	85%	0%	15%
7	1918 - 1927	7	67%	0%	33%
8	1928 - 1937	4	100%	0%	0%
9	1938 - 1947	8	100%	0%	0%
10	1948 - 1957	10	100%	0%	0%
11	1958 - 1967	12	100%	0%	0%
12	1968 - 1977	20	100%	0%	0%
13	1978 - 1987	33	67%	11%	22%
14	1988 - 1991	18	100%	0%	0%

Table 4

Chi-Square Statistical Test: Application Preference of Courts for When in Time Courts Apply the Intent Test

Intent Test	**(f_o)**	**(f_e)**	**%** ?	**(f_o-f_e)**	**(f_o-f_e)^2**	**$\frac{(f_o-f_e)^2}{(f_e)}$**	**% split**
Time of Contract	58	23.33	149.00	34.70	1204.09	51.68	83
Time of Trial	2	23.33	91.43	-21.33	454.97	19.47	3
Time Undefined	10	23.33	57.14	-13.33	177.69	7.62	14
Totals	70	70.00				78.77	100

Note. The expected frequency of 23.30 indicates a 33.33% split in court application preference. A 33.33% split outcome represents no application preference by the courts for when in time the intent test is applied.

$f_e = \underline{(70)} = 23.30$
(3)
X^2 statistic = (32.93) + (12.84) + (4.55)
X^2 statistic = 78.77
X^2 critical = 5.99, d.f. = (3 - 1) = 2, significant, $p < 0.05$
X^2 statistic = 78.77 > X^2 table = 5.99, reject null hypothesis

A closer inspection of the data frequency counts reveals that the courts exhibit a statistically significant application preference for the when in time classification category time of contract. This nonrandom numerical deviation from the observed (f_o) and the expected (f_e) of 149%, or 34.7, represents the largest contributing numerical value to the chi-square significant value. This 149% numerical deviation in application preference in classification category time of contract is larger than would be expected by mathematical chance. This indicates that when the courts apply the intent test, to ascertain the legality of a liquidated damages clause, the preferred application time period is the classification category time of contract. A review of Figure 2 supports this conclusion. The data plot for Figure 2 is derived from the data contained in Table 3.
For the data plot contained in Figure 2, a Stuart-Cox sign test for presence of a trend was calculated for the time interval 1928 to 1991. Although the chi-square significant statistic

equaling 78.77 supports an application preference for the intent test for the classification category at time of contract, there is clearly a downward movement in time interval 1978 - 1987 for this application preference, while there simultaneously exists upward movement in the time of trial and time undefined categories. These application preference movements are subsequently followed by another upward movement in the former while simultaneously followed by downward movements in the latter period.

Figure 3 displays a plot of the application preference classification category apply intent test at time contract.

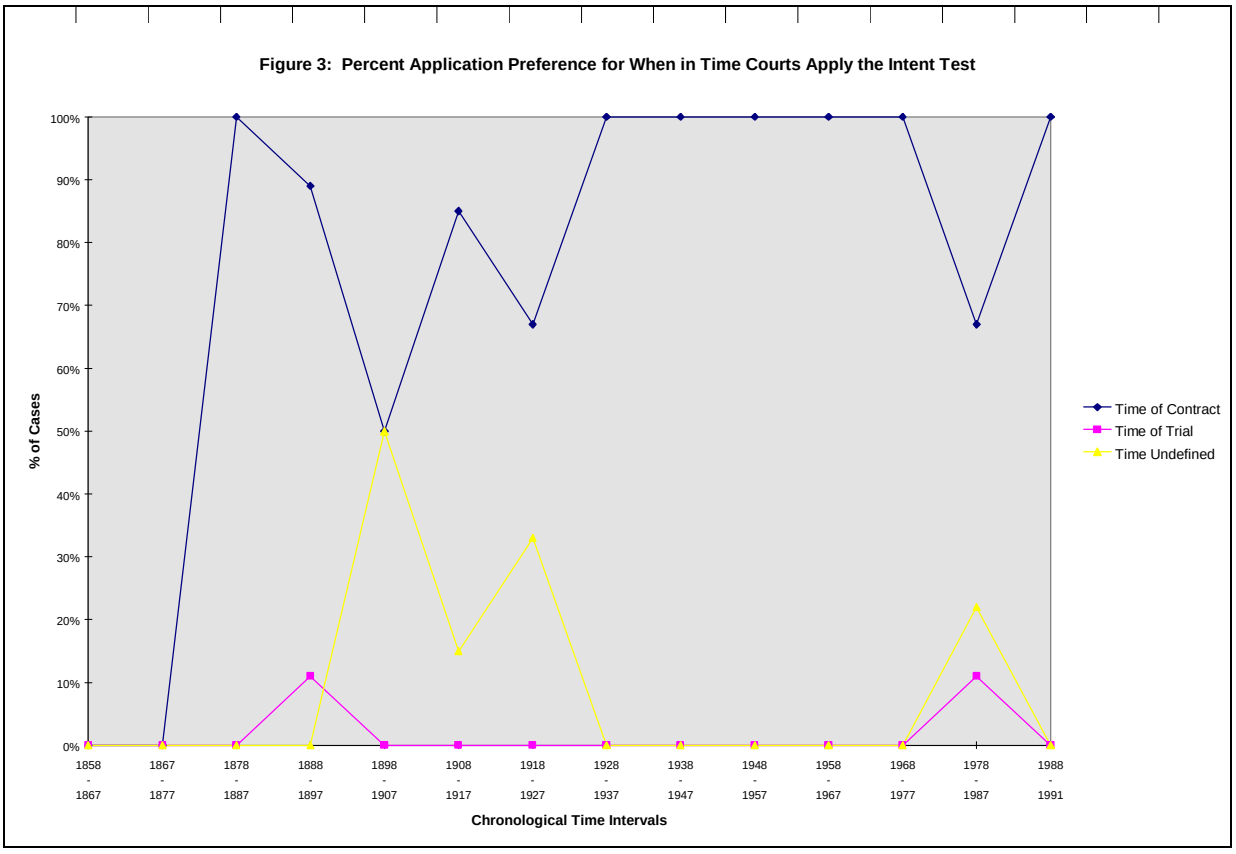

Figure 3. Intent test--applied at time of contract.

Tables 5 and 6 contain the data enumeration and calculations for the trend analysis time of contract. At $P(K \leq 313, 0.50) = 0.250$ at ?/2 = 0.025, the null hypothesis cannot be rejected because there is no trend present. It is, therefore, concluded that the data for the inspected time interval 1928 to 1991 do not indicate the presence of a trend in either direction.

Table 5

Data Compilation for Trend Analysis for When in Time Courts Apply Intent Test: Time of Contract from 1858 to 1991

Time Interval	(X_i) % Cases Time of Contract	(Y_i) Time Interval	% of Cases Time of Contract	$(X_i - Y_i)$ Sign Test
1858 - 1862	0.00	1928 - 1932	100.00	-
1863 - 1867	0.00	1933 - 1937	100.00	-
1868 - 1872	0.00	1938 - 1942	100.00	-
1873 - 1877	0.00	1943 - 1947	100.00	-
1878 - 1882	0.00	1948 - 1952	100.00	-
1883 - 1887	100.00	1953 - 1957	100.00	0
1888 - 1892	66.67	1958 - 1962	0.00	+
1893 - 1897	100.00	1963 - 1967	100.00	0
1898 - 1902	100.00	1968 - 1972	100.00	0
1903 - 1907	16.67	1973 - 1977	100.00	-
1908 - 1912	60.00	1978 - 1982	66.67	-
1913 - 1917	100.00	1983 - 1987	0.00	+
1918 - 1922	100.00	1988 - 1991	100.00	0

Table 6

Data Calculation for Trend Analysis for When in Time Courts Apply Intent Test: Time of Contract from 1928 to 1991

Time Interval	(X_i) % Cases Time of Contract	(Y_i) Time Interval	% of Cases Time of Contract	$(X_i - Y_i)$ Sign Test
1928 - 1932	100.00	1963 - 1967	100.00	+
1933 - 1937	100.00	1968 - 1972	100.00	0
1938 - 1942	100.00	1973 - 1977	100.00	0
1943 - 1947	100.00	1978 - 1982	66.67	+
1948 - 1952	100.00	1983 - 1987	0.00	+
1953 - 1957	100.00	1988 - 1991	100.00	0

Statistical Hypothesis:
H_o: There is no trend present in the data.
H_1: There is either an upward trend or downward trend.
n?= 13, n = 3, K = 3 positive differences, ? /2 = 0.025

Test Statistic:
P (K $\leq$ 3? 3, 0.50) = 0.1250 * 2 = 0.250
P = 0.250 > ? /2 = 0.025
Decision: Cannot reject null hypothesis; there is no trend present in the data.

Conclusions

Occurrence of the application of the intent test at the time of contract in 83% of the court cases in the study supports the hypothesis statement by demonstrating an association between the application of the intent test at the time of contract and validity of liquidated damages clauses in construction contracts. The graphical representation of the percentage of cases in which the intent test was applied (Figure 1), however, exhibits disparity in the data in two time frames, from 1858 through 1887 and from 1928 through 1947. For the time period from 1858 through 1887, only five cases were found, an average of 1.7 cases per 10-year interval. For the time period from 1928 through 1947, only 12 cases were found, an average of six cases per 10-year interval. By comparison, the average case count for all of the other 10-year intervals is 17.6 cases per interval. These calculations are presented below Table 1. The columns containing the data for the intervals in question are shown shaded in Table 1. If these intervals were omitted from Figure 1, the percentage of cases in which the intent test was applied would vary between approximately 70% and 90%, substantially decreasing the variation between the intervals.

The most consistent time of application of the intent test, based on the results of the study, was found to be at the time of contract formation. This outcome agrees with the legal literature and similarly supports the experimental hypothesis. Of these cases in which the intent test was applied, the application preference was at the time of contract formation (83% of the time) (Table 1).

In comparison to the overall percentages of application, the interval percentages, in Figure 2, display when in time the intent test has been applied over time increments of 10 years each. This graphical representation provides a technique for observing increasing or decreasing trends that may have occurred during the measurement period. Although no obvious trends are apparent from Figure 2, the graph indicates that in the majority of the intervals, the intent test was applied at the time of contract formation. This consistent preference for the time of contract formation by the court further supports the historical importance of the intent test, as applied in view of future damages.

Based on the results of this study, a drafter of a contract for construction has good reason to create a liquidated damages clause with careful attention. The study confirms the importance of the intent test, applied primarily at the time of contract formation. To satisfy this test, a drafter of a liquidated damages clause in a construction contract must be prepared to prove the stipulated amount is an accurate pre-estimate of probable damages that would occur from the breach. Maintaining documentation to support calculations of probable damages would provide critical support for the validity of the liquidated damages amount if the clause were to be challenged in court.

The secondary issue of the application of the intent test at time of trial, which requires that the stipulated amount be proportionate to actual damages, is difficult, if not impossible, of estimation. Because the intent test has been applied most often at the time of contract formation, and accurate estimation of actual damages at the time of trial is improbable.

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Cost Models For ISO 9000

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Predictive models were developed to estimate the effort required for domestic construction contractors to achieve ISO 9000 registration. The best predictor was the number of employees in the registered unit. A major cost factor is the presence of procedure writers within the company.

Key Words: ISO 9000, Cost Models, Survey, Documentation, Construction

Objectives

The objective of this paper is to define useful cost models for domestic construction contractors seeking ISO 9000 registration. No predictive cost models have been published in this area. Recognition of the need for documented quality management systems in the construction industry is growing. Competition and customer pressure are given as reasons for seeking registration under ISO 9000 (Lew, 1994). The number of ISO 9000 registered firms in the US and Europe continues to grow. US construction companies are seeking registration primarily under ISO 9001 and 9002. The extensive documentation and auditing requirements of ISO 9000 registration require a significant commitment of time and resources (Bray 1996). This study uses statistical methods to develop predictive models for time and costs associated with ISO 9000 registration.

Need for Research

The most important barriers to achieving ISO 9000 registration are believed to be development of documentation, procedures and work instructions (ISO 9000 1993). Registration barriers may affect the cost and effort required for ISO 9000 registration and may also affect potential cost savings from ISO 9000 registration.

Construction contractors will be most interested in the amount of effort required to achieve ISO registration. Effort may be measured in time and cost. Time required for registration is of interest because a contractor will want to estimate the amount of resources that will have to be committed to the registration effort.

Method

Model Development

Registration costs include startup costs and annual maintenance costs. Startup costs include internal and external costs. Internal startup costs include planning, procedure writing and documentation, internal audits and training. External startup costs include registrar and consultant fees. Annual costs have similar internal and external components. ISO 9000 is documentation-intensive. The time required for registration is believed to be greatly influenced by the number and complexity of procedures that must be documented. Registration costs are directly related to registration time requirements.

A single variable to measure and describe the complexity of documentation has not been identified. Instead, the level of documentation effort was estimated indirectly using other simply measured variables. Number of employees and annual sales were used as a gross estimator of documentation effort. Both number of employees and annual sales give an approximation of the overall size of the firms' operations. Number of employees and annual sales are only rough estimators of documentation effort. However, the variables are easily measured and compared.

Most contractors would choose between ISO 9001 registration and ISO 9002 registration. The model includes an indicator variable for the registration pursued to determine if 9001 registrations require more effort than 9002 registrations.

Registration effort may be related to the current stage of development of the firm's quality culture. A previous study indicated that companies with a functional quality management system achieved registration with less effort than companies without functional quality management systems (ISO 9000 1993). However, no statistical evidence has been presented to show that simply having a quality management system reduces the effort required for registration. A better indicator of a firm's readiness to pursue registration may be the presence of an experienced procedure writer at the management level. Indicator variables for the presence of a quality management system and a procedure-writer were included in the model to determine the effect on registration effort.

A model for cost savings may be proposed. Cost savings may come from increased market share and productivity improvement. Companies without quality management systems may have greater potential savings than firms that have previously implemented quality systems and already captured a share of potential savings due to productivity improvements. Total savings should be in proportion to the overall size of the company. Firms with functional quality systems or experienced procedure-writers may be more effective in designing ISO 9000 quality programs that result in cost savings. Based on the previous discussion, the same indicator and quantitative variables proposed for estimating registration effort may be used for the cost savings model. In order to achieve a better understanding of factors affecting ISO registration, the following linear models with covariates and interaction effects were proposed:

$$C = ß_0 + ß_1 Z_{i1} + ß_2 Z_{i2} + ß_3 Z_{i3} + ß_4 X_{i1} + ß_5 X_{i2} + ß_6 Z_{i1} X_{i1} + ß_7 Z_{i1} X_{i2} + ß_8 Z_{i2} X_{i1} + ß_9 Z_{i2} X_{i2}$$

$$ß_{10}Z_{i3}X_{i1} + ß_{11}Z_{i3}X_{i2} + ß_{12}X_{i1}X_{i2}$$
$$ß_{13}Z_{i1}Z_{i2} + ß_{14}Z_{i1}Z_{i3} + ß_{15}Z_{i2}Z_{i3} + ?$$

$$S = a_0 + a_1Z_{i1} + a_2Z_{i2} + a_3Z_{i3} + a_4X_{i1} + a_5X_{i2}$$
$$a_6Z_{i1}X_{i1} + a_7Z_{i1}X_{i2} + a_8Z_{i2}X_{i1} + a_9Z_{i2}X_{i2}$$
$$a_{10}Z_{i3}X_{i1} + a_{11}Z_{i3}X_{i2} + a_{12}X_{i1}X_{i2}$$
$$a_{13}Z_{i1}Z_{i2} + a_{14}Z_{i1}Z_{i3} + a_{15}Z_{i2}Z_{i3} + ?$$
$$T = d_0 + d_1Z_{i1} + d_2Z_{i2} + d_3Z_{i3} + d_4X_{i1} + d_5X_{i2}$$
$$d_6Z_{i1}X_{i1} + d_7Z_{i1}X_{i2} + d_8Z_{i2}X_{i1} + d_9Z_{i2}X_{i2}$$
$$d_{10}Z_{i3}X_{i1} + d_{11}Z_{i3}X_{i2} + d_{12}X_{i1}X_{i2}$$
$$d_{13}Z_{i1}Z_{i2} + d_{14}Z_{i1}Z_{i3} + d_{15}Z_{i2}Z_{i3} + ?$$

$$A = \mu_0 + \mu_1Z_{i1} + \mu_2Z_{i2} + \mu_3Z_{i3} + \mu_4X_{i1} + \mu_5X_{i2}$$
$$\mu_6Z_{i1}X_{i1} + \mu_7Z_{i1}X_{i2} + \mu_8Z_{i2}X_{i1} + \mu_9Z_{i2}X_{i2}$$
$$\mu_{10}Z_{i3}X_{i1} + \mu_{11}Z_{i3}X_{i2} + \mu_{12}X_{i1}X_{i2}$$
$$\mu_{13}Z_{i1}Z_{i2} + \mu_{14}Z_{i1}Z_{i3} + \mu_{15}Z_{i2}Z_{i3} + ?$$

Where:

C = Startup costs of registration, $.
S = Annual cost savings after registration, $.
T = Time required to achieve registration, MH.
A = Annual costs to maintain ISO registration, $.
Z_{i1} = 0 if firm "i" had functional quality system present prior to ISO registration; 1 if else
Z_{i2} = 0 if prior to ISO registration, firm "i" had manager with chief responsibility for developing procedures; 1 if else
Z_{i3} = 0 if firm "i" had ISO 9001 registration; 1 if ISO 9002 registration.
X_{i1} = Annual sales for registered site "I," $1000.
X_{i2} = Number of employees under site "i" management.
$ß_j$ = Regression coefficients in startup costs model.
a_j = Regression coefficients in savings model.
d_j = Regression coefficient in time model.
μ_j = Regression coefficient in annual costs model.
? = Error term in models.

Hypothesis

Tests of significance were conducted at the 0.95 confidence level to test the hypothesis:

$$H_0: \text{ All } ß_j = \text{All } a_j = \text{All } \mu_j = \text{All } d_j = 0$$

After testing the full models, analysis was performed to identify useful and statistically significant models by removing variables that did not significantly contribute to the prediction of the response variables.

Sampling Procedure

Since ISO 9000 is new to the US construction industry, no data could be obtained from US construction companies. Instead, a sample was drawn from US companies with characteristics believed to be common to domestic construction firms.

A sample of registered firms was obtained from the CEEM ISO 9000 Registered Company Directory, May 1994 Update ("ISO 9000 Registered" 1994). The firms were selected on the basis of the registration scope published in the Registered Company Directory. The chief characteristic of the firms selected for the survey was the production of a custom product in a batch of one. Only firms currently registered under ISO 9001 or ISO 9002 were considered. Companies with registration scopes indicating the primary concern of the quality system was maintaining operation of a continuous assembly or process flow line were not considered. No specific instrument for selection was used. The researcher simply read the registration scope and determined if the selection criteria were met.

The selection criteria were somewhat subjective. An alternative approach would be using cost data from foreign construction companies. Data from foreign construction companies were not used due to difficulties in obtaining the data and difficulty in comparing cost data for construction companies operating in other cultures. Fundamental differences in the economic systems of other countries complicate use of data from foreign companies.

No effort was made to compare the companies sampled to "typical" construction companies or to establish operational characteristics of a "typical" construction company. The only common characteristic was production of custom products and the absence of an "assembly-line" style production process.

Telephone Survey

The questionnaire shown in Table 1 was developed to collect data for the proposed models. The questionnaire was administered by telephone interviews with each firm's quality manager. Steps were taken to achieve a high response rate. Two weeks prior to the telephone survey an explanatory letter and a copy of the questionnaire was sent to the quality manager in charge of ISO 9000 at each firm. Two weeks after telephone interviews were begun, a second notice was sent to firms the researcher had been unable to contact. Response rates of 70 percent to 90 percent may be expected in surveys of elite professional groups (Dillman 1978).

Each questionnaire required 20 to 30 minutes to administer by telephone. An open-ended discussion format was used. The researcher asked questions about the firm's quality management system. Functional quality management systems were those that the interviewee indicated had authority from management to carry out the company's quality policies. The number of employees and the presence of a procedure-writer are fairly objective questions.

Problems arose in estimating annual sales for registered firms that did not record annual sales. For example, the production unit of a large firm may operate nearly independently of the balance of the company. The estimated production or total value of contracts was used in place of annual

sales. The number of employees in the registered production unit was used rather than the total number of employees for the company.

Table 1

Survey Form

1.	Prior to seeking iso registration, how many employees worked at this site?
2.	Before seeking iso registration, did this site have a functioning quality program such as tqm, mbnqa, deming or others (name_____)? Yes / No
3.	Prior to seeking registration, did this site include a person whose chief responsibility was writing procedures, work instructions or specifications, or managing those activities? Yes / No
4.	What was the approximate annual sales (or production) in $ of this site before seeking iso registration? If there are multiple sites, estimate the share that can be credited to this site.
5.	Estimate the total employee-hours that were required to obtain the initial iso registration of this site. Do not include time required to maintain registration.
6.	What was the approximate total of all costs in $ for the initial registration of this site, including the initial registrar charges? Do not include ongoing or annual costs. If there are multiple sites, estimate the cost that can be assigned to this site.
7.	What are the estimated total annual costs in $ at this site to support continuing iso registration? This would include annual registrar charges, personnel, indirect costs and any other costs associated with maintaining registration at this site.
8.	What are the estimated total annual savings in $ at this site that can be attributed to obtaining iso registration? This should include new sales or production that occur due to registration. Do not deduct the costs of maintaining registration from this figure. If there are multiple sites, estimate the savings that can be assigned to this site.

Cost figures were verified during the telephone interview in order to insure that registrar and personnel costs had been included. Other costs included consultants and training. When records were not available, employee-hours were estimated by the quality manager with the help of the researcher. The reported data represent the best estimate of the firm's quality manager. In most cases the quality manager had maintained accurate cost records.

Estimating cost savings was much more difficult. Few firms had attempted to measure cost savings. The accuracy of the estimated savings data is low.

Results

Survey Demographics

A full data abstract is not included in this report. However; some interesting observations from the summary statistics are listed.

1. The overall useful response rate was 81 percent. Of 98 sites selected, 79 participated in the survey. Even after repeated attempts, five were never contacted. Only four refused to participate after being contacted. The high response rate means the data are not likely to be affected by response bias.
2. The survey included 43 percent ISO 9002 registered firms and 57 percent ISO 9001 registered firms.
3. The average startup costs for all firms was $ 191,480 (Z_1 = 0 or 1, Z_2 = 0 or 1).

4. For firms without a procedure-writer prior to registration ($Z_2 = 1$), the average startup cost was $214,976.
5. For firms with a procedure-writer ($Z_2 = 0$), the average startup cost was $146,296.
6. For firms without a procedure-writer or a functional quality management system prior to registration ($Z_1 = Z_2 = 1$), the average startup costs was $155,538.
7. For firms with a procedure-writer or a quality management system ($Z_1 = Z_2 = 0$), the average startup cost was $140,948.
8. Average startup cost for ISO 9001 firms was $266,479 ($Z_3 = 0$).
9. For ISO 9001 firms with neither a quality management system nor a procedure-writer prior to registration, average startup costs were $202,767 ($Z_3 = 0$, $Z_1 = Z_2 = 1$). For ISO 9002 firms the corresponding cost was $91,136 ($Z_3 = Z_1 = Z_2 = 1$).
10. The median startup costs for ISO 9001 without a procedure-writer or a quality management system in place prior to registration ($Z_3 = 0$, $Z_1 = Z_2 = 1$) was$100,000.

Confidentiality of Data

All graphs in this study are shown with dimensionless axes. The data are plotted to show the goodness of fit, but the scale is omitted to protect the confidentiality of survey respondents.

Test of Models

The models represented by equations I - 4 were tested. Ho was rejected at the 5 percent level for equations 1, 3, and 4. The annual savings model represented by equation 2 was not significant at the 5 percent level.

More statistically significant and useful models were created by elimination of variables from the full models. No significant model for annual savings was found. The reduced models shown have a maximum probability that no regression coefficients are zero (maximum F value), and no individual coefficients exceed 0.05 likelihood of being zero. In all cases the adjusted R2 shown are only slightly below the maximum value obtained from the best combination of variables. For all models presented here, validity was confirmed with plots of standardized residuals and normal probability plots.

Startup Cost Reduced Model

The best-cost model was found to be:

$$C = 110{,}880 + 321 Z_2 X_2 \quad (5)$$

Where $Z_2 = 0$ if firm has a procedure-writer or 1 if else

X_2 = number of employees

$R^2 = 63.7\%$

Equation 5 maybe reduced to two linear equations.

If $Z_2 = 0$ (had a procedure-writer):

$$C = 110{,}880 \quad (6)$$

If $Z_2 = 1$ (no procedure-writer):

$$C = 110{,}880 + 321 X_2 \quad (7)$$

The fitted equations are shown in Figure 1.

Time to Registration Reduced Model

The best time for the model was found to be:

$$T = 4722 + 3.65\ Z_2\ X_2 \quad (8)$$

$R^2 = 26.1\%$

Equation 8 may also be reduced to two linear equations.

If $Z_2 = 0$ (had a procedure-writer):

$$T = 4722 \quad (9)$$

If $Z_2 = 1$ (no procedure-writer):

$$T = 4722 + 3.65\ X_2 \quad (10)$$

The fitted equations are shown in Figure 2

Annual Cost Reduced Model

The best annual cost model was found to be:

$$A = 32{,}643 - 30{,}822\ Z_3 + 138\ Z_2\ X_2 \quad (11)$$

$R^2 = 85.6\%$

Equation 5 maybe reduced to four linear equations.

If $Z_2 = Z_3 = 0$(Had procedure-writer and ISO 9001 registration):

$$A = 32{,}643 \quad (12)$$

If $Z_2 = 1$, $Z_3 = 0$(No procedure-writer, had ISO 9001 registration):

$$A = 32{,}463 + 138\ X_2 \quad (13)$$

If $Z_2 = 0$, $Z_3 = 1$ (Had procedure-writer, had ISO 9002 registration):

$$A = 1821 \quad (14)$$

If $Z_2 = Z_3 = 1$ (No procedure-writer, had ISO 9002 registration):

$$A = 1821 + 138\ X_2 \quad (15)$$

The fitted equations are shown on figure 3.

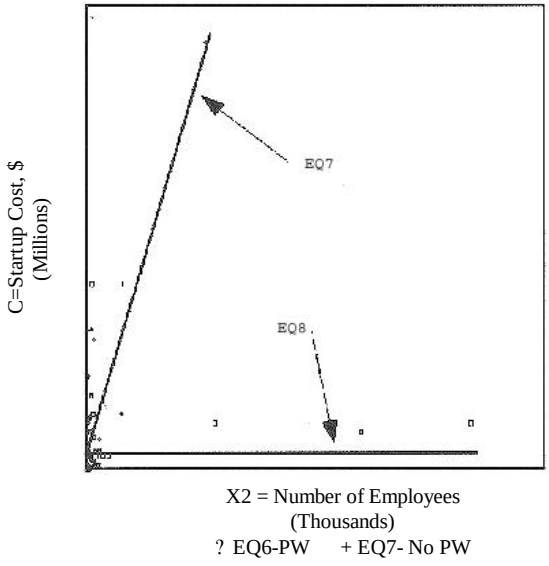

Figure 1: Fit of startup costs.

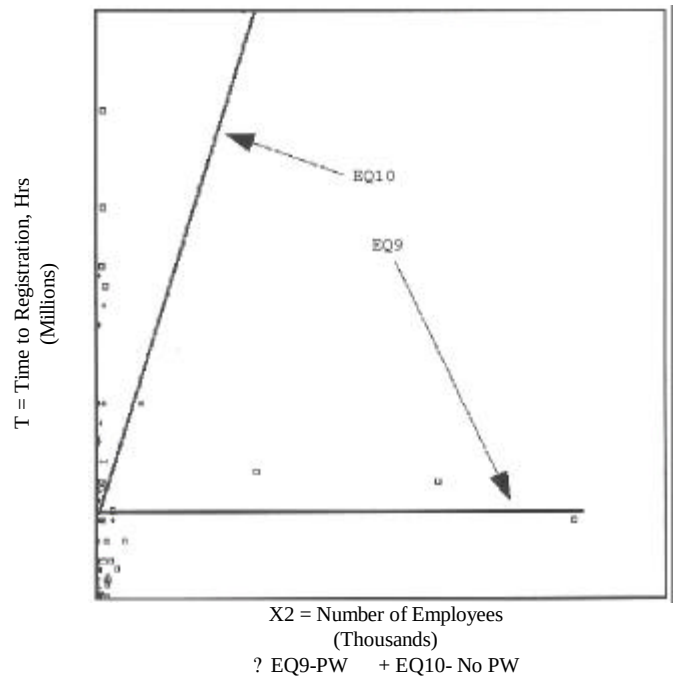

Figure 2: Fit of time to registration.

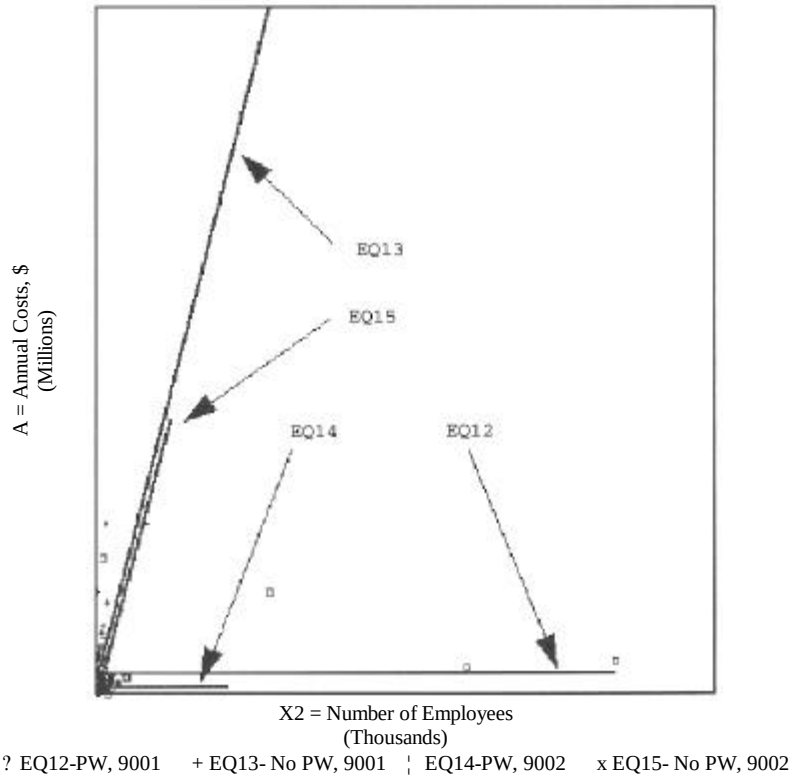

Figure 3: . Fit to Annual Costs.

Conclusions

General Observations

Experience in writing procedures is an important factor in startup costs, time required for registration and annual costs of registration. The effect of procedure writing was the single most important factor in all models.

The costs and efforts required for ISO registration are more directly related to the number of employees managed than the size of the firm as reflected by annual sales.

The effort required in time and startup costs are not significantly different for ISO 9001 and ISO 9002. However; ISO 9001 has significantly higher annual costs.

Having a functional quality system in place prior to registration did not significantly lower the costs and efforts of obtaining ISO registration. One reason could be the lack of agreement over what constitutes a functional quality system. In some firms the quality system consists of detecting and correcting defects prior to shipment. This is more of an inspection approach. ISO 9000 requires setting up or modifying existing procedures to prevent problems, so it is not surprising that some firms with "quality management systems" are not efficient in obtaining ISO registration.

Implementation in Construction

Construction companies pursuing ISO registration should concentrate on documentation and procedure writing. Cost savings does not seem to be a major reason for pursuing ISO 9000 registration. This does not mean that cost savings are not present. However, cost savings are difficult to measure. In addition, other factors such as market share play a larger role. A major obstacle for ISO 9000 registration in construction companies will be in creating and maintaining adequate procedures and documentation. Companies will need to take care to develop general procedures that may be customized for different projects. For example, the company may have a prefer-red method of constructing a manhole or a slab, but project specifications may require use of other methods. Companies will need to develop procedure-writing capabilities of construction personnel. One approach might be to build documentation gradually by targeting one or two activities on any project and absorbing documentation costs in the project overhead costs. A serious obstacle will be in keeping procedures current. ISO registration will likely cause increased use of planning at the foreman/superintendent level. The use of short look-ahead schedules made by field personnel will be helpful in ensuring that quality procedures are followed. The ISO quality system may require closer coordination between field and home office employees in the form of meetings and written records. Field personnel will have an increased paper work load from creating the records that show proper procedures were followed.

Employees that actually perform the work should be involved in writing procedures. If the employees cannot write the documentation, it is likely the process needs to be simplified or employees need additional training. Office personnel such as estimators usually have well-established procedures for taking-off jobs. The challenge will be to ensure that all personnel use

current procedures and to update procedures when required. The procedure-writing process will probably require both an experienced estimator and field supervisor. Specific procedures should have input from the personnel that will actually perform the work. The procedures that are developed should be documentation of the way the company's work is actually performed, rather than some ideal way of doing the work.

Additional Observations

Several companies refused or were unable to respond to the survey. The parties contacted at two of the non-responding companies gave confusing reasons for not participating. One indicated that there was no one in the firm with overall responsibility for administrating the quality system. This seems unlikely. The other firm indicated that they could not provide the data requested because only the company's consultant had the information. This represents a fundamental lack of understanding of the commitment required to implement the ISO 9000 quality management system. One possible reason for pursuing registration with such an obvious lack of commitment would be in order to satisfy a customer's requirement for ISO registration for one or two projects. It is possible to achieve registration through the use of consultants without total commitment from top management. However, the registration would be extremely expensive to maintain. Companies should understand that ISO 9000 registration is meant to be a commitment from top management to a set of quality principles. Companies will not likely be able to afford the cost of ISO 9000 registration to bid on only a few projects.

A surprising result of the survey was the general lack of interest by ISO 9000 firms in the amount of savings achieved through ISO 9000. The majority of quality managers felt the savings were negligible. A majority of quality managers reported that top management gave strong support to the registration effort. These managers reported that they did not feel pressured to demonstrate cost savings from ISO 9000. This may indicate the development of a domestic "quality culture" where product quality is valued for reasons other than cost-cutting measures. It might have been expected that quality managers would go to great lengths to justify the expense of maintaining the quality system. However, that concern was not found in the study.

Interviewee Comments

Several interviewees agreed to review and comment on the initial results of the study. Tom Polizzi, Quality Manager for Glenayre Electronics in Duluth, GA, stated that cost savings was not a major reason for Glenayre's decision to pursue registration. Major considerations were obtaining greater market share and increasing customer satisfaction. Polizzi suggests that since firms without procedure-writers seem to face higher costs and time requirements for registration, these firms are most likely to benefit from the use of consultants in procedure-writing (Polizzi 1994).

Raj Sikand, a consultant for Intertek Services in Fairfax, VA, provides consulting services for firms seeking registration. Intertek Services is an ISO 9002 registered consulting firm. Sikand confirms that others also see number of employees as an estimator of the effort required for registration. Intertek bases fees on the number of employees in the registration unit. The number of employees was a major estimator in the models of startup cost, annual cost and time required

for registration. Intertek's billing practice seems to confirm that number of employees is a reasonable estimator of effort required for registration (Sikand 1994).

Dick McDonnell, Production Manager for Digital Equipment Corp. in Sunnyvale, CA, agreed with the importance of procedure-writing. Digital had many repair processes to document and used a team approach to writing the actual repair procedures. McDonnell emphasized the requirement of continual commitment. One area of the site gets an internal audit each month, which helps maintain a state of constant readiness. In fact, the firm makes no special preparations for the regular registrar audits (McDonnell 1994).

Future Research

The annual savings model was not statistically significant, due largely to a lack of agreement on how savings should be calculated. Development of more accurate methods for estimating savings and cost is a potential area for future research.

A more sophisticated instrument for selecting companies could be developed. This would help focus the results of future work. Additional work in developing cost models should include methods for capturing costs of creating and maintaining the quality system. Future research in this area would probably need to focus on a small number of companies and attempt to fully understand the relationships between the various costs and components in the quality system. Additional research on procedure writing may be valuable since procedure writing was such a significant factor in the study. An effective method of classifying procedures and documentation or predicting the effort required to produce procedures and documentation would be useful.

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Enforceability of International Construction Contracts and the Arbitral Decision

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International construction contracting offers many economic benefits, while similarly posing significant risk to the United States Multinational Construction Corporation. To better understand contractual enforcement risk, this paper discusses the relationship between treaty law, customary international law, and the commonly employed international construction contract dispute mechanism arbitration.

Key Words: International Construction Contracting, Treaty Law, New York Convention, Arbitration

Introduction

There is a global trend towards less restrictive international trade barriers that is leading to an expansive global market place. This result is a function of both treaty and statutory reform between numerous countries including the United States. Owing to this global economic expansion, the growth and opportunity for the United States (U.S.) Multinational Construction Corporation (MCC) is immense. For example, reported international construction revenues for 1995-1996 equate to $105 billion dollars. This dollar figure represents a 14 percent growth rate from the prior year. For the U.S. MCC, design build contracting offers tremendous emerging market opportunity (Altman, Trinka, 1997). The international construction market does however represent a higher degree of unpredictable, legal, and business risk (Stokes, 1980). This extraordinary increased business risk is a function of political risk, national custom, foreign legal requirement, and associated applicable municipal law. As with domesticated U.S. construction contracting, international construction contracting also maintains a high degree of contract related disputes and claims. When a construction contract claim does arise, a multitude of complicated legal questions are set-forth such as: a.) which nation's law is applicable as to governance of the contract, b.) which nation possesses jurisdiction to decide the legal question presented, and finally c.) whether the judgment can be enforced (Cushman, Jacobsen, Trimble, 1996). In general, the purpose of this paper is to examine the contracting paradigm for private international law. More specifically, discussion shall focus on the legal aspects of the construction contracting process in a foreign nation and enforcement of same. Furthermore, this discussion shall be two-part. This first part shall write to and discuss the relationship between international treaty law and the formation and enforcement of an international construction contract. The second part shall explain the international construction arbitration mechanism as a subset of the international construction contracting process, and subsequent enforcement of same.

International Law

International law is divided into *public law*, and *private law*. The former relates to political relationships between nation states. The latter, focuses on policing international trade and commerce between national legal systems (Janis, 1999). As noted in the introduction, this paper shall focus and write to private law. Therefore, no further discussion relative public international law shall take place.

The rules of law applied to private international law can be divided into the following three areas: a.) *treaty law or convention*, b.) *customary international law*, and finally c.) *general principles of law*. The law of treaty is similar to private contract law. The reason for this conclusion is that such a document typically explicitly creates a set of legal rights and duties that are obligatory to the signatory nation state. Thus, a treaty serves as an international contract, thereby binding the consenting signatory sovereign states. The underlying fundamental underpinning of *pacta sunt servanda* is the normative rule of law binding nation states to honor a treaty (Mazzini, 1997). Thus, a treaty is considered to be either: a.) constitutional, b.) legislative, or c.) contractual (Janis, 1999).

The descriptive rubric customary international law is unwritten law meaning custom and usage. This law has historical relevance in terms of longitudinal acceptance of normative procedures between nations. Illustrative of this body of law is maritime law. Custom law is used as a supplement to fill gaps in treaty interpretation, or establish law when no law exist (Janis, 1999; Mazzini, 1997). The conjoining of treaty law with customary law thereby creates a complete body of international law.

The third international law construct is general principals of law. The notion here is that all nation states observe their own domestic law. The basic proposition advanced by this model is that a general principle of law is fundamentally common to every legal system. The legal construct pacta sunt servanda illustrates such a model. In the hierarchy of international internal rules of law, general principals of law are applied last when treaty and customary law cannot give guidance to the court (Setar, 1996).

International Commercial Law

Prior to commencing with a discussion regarding international construction contracting, it is both informative and important to note that there exists a body of private international law termed *international commercial law* (also termed private international economic law). This term means *law of merchant* having derivation emanating from the medieval body of law known as *customary legal rules*. In short, this body of law currently provides governance of, and to the majority of international business transactions (D'Amato, 1971). In line with this area of private international law, the United Nations has created the United Nations commission on International Trade Law (UNCITRAL) to facilitate and coordinate the unification of such private international economic law (Gwyn, Taylor, 1999). Another international document of import currently employed in the private economic law arena is the United Nations Convention on Contracts for International Sale of Goods (UNC). The UNC is similar to the Uniform

Commercial Code presently employed in the U.S. A multitude of nations, including the U.S., have ratified and become signatory parties to this agreement regarding its application and governance over international sales transactions. Both UNCITRAL and UNC are applicable to international construction contracts, and the arbitral process for same (Altman, et el, 1997).

International Construction Contracts

There exists a legion of international contract forms and provisions. For the U.S. MCC, the American Institute of Architects (AIA), and the International Federation of Consulting Engineers (FDIC) are the most common construction contract forms currently being utilized in the international construction arena (Cushman, Myers, 1999; Altman, et al, 1997). Another commonly employed construction contract is the United States Army corps of Engineers (COE) contracts for work performed in foreign countries. The (COE) either parallels and falls under the auspices of the Federal Acquisition Regulation (FAR) of the U.S. government. Of those contractual types alluded to above, the FDIC contractual form is most commonly employed in the international construction arena (Stokes, 1980). Therefore, owing to the wide utilization of the FDIC document, further discussion shall directly focus to the FDIC contract format (Altman, et el, 1997; Grove, Hummel, 1994).

The FDIC document has three principal parts: a.) form of agreement, b.) conditions of contract for works of civil engineering construction, and c.) conditions of particular applications. The FDIC contractual form is commonly referred to as the *Red Book* (Cushman, et el, 1999; Molineaux, 1995; Altman, et el, 1997). Like the standard U.S. private construction contract, particularly the AIA version, similarly too the FDIC document is a tri-union constellation (owner, contractor, and designer) of contractual parties. Within this tri-union, the engineer has a significant and substantial discretionary authority regarding interpretation and administration of the construction contract documents (Molineaux, 1995). This discretionary authority creates what is referred to operationally and constructively as the *independent engineer*. In this role, the engineer function similarly to that of the architect role found in the standard AIA document (typically referred to as a quasi-adjudicator) regarding contractual disputes (Stokes, 1980). Here also, like the standard AIA documents (AIA 201 - General Conditions), the FDIC civil form provides for arbitration of disputes found at clause 67 of the document. Clause 53 of the FDIC document outlines the procedural aspects for presentment of a contractual claim, this clause conjoins with clause 67, whereby arbitral proceedings shall relate to claims relative to the work, completion of the work, satisfaction of the work, breach, termination, and abandonment (Molineaux, 1995; Cushman, et el, 1999). Thus, because the FDIC document, as well as many other international construction contracts documents provide for mandatory binding arbitration, the arbitral process is currently the most often preferred and utilized dispute resolution mechanism employed in the international construction arena (Hoellering, 1994; Stokes, 1980).

International Commercial Arbitration

International *arbitration* is defined as a systematical methodology of dispute resolution privately agreed to by contractual parties. The system creates a process, whereby an appointed private

judge acting as a neutral having expertise in the disputed area, conducts a hearing without the normal formal civil court proceedings (Jones, 1994). Arbitration is a process and system of dispute resolution dating back to ancient Greece 500 B.C., and has developed internationally as a customary practice originating over the centuries primarily from international maritime trade (King, LeForestier, 1985). Although the proceedings are entirely private, arbitral decisions are rendered on the predicate of international law (treaty, and/or customary law) and enforced via treaty. In view of the above, however, international commercial arbitration is viewed as an alternative dispute resolution mechanism to that of municipal (law of one's own nation) litigation and the uncertainties relative domestic court rulings (Janis, 1999). Therefore, the fundamental purpose and objective of international commercial arbitration is to promote, harmonize, and facilitate the growth of international trade and commerce.

Essentially, commercial international arbitration finds governance and enforcement via pertinent multilateral or bilateral convention, treaty, or agreement (McDonnell, 1995, et el). Most notable are the United Nations Convention on Recognition and Enforcement of Foreign Arbitral Awards (the New York Convention), and the United Nations Commission on International Trade law Model Rules of Arbitration (UNCITRAL) (Davis, 1994; Hoellering, 1995). The effective and predictable enforcement of arbitral proceeding are greatly enhanced and facilitated by such treaty and convention law. With the above, and because: a.) international commercial arbitration leads to more predictable outcomes than international domestic municipal law decisions, b.) is also less expensive than litigation c.) provides faster resolution to disputes, and finally, d.) most international entities prefer private negotiation to resolving disputes rather than litigation. Therefore, arbitration is the preferred mechanism for resolving international commercial disputes (Hoellering, 1994).

International Construction Arbitration

As with the U.S. construction industry, international construction contracting is fraught with contractual dispute. Similarly, as with U.S. construction contracting, the rapid increase in employing arbitration as a dispute resolution mechanism is a growing trend in the international construction arena (Stipanowich, 1998). This trend is a function of the complexity of the construction process, time constraints associated with same, and the significant cost associated with the litigation in a foreign jurisdiction (Mason, 1994; Molineaux, 1995). As a result, the standard international construction contract document (FDIC) typically includes a commercial arbitration clause (Wagoner, 1993). When an international construction contract has a commercial arbitration provision incorporated within the agreement, the enforceability of a foreign arbitral awards falls under the auspices and governance of the New York Convention (NYC), and UNCITRAL (Mason, 1994; Hoellering, 1994; et el). In short, the above alluded to treaty and convention requires all signatory countries to recognize and enforce the written arbitration agreements and the subsequent decisions rendered there from by the arbiter. Gwyn and Taylor (1999), list minimum requirements set-forth by the NYC necessary to enforce an arbitration as follows:

"The arbitration clause should meet the minimum requirements of the New York Convention, i.e. that: 1) the agreement is in writing; 2) the agreement deals with differences that have arisen or

that may arise between the parties; (3) the agreement is valid under the law to which the parties have subjected it; (4) the parties have legal capacity under that law to enter into such an agreement; (5) place of arbitration; (6) number of arbitrators; (7) language of the arbitration; (8) law to be applied in the arbitration; and (9) the international arbitration institution and/or arbitration rules that the parties intend to use, unless an ad hoc arrangement is intended. "Ad hoc" refers to arbitrations conducted without institutional assistance, established rules, or both. Ad hoc arbitrations can be very effective, if the appointed arbitrators are competent and the contract designates an authority, such as a chamber of commerce or court, to appoint the arbitrator or the chairman of the arbitration panel if the parties cannot agree. Provided these minimum requirements are met, then the NYC prescribe that signatory nations enforce the arbitral judgments as international law amongst the signatory nations."

Now that the process and relationship between treaty, international contract law, the arbitration provision, and enforceability of same have been outlined, this discussion shall turn and next write to international arbitration organizations. Referring to the list of minimum requirements laid down by the NYC, note that item 9 refers to arbitration institution and/or rules. There presently exists a myriad of international arbitration systems to perform such a task, and most international contracts specify such a managing dispute resolution organization (Coulson, 1986). The international law community does not dictate which arbitral system to be employed because such agreements are private in nature. However, NYC, does recommend that the parties select of one such institution and incorporate the designated organization in the contract (Mason, 1994, Hoellering, 1994, 1995). There are several well-known institutions, these being: a.) the International Chamber of Commerce (ICC), b.) the American Arbitration Association, c.) London court of International Arbitration, d.) Inter-American Commercial Arbitration Commission, and e.) Institute for Dispute Resolution (Bresee, 1994). Thus, under the FDIC red book agreement, the parties would stipulate to the managing international commercial arbitration system to be implemented in the event a dispute arose (Stokes, 1980). Thus, for example, should the parties to an international construction contract elect the International Chamber of Commerce (ICC) as the managing arbitral system, then the parties are thereby bound to comply with promulgated ICC rules. Typical rules for managing arbitral systems relate to a.) rules regarding the appointment and number of arbitrators, b.) notice provisions, c.) discovery, d.) choice of language, e.) choice of law and f.) award (Gwyn; et el, 1999). Once the arbitral proceedings are concluded, the award is issued and the winning party looks to NYC and UNCITRAL for enforcement of the award under international law (Groves, et el, 1994).

Illustrative of the discussion above is *Biotronik Mess-und Therapiegeraete GmbH & Co., v. Meford Medical Instrument, Company*, 415 F. Supp. 133, (1976). Biotronik, a West German manufacturer/distributer, entered into a commercial agreement with a U.S. firm, Medford Instrument Co. (Medford). The agreement contained a provision for arbitration under the International Chamber of Commerce rules (ICC). The issue presented to arbitration was one of contractual breach, and in dispute was the amount owing and due regarding goods delivered to Medford. The dispute was submitted to the ICC for arbital decision. The arbiters' award was in favor of the German firm Biotronik. The U.S. firm Medford refused to honor the award, contending that Biotronik knowingly concealed evidence at the hearing that constituted fraud and, therefore, the arbitrators' decision was not enforceable. Thereafter, Biotronik sought suit in federal court to confirm and enforce the award as provided for by the New York Convention,

pursuant to 9 U.S.C. section 201, 1976. Although the court examined the record presented by Medford, the court emphasized that there existed no fraud by narrowly construing the statutory fraud defense found at 9 U.S.C. 10 (a) (court noted that it may vacate an arbiters award on the basis of fraud). Because Medford was incapable of establishing fraud pursuant to section 10 (a), the court, after establishing subject matter jurisdiction via the Convention and subsequent pertinent U.S. code section (9 U.S.C.), enforced the international awards against Medford.

In *Parsons and Whittemore Overseas Inc. v. Socete Generale De Industrie Du Papier,* 508 F.2d 969 (2nd Cir. 1974), here Parsons (U.S. corporation) seeks relief from U.S. court arguing that an international award rendered by an arbitration tribunal is unenforceable as violative of U.S. public policy because the award was predicated on resolution of issues beyond the scope of the contractual agreement to submit to arbitration. The court held by agreeing to submit to arbitration, Parsons relinquished its right to judicial review by agreeing to arbitration. The court further wrote that the issue before the arbitral panel was not of national interest, but instead, a judicial resolution of contractual obligation. Thus, the court held the arbitral tribunal acted within subject matter jurisdiction promulgated by the Convention, and pursuant to the Federal Arbitration Act, 9 U.S.C. enforced the foreign award rendered by the foreign arbitral body against Parsons. SEE also, *Landers Company, Inc., v. MMP Investments, Inc.,* 107 F.3d 76 (7th Cir. 1997); arbitral award was enforceable against Polish national corporation. Plaintiffs (Landers) failure to plead diversity jurisdiction did not abrogate the applicability and enforceability of the arbitral award rendered under the Convention, and same did not deprive district court of jurisdiction under the Federal Arbitration Act. Also, Bergesen, supra note 50, domestic arbitration awards are enforceable in foreign jurisdiction subject to the Convention because the Convention is subsumed into the legal structure of such signatory countries. Refer to *In the Matter of the Arbitration Between: Trans Chemical Limited, and China National Machinery and Export Corporation,* 978 F. Supp. (S.D. Tex. 1997), mirroring, and standing for the same proposition as Bergesen supra.

Conclusion

Significant economic opportunity avails itself in the international construction arena. There is however significant risk associated with international construction. This risk has to do with unpredictable legal outcomes rendered by international courts. As a solution to this problem, nations have joined together and signed an international treaty authorizing arbitration as an alternative mechanism to international litigation. The intent was to minimize and harmonize economic trade between nation states. As a result of this effort, 70 nations currently recognize the United Nations Convention on Recognition and Enforcement of Foreign Arbitral Awards. In short, this convention requires each signatory nation to recognize and enforce written arbitration agreements and awards of all other signatory countries.

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End Notes

1. Ross J. Altman, timothy E. Trinka, *International Law*, The National Law Journal, 1 (1997); ("trade agreements such as the North American Free Trade Agreement and the General Agreement on Tariffs and Trade, is having a vast impact on the design and construction industry.").
2. SEE *Biotronic Mess-und Therapiegeraete GmbH & Co., v. Medford Medical Instrument Company*, 415 F. Supp. 133 (1976). Thomas Sanders, *International Commercial Arbitration-How to Improve its Functioning?* Arbitration 9, 1990, (there is greater uncertainty regarding rules that govern dispute in foreign venue, therefore procedural complexities of litigating in a foreign jurisdiction lead to increased time, expense, and less certainty as to enforceability of the judgment. Regarding arbitration enforcement, a foreign arbitral judgment is simpler and more certainable to enforce than enforcement of a foreign judgment. Therefore, arbitral clauses predominate international commercial contracts.
3. Pacta sunt servanda means agreements of parties must be observed. Black's Law dictionary, 999, (1979).
4. Customary International law is also termed general international law.
5. Clause 67 provides a three tiered process for dispute resolution: step 1 – claim presentment to engineer for decision, step 2 – effort to reach an amicable settlement, and step 3 – final and binding arbitration. Article 50 states the decision of the engineer is subject to full (de novo) review; *De novo* meaning anew. Black's Law Dictionary, 5th ed., 392 (1979).
6. Under United States Law – Codified at 9 U.S.C. and incorporated into the Federal Arbitration Act by legislative Enactment. See Janis, at Chapter 4, discusses legislative ratification of treaty's in relation to the U.S. Constitution and the Supremacy Clause of Article VI, whereby a treaty is regarded by courts of the United States to be operative similar to an act by the U.S. congress, thus being considered codified law in the United States provided such treaty is not in contravention of the United States Constitution. Further New York convention was adopted in 1958, now ratified by 90 countries; the Convention supercedes two prior multilateral treaties adopted by the League of Nations, the Geneva Protocol on Arbitration Clause (1923), and the Geneva Convention on the Execution of Foreign Arbitral Awards (1927).
7. In Biotronik, citing to 9 U.S.C. sec. 203: An action falling under the convention shall be deemed to arise under the law and treaties of the United States district courts of the U.S. shall have original jurisdiction regardless of amount in controversy.
8. *Productos Mercantiles E Industriales, S.A. v. Faberge USA, Inc.*, 23 F.3d 44, 41 (2nd Cir. 1994). International commercial arbitration agreement, (New York convention) and the Federal Arbitration Act provide authority to signatory states, and to the district courts of the U.S. to recognize and execute an arbitration award.
9. *Bergesen v. Joseph Muller Corp.*, 710 F.2d 928 (2nd Cir. 1983), congress intended to provide subject matter jurisdiction via treaty convention and parallel legislation under the Federal Arbitration Act, thereby giving jurisdiction to courts to confirm arbitration awards both in the United States and those of foreign countries that are signatories to the Convention.

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